



The recovery begins

The floods have destroyed or damaged hundreds of kilometres of roads and many bridges. Travel on some routes is difficult, if not impossible and community and industry activities have been severely disrupted.

ARRB has placed a priority on contributing to the response and is already providing assistance in a range of ways to road authorities (see page 2).

Extreme weather events are regular occurrences overseas also. On page 3 is a report from a recent European conference in which the results of a large research program on the implications of these events for road authorities were presented.

Photo AAP/David Hunt © 2011 AAP

Contents

Issue 129 March 2011

The recovery begins	1
Contributing to the recovery	2
Road owners getting to grips with climate change	3
Landmark Australian High Court decisions on non-feasance are 10 years old	4
Prequalification streamlined in new system	5
Road and Transport Research Journal	5
Improving road maintenance in Indonesia	6
Giving priority to emergency vehicles	7
Helping motorcyclists go round the bend	8
A new generation of traffic signal controller	9
Developing a skid resistance management policy	9
Helping road authorities tackle skid resistance	10
3rd International Road Surface Friction Conference	10
Safer road surfaces - saving lives	11
Review of post-completion evaluation procedures	12
Estimating the costs of infrastructure projects	13
Conferences	13
50th Roughometer sold into India	14
Airport runways testing	14
Luxmoore assisting airports	15
Hawkeye Processing Toolkit new features	15
ARRB's local representatives	16
iRAP India 4 states project	17
Improving our knowledge transfer workshops	17
New staff	18
Max Lay's new book	18
ARRB Conferences - Reducing the carbon footprint	19
Knowledge transfer program	19

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Contributing to the recovery

The recent natural disasters occurring across Australia and New Zealand have been alarming and the damage has been extensive.

To assist recovery efforts, ARRB has offered immediate and ongoing help. Wherever possible, ARRB will divert our experts in pavements, structures, asset management and road safety from current jobs to work with state, territory and local staff.

ARRB is well placed to assess and advise on the extent of damage to road infrastructure and has equipment, permanently based at our regional offices, that may be of use. This equipment includes network survey vehicles with multilaser profilers, road geometry systems, digital imaging systems and road referencing systems. The data collected can be used to determine investment priorities and to document the extent of the damage for future verification.

Additionally, ARRB's non-destructive pavement testing equipment can be used to provide project level analysis of pavement structural condition and indications of the future performance of the pavement under the predicted traffic loading.

Over the last several years, ARRB has worked extensively with local and state road authorities in a number of Australia's flood stricken areas on aspects of infrastructure planning and performance. Case studies include:

- applying the latest practices in the redesign and construction of roads thereby gaining greater value from available funding
- applying drainage and design standards, infrastructure asset management and making better use of local pavement materials
- documenting the benefits of improving the flood immunity of river and stream crossings e.g. improving travel times, reliability and journey safety
- optimising net benefits from well-targeted bulk-purchased bridge and pavement replacement and rehabilitation programs.



Photo: K. Nealyon

Choosing the optimum restoration or improvement strategy could reduce unplanned expenditure by 60%, and ensure continued economic activity during periods of extreme weather events. ARRB can assist with developing this strategy.

Many bridges have been damaged during these events and need to be assessed as soon as possible. ARRB has already been involved in condition assessment of bridges and estimating repair costs to restore their functionality.

The events of recent months are a timely reminder that as researchers and as infrastructure and building professionals, we have a responsibility to our communities to seek solutions so that future natural disasters have less of an impact. While it is recognised that emergency response is the priority at this time, where budgets permit the following may be considered:

- Reconstruction efforts could be extended to include flood mitigation works to minimise future disaster event impacts.
- Pro-active road safety assessments could be undertaken to identify significant road safety risk elements which may be able to be addressed while construction crews are present (e.g. shoulder sealing, wider clear zones, provision of wire rope safety barriers in lieu of guardrail).
- Trials of reconstruction treatments could inform road authorities of optimum selections to be used after future events.

ARRB is planning a free Webinar on drainage design. If you wish to take part please email training@arrb.com.au.

If you would like assistance over the coming months, please contact ARRB's Regional Managers. Their contact details are listed on page 20.

Road owners getting to grips with climate change

In December, Adam Ritzinger from ARRB attended the 'Road owners getting to grips with climate change' final conference, held at the German Federal Highway Research Institute (BAST), in Cologne. The subject of the conference was the four projects relating to the effects of climate change on road infrastructure that had been conducted under the research program, which started in 2007 and finished in 2010. The aim of the conference was the dissemination of the research results and recommendations that had been produced. The four projects were:

Risk management for roads in a changing climate – This project developed a common method for risk analysis and risk management with regard to the effects on road infrastructure of possible changes to Europe's climate. The project focused on risk analysis – methods of risk assessment and risk management were proposed. New road design parameters were considered, as well as the improvement, maintenance, and operation of existing road infrastructure.

Improved local winter index to assess maintenance needs and adaption costs in climate change scenarios – This project used global climate models and historical weather observations from the road weather information systems in Sweden and Finland (temperature, moisture, wind speed, rainfall etc.) to develop better winter maintenance strategies and plans for road network infrastructure.

Storm water prevention methods to predict water damage in and near road pavements in lowland areas – This project focused on the road network drainage systems in lowland areas for countries including the Netherlands, Sweden, Denmark, and the UK. The project developed two sets of guidelines; the first at a holistic level aimed at determining the highest-risk areas in terms of negative effects of increased levels of stormwater, and the second focused on actions that should be undertaken in order to address these risks. The project used an innovative graphical information system (GIS) for screening the national road network for risk of flooding, called the 'blue spot analysis'. This method involved three key steps (see images at right):

- Screening of terrain data (identification of 'blue spots', and flow paths on surfaces)
- Rain sensitivity analysis of runoff for all blue spots (catchment areas coupled to rain depth)
- Coupling of combined terrain and rainfall data with drainage systems (predicting the effects of floods and storm water).

Pavement performance and remediation requirements following climate change – This project aimed to predict the difference in moisture condition in pavements in Europe as a consequence of climate change. The project sought to estimate the consequences for pavement and subgrade materials, and the entire pavement in terms of material composition, new/modified drainage practice, and required changes for maintenance. Current climate models were used to predict the effects of changing weather patterns, and this was coupled with the known/expected effects on road pavements, to determine the outcomes for road infrastructure.

These four projects put forward useful methods of mitigating the effects of extreme weather events with a particular focus on flooding caused by heavy rainfall. Thus, the findings of these



Screening of terrain data (identification of 'blue spots')



Rain sensitivity analysis of runoff for all 'blue spots'



Coupling of combined terrain and rainfall data with drainage systems

projects are considered particularly relevant for certain regions in Australia, which have experienced the severe effects of such events in recent times.

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Landmark Australian High Court decisions on non-feasance are 10 years old!



protection' for public bodies (including road authorities) was legislated, although it is important to note that where this has been done, it stops far from restoring a blanket immunity.

The legislative advances in civil liability have been less frequent since 2004/2005 and the number of claims against road authorities has fallen, with misfeasance (negligent repair) type cases tending to predominate. However, it is considered essential that road authorities continue to track precedent and case law, especially in areas such as 'prior knowledge' (i.e. whether a road authority knew of a defect in advance of an incident and injury that has led to a claim), and also regularly consider their practices with respect to record keeping and the supervision of consultants and contractors.

Additionally, it is the ARRB philosophy that preventing incidents from occurring in the first place, i.e. securing positive road safety outcomes through the practical implementation of principles such as the Safe System approach, is by far the best way to reduce a road authority's exposure to civil liability claims, as well as helping to meet stakeholder expectations.

ARRB is able to advise road authorities on highways liability issues and emerging trends, either through our knowledge transfer workshop - Legal Issues Facing Road Authorities (which has been running nationwide and internationally since 2004/5) or through individual consultancy commissions.

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On 31 May 2001 Australian High Court *Ghantous and Brodie* judgements determined that Australian road authorities could no longer rely upon what was known as the highway rule, which provided an immunity from actions brought alleging a failure to maintain public road infrastructure.

This was a considerable change to the previous situation where road authorities could only be held liable under misfeasance (i.e. taking action, but performing this action negligently). The judgements concluded that subsequent cases should be heard under the general principles of negligence, which introduced much uncertainty and a widespread fear that the floodgates would open on highways related claims.

However, at the time it was believed that there was also an opportunity for Australian road authorities to use the development as the catalyst to a much needed review and improvement of their asset management systems, particularly with respect to key building blocks such as visual inspection regimes, prioritising works and setting maintenance intervention levels. A road authority could expect to mount a successful defence

against a civil action based on the fact that it could demonstrate that it had implemented and followed reasonable measures in managing and maintaining its highway network.

The judgements also provided useful guidance, in that road users must take more personal responsibility and not expect the infrastructure to be in a perfect state of repair at all times.

Subsequent local (state and territory) civil liability legislation, in most cases introduced in 2002 and 2003, served to clarify the responsibilities of road authorities in each jurisdiction within Australia. For example, in South Australia and Victoria, the highway rule immunity of road authorities was reinstated by local legislation. In the case of Victoria this was done to allow time and opportunity for the drafting of a comprehensive **Road Management Act** (2004). In other states, a 'special



Illustration: J. Best

Photo: P. Roper

Prequalification streamlined in new system

Austrroads has developed a national prequalification system for road and bridge construction contracts (NPS). The NPS consolidates the various jurisdiction-specific systems previously in place into a seamless, harmonised framework for applications, assessments and reviews. The NPS commenced operation on 1 January 2011.

A uniform set of road and bridge construction categories were introduced along with a separate set of financial levels which all participating authorities have adopted, providing greater certainty and consistency for industry and authorities alike. For example, it will enable a contract to be advertised as R3/B3/F10 where it has roadworks characteristics corresponding to an R3 prequalification category, bridgeworks characteristics corresponding to category B3 and a financial level of F10.

Participating authorities will also harmonise their own internal processes for assessing prequalification applications, managing contractor performance and reviewing prequalification status.

A contractor prequalified by one authority will be able to apply for recognition of its prequalification status by another authority, subject to meeting eligibility requirements. A contractor would therefore only need to apply or reapply for prequalification under the NPS with one authority. Any upgrade of a contractor's prequalification status by one authority will also be recognised by other authorities.



Illustration: J. Best

Furthermore information about contractor performance will be readily shared across jurisdictions in which a contractor is prequalified. Poor performance will be managed via a uniform sanctions regime e.g. cancellation of a contractor's prequalification status, a downgrading of categories/levels or suspension. Changes to prequalification status arising from other than performance issues, such as significant changes in financial or technical capacity, will also apply in all relevant jurisdictions.

At this stage, mutual recognition will only apply to prequalification in the 'core' categories of road and bridge construction, and financial levels.

Some road authorities also prequalify contractors in specialist categories such as line-marking, road safety fencing, asphalt supply etc. Prequalification in specialist categories such as these will continue to be managed by individual authorities.

For participating authority contact details and information on how to become prequalified, please visit the Austrroads Prequalification website <http://www.austrroads.com.au/prequalification.html>

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Road and Transport Research Journal

The December 2010 issue contains articles on:

- adapting to climate change
- tourism impacts from aviation carbon pricing
- the toxicity of bitumen emulsions
- travel time analysis on arterial roads
- tests for determining mineral content of sedimentary rock
- calibration and validation of a fatigue performance function for asphalt concrete.

Shorter news items, upcoming conferences and a review of Dr Max Lay's latest book are also featured.

As a special offer for **Briefing** readers, the first ten new subscribers (not renewals) for the journal in 2011 will receive a copy of the December 2010 issue free of charge.

Subscription enquiries should be directed to: booksales@arrb.com.au quoting this article.





Improving road maintenance in Indonesia

Rural roads provide vital links to services and employment for communities, access to markets and the transport of goods. Their quality, in terms of providing reliable and efficient access, can also significantly affect socio-economic outcomes.

In many parts of Indonesia poor conditions exist on regional and local road networks. Consequently, the Directorate General of Highways (DGH) has been given national responsibility for the provision of leadership and support to local road agencies for helping improve the management of regional roads.

In 2010, ARRB was commissioned to lead a project which reviewed current road maintenance practices and funding at the sub-national level to assist DGH in its mission. This has been followed by a subsequent phase to develop and demonstrate a sustainable approach to planning, programming and budgeting road maintenance activities in selected provinces which will provide a model that can be adopted throughout Indonesia.

The Phase 1 study drew on extensive consultation with representatives from provincial road agencies from West Java, Central Java, Bali, Nusa Tenggara Barat and West Sulawesi, which were selected as being representative of both eastern and western Indonesia, and with senior personnel from DGH, Ausaid and IndII, and specialists in the field. It also sourced historical and current data on road conditions and funding, and supplemented this with extensive analysis and reviews of national and international practices.

Recommendations from Phase 1 addressed budget constraints and funding needs, access standards, travel demand, improved approaches to asset management and trial demonstration projects and programs.

Key issues and actions have also been identified which emphasise:

- the need for a strong policy-driven environment
- a commitment to clearly defined maintenance standards and their successful delivery
- supportive planning procedures, tools and cost-effective solutions



Photo: T. Toole

- building capacity in outcome based delivery.

The results from the Phase 1 review have been very effective in describing agencies and their road networks. The range of physical, financial, workforce capability and management environments across these agencies provides a rich range of choices from which to prepare plans for future technical assistance.

Phase 2 is now underway with a focus on:

- developing a new maintenance policy, and associated guidelines
- reviewing funding sources and mechanisms, including a possible output-based grant system aiming at restoring and preserving strategic parts of the network
- disseminating the solutions to senior policy makers, politicians and other stakeholders
- trialing the new policy, funding strategy and procedures in a representative province, and a number of districts in eastern Indonesia
- formulating Phase 3 and 4 programs, with the former aiming to assist in preparing an investment program, and the latter involving physical works implementation.

The overall approach is aimed at delivering a sustainable basis for renewal and maintenance, with the aim that the provincial and regency governments would commit their own funds to sustainable maintenance as part of the overall approach, incentivised by substantial grant support to address the backlog.

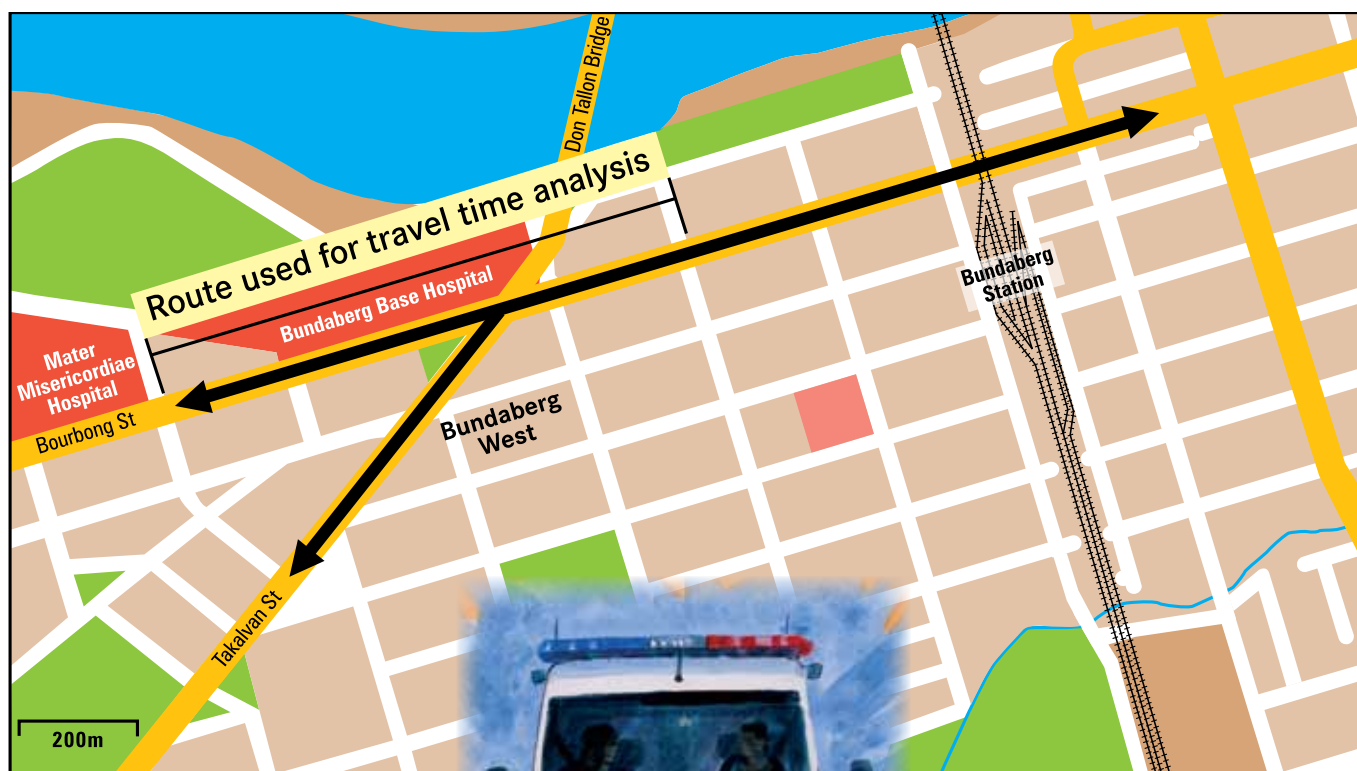
This article is drawn in large part from an article appearing in the journal *Prakara*, published by the Indonesia Infrastructure Initiative (www.indii.co.id), in January 2011.

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Photo: T. Toole

Giving priority to emergency vehicles



The Queensland Department of Transport and Main Roads (TMR) has implemented a pilot signal pre-emption system that provides signal priority to emergency vehicles (EVs) in the City of Bundaberg. This emergency vehicle pre-emption system (EVPS) makes use of the wireless mesh technology from Motorola for communication and vehicle positioning within the STREAMS architecture.

ARRB was invited by TMR to evaluate the performance of the EVPS using data from STREAMS. The evaluation study consisted of the analysis of EV travel times 'with' and 'without' EVPS. The comparison was carried out at the route level and the link level. A user survey was also incorporated into the evaluation to ascertain the EV drivers' experience of the system.

The conclusions were as follows:

- At a route level, the EVPS reduced the mean travel time of EVs by 20%. The difference was statistically significant at the 95% confidence level (CL).
- At a link level, performances were improved at different confidence levels. Of the three links analysed, only one link showed a statistically significant performance improvement

of 20% at the 95% CL. The other two links showed performance improvement but the differences were significant only at the 90% CL.

- The review of the user surveys concluded that there was a general improvement in the EVs level of service with EVP in place, e.g. reductions in travel time, delay, driver stress and road crash risk. In some cases, this improvement may only be minor and some of the users reported that the improvements were not obvious. This is a positive result even though it may have been affected by the fact that the survey was carried out shortly after the EVPS was turned off representing the 'without' EVPS case.

The following operational issues were identified:

- There was a relatively high incidence of the system being activated (by the push button in the EV) that did not result in the EV passing through any EVP equipped intersections. This was at least partly attributed to accidental button presses while the vehicle was in the EV station.
- In a few cases, the system was activated but the wrong route had been selected.
- There was a relatively high incidence of pre-emption being provided unnecessarily due to the EV turning off before the intersection or by other design issues related to not knowing the intended destination of the EV.

It was concluded that the EVPS improved the level of service and that the system could be improved further. This study also showed that the EVPS-STREAMS system was successful in capturing travel time data in real time.

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Helping motorcyclists go round the bend

VicRoads has commissioned ARRB to conduct a trial of 'Where you look is where you go' (WYLIWYG), a new form of curve delineation which has reduced crashes in England.

The aim is to reduce run-off-road crashes by providing riders with improved visual cues regarding the radius of a curve. By augmenting conventionally-placed guideposts with additional guideposts at the approach and exit to the curve, WYLIWYG is said to assist riders to select the ideal road position, gear and entry speed.

Maintaining a focus on the 'vanishing point' – the point at which the road passes behind the surrounding terrain – is generally accepted as an important technique for maintaining positional awareness in a curve. If the vanishing point appears to be moving closer to the rider, the curve radius is tightening. If it is moving away, the curve is opening out.

WYLIWYG appears to be most suitable for sites at which riders' vision is likely

to be fixated on a particular point on the curve, distracting the rider from monitoring the vanishing point. Examples of such distractions include signage, utility poles, gates and trees. WYLIWYG seeks to redirect riders' attention away from these points of focus and back to negotiating the curve.

The project will involve a before-after study of the treatment, with control sites. A number of measurements of rider behaviour will be used to assess the effectiveness of the treatment: curve speed, time of brake application, braking force, lean angle, rate of change of lean angle, angular acceleration and/or lane position. Unobtrusive recording of the behaviour of riders will be made using hidden cameras.

The capacity of WYLIWYG to reduce crashes will be assessed on the results of the before and after comparisons



Photo: P. Cairney

Installing one of the cameras during the pilot trial

of cornering behaviour. Key data to be considered will be the proportions of motorcyclists who:

- inadvertently come close to crossing the centre line at the apex of the curve
- inadvertently come close to crossing the edge line or leaving the paved surface on the exit from the curve.

Recommendations for the use of WYLIWYG will be developed based on its capacity to reduce motorcycle crashes, the type of site where it appears to be most effective, its compatibility and performance compared with other types of delineation, effect on other traffic, and cost.

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Photo: P. Cairney

A new generation of traffic signal controller

Australian road agencies have been pioneers in the development and usage of traffic signal controllers. Since early 2008, Austroads through ARRB has funded two projects to develop a new generation of controllers that can make better use of advances in the processing power and memory availability in the current generation of signal controllers.

The new controller is to be modular, scalable and with an open architecture. It should also enable easy programming and facilitate the implementation of advanced traffic control algorithms and various intelligent transport system applications.

The first project NS1377 (Traffic Signal Controller – Future Directions) identified new technological and methodological developments suitable for developing the functional requirements of a future traffic signal controller. The current project (NS1510) aims to produce functional



Photo: J. Best

specifications so that local controller manufacturers can then prepare technical specifications suitable for the

development and construction of their own proprietary products.

After the functional specifications are released, manufacturers can plan, develop, test and get type approval by a jurisdiction before the product is ready to go onto the market. Road agencies will then be able to tender for the supply of controllers based on the final, revised specifications. The Austroads project team has suggested a 10 year horizon so that a prototype could be available in about 2018.

The projects have also received inputs from the industry. Because a traffic signal controller is a safety-critical device, a specialist firm in safety engineering was recently contracted to provide a framework for the specification of safety functions for a controller.

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Developing a skid resistance management policy

Current skid resistance monitoring programs and investigatory limits used in Australia have been 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.

Austroads recognised a targeted approach applicable to Australian conditions was required and initiated a research project to develop a suitable national approach to skid resistance management.

The project report (Austroads AP-R374/11) provides guidance on a process whereby a road authority can set its own skid resistance policy and/or management practice as applicable to individual circumstances and local conditions.

The report outlines the basic contribution of a road surface to skid resistance, followed by the types of skid resistance

measurement devices commonly used in Australia. The report then discusses how a road surface provides friction, including how this can vary with the seasons.

A new concept of dividing Australia into skid resistance demand zones based on population densities, annual rainfall, topographic environment and traffic was developed.

For the first time, instruction in determining investigatory levels, and the updating of these levels, is then provided. A uniform pro-forma for undertaking an 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.

Advice is offered on the following key steps:

- Determining which zones of similar skid resistance demand apply to which portions of the network.



Photo: P. Hillier

- Determining the applicable minimum level of testing
- Setting investigatory levels for the equipment that will be used in the testing
- Establishing and documenting a skid resistance management plan/strategy
- When investigatory levels are reached, undertaking an investigation
- Ranking the investigated segments into priority order
- Reviewing and updating investigatory levels.

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Helping road authorities tackle skid resistance

In addition to collating and formulating national best practice in the fields of skid resistance and surface texture management and hosting the 3rd International Road Surface Friction Conference in 2011, ARRB is also active in helping road authorities (internationally and within Australia) to develop their own skid resistance strategies. In the last decade, ARRB has undertaken commissions for all but two of the state/territory road authorities in Australia.

The most recent commissions have been for Main Roads Western Australia and the Israel National Roads Company. ARRB has benchmarked current approaches against best practice, and worked with the clients to develop realistic local development plans.

ARRB is often asked to help draft, or review, an authority's Skid Resistance Management Plan (strategy) document which then goes into the public domain. Perhaps the three most important stages in these commissions



Photo: P. Hillier

have been fact finding, consultation and dissemination at a regional/district office level.

This goes a long way towards ensuring buy-in to a strategy and ultimately

whether it actively contributes to positive road safety outcomes and in reaching important corporate and regional objectives and targets. The message is a simple one: ignore local challenges and issues and local input and experience at your peril.

ARRB is also an active contributor to local technical events, for example, Kym Neaylon and Paul Hillier were both participants and speakers in TMR's two day skid resistance discussion forum and workshop in Brisbane on 22/23 February 2011. ARRB's knowledge transfer workshop on this issue also runs regularly throughout the country or can be held at an authority's offices as required. For further information, see pages 19 and 20.

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3rd International Road Surface Friction Conference **Safer Road Surfaces – Saving Lives**

15-18 May 2011, Hyatt Regency Sanctuary Cove, Gold Coast QLD



Registrations now open

ARRB Group is hosting the 3rd International Road Surface Friction Conference (15 – 18 May 2011) on the Gold Coast, Australia in association with the New Zealand Transport Agency and WDM®.

The theme of the Conference is Safer Road Surfaces – Saving Lives reflecting the undoubted contribution that effectively managing road surface friction can make to achieving positive road safety outcomes.

The Conference will provide opportunities for delegates to network, share industry knowledge and exchange research information.

One of the highlights of the conference will be held at Queensland Government's Mount Cotton test track on Day 3 of the Conference. Delegates will be able to witness and, in a number of cases, experience some of the key concepts and underlying principles of road surface friction, across a range of different vehicle types.

For further information please contact
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THE 3RD INTERNATIONAL ROAD
SURFACE FRICTION CONFERENCE IS
BEING RUN IN ASSOCIATION WITH:



NZ TRANSPORT AGENCY
WAKA KOTAHU

Early Bird closes 31 March 2011 - Register online at www.friction2011.com.au

Safer Road Surfaces – Saving Lives

The 3rd International Road Surface Friction Conference will be held on the Gold Coast, on 15-18 May 2011.

The theme of the Conference is **Safer Road Surfaces – Saving Lives**, reflecting the contribution that effectively managing road surface friction can make to achieving positive road safety outcomes and making our road networks more forgiving.

Invited speakers include The Honourable Craig Wallace MP, Queensland Minister for Main Roads; Rob McInerney, Chief Executive Officer for the International Road Assessment Programme (iRAP); Superintendent Paula Rose, National Manager- Road Policing, NZ Police; and Matthew Lugg, Chairman of the UK Roads Board.

The program technical sessions will include:

- Skid resistance strategy and objectives

- Materials
- Asset management benefits
- Measurement, data processing, data analysis, seasonal variation
- International perspectives
- Asset management processes
- Crash case studies and legal
- Identifying and meeting friction demand
- Tyre-road interface
- Achieving positive road safety outcomes
- Partnerships in practice.

One of the highlights will be a technical demonstration day at the Queensland Government's Mount Cotton test track on 17 May. Delegates will be able to witness many of the key concepts and underlying principles of road surface friction as they affect vehicle dynamics, across a range of vehicle types and ages, and under different road surface conditions.

Activities and demonstrations will include:

- observing a crash investigation demonstration with an experienced investigator
- undertaking a skills test in visually assessing the speed of various moving vehicles
- being informed about the functionality



of braking systems in heavy vehicles and motorcycles

- observing 'skid to stop' straight line braking with a range of vehicles
- observing straight line braking in ABS and non-ABS vehicles, in both wet and dry road conditions
- observing the practical effects of differential friction on straight line braking and cornering, using various cars (new and old, with/without ABS)
- observing mobile test devices in controlled road test environments supplemented with hands-on static displays
- observing the use of various items of static test equipment, as well as having an opportunity to 'talk materials' with industry experts
- learning about vehicle safety control devices (e.g. ABS, traction control, ESC etc.) and the basics of tyre technology to gain an understanding of how these items help save lives, and significantly, what is coming in the future.

This is the first time this event has been held in Australia and more than 250 delegates are expected to attend from Australia and overseas. Previous conferences were held in New Zealand (2005) and the United Kingdom (2008).

ARRB Group is hosting the conference, in association with the New Zealand Transport Agency and WDM Limited.

Mr Gerard Waldron, ARRB's Managing Director, said, 'We are proud to host this conference which will provide an opportunity for Australian practitioners to demonstrate their capabilities and knowledge and for international representatives to share their expertise.'

The conference will be held at the Hyatt Regency Sanctuary Cove, Gold Coast, Queensland, Australia.

Visit www.friction2011.com.au for updates.

Conference hosted by:



In association with:



NZ TRANSPORT AGENCY
WAKA KOTAHI



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Photos courtesy VicRoads

Review of post-completion evaluation procedures

ARRB was commissioned by a road authority to review post-completion (ex post) evaluation procedures across Australasia and abroad. Post-completion evaluation is an integral part of the project evaluation process. It involves examination of the initial appraisal of the project (ex ante analysis) in terms of actual costs and benefits following implementation, e.g. outturn construction costs and traffic data.

In Australasia, guidance on post-completion evaluation for transport projects is detailed in the Australian Transport Council (ATC) *Guidelines for Transport System Management*, the Austroads *Guide to Project Evaluation* and the New Zealand Transport Agency's *Economic Evaluation Manual*.

The aim of the study was to review post-completion evaluation procedures across road authorities and other government departments (e.g. health & treasuries) to determine the extent to which they exist and to identify key components of these procedures. This would assist road authorities in drawing up post-completion evaluation procedures of their own, taking into account 'best practice'.

The study found that practices vary widely across jurisdictions. While there

are numerous detailed guidelines for the economic evaluation of projects, e.g. the Caltrans *Guide to Benefit Cost Analysis*, post-completion evaluation is not incorporated as an integral component of the transport project appraisal process.

Where procedures exist, they are broad and indicate steps to be followed in a 'checklist' approach without going into detail, leaving room for interpretation. Numerous useful detailed ex post evaluations of major road infrastructure projects have been undertaken but procedures behind these exercises were not formally developed. However, they can serve as useful examples from which procedures might be formulated.

While there is some recognition of the need to undertake post-completion evaluations of major projects, not much attention is paid overall to post completion evaluations of projects of lesser size. Some departments put monetary amounts to these categories (e.g. projects over \$5m). Other departments admit that more effort is put into the evaluation of larger projects and programs, due to resource constraints.

There is evidence of the role of treasuries advocating for project appraisals to be

undertaken, especially for major projects, and for more detailed guidelines to be developed for transport, including post-completion evaluation. An example is the HM Treasury (UK) *Green Book on Appraisal and Evaluation*, which serves as a basis for the *Transport Analysis Guidelines* developed by the UK Department for Transport.

The widespread absence of a legal requirement for infrastructure project appraisal, including post-completion evaluation, was noted. However even where a legal requirement was applied, it did not result in a perfect record of compliance in terms of evaluations completed, e.g. in France.

Finally, the review found that there appear to be significant differences in the understanding, purpose and application of post-evaluation approaches across government departments e.g. treasury and line departments.

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Estimating the costs of infrastructure projects

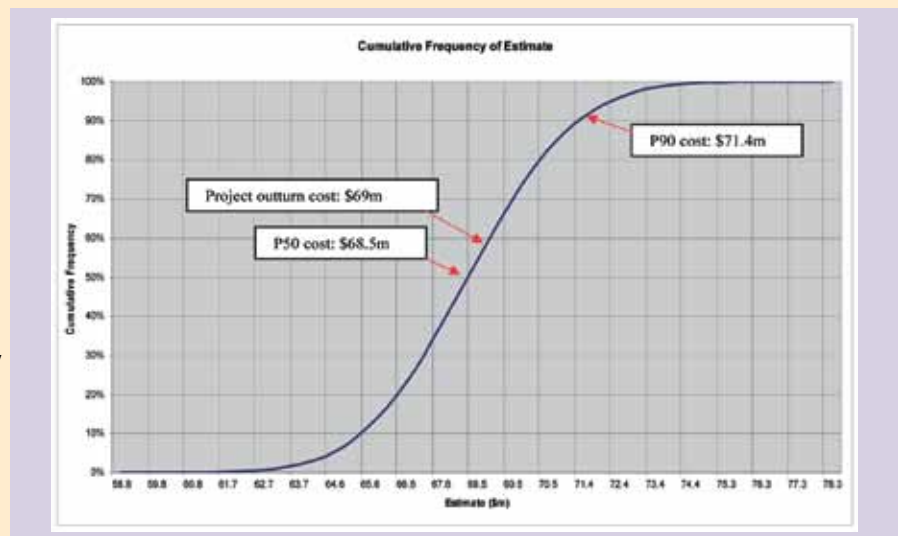
In the road transport sector, some large scale or complex projects run over budget. This can result from probabilistic risk methods not being applied, fund contingencies being set too low and cost estimates not adequately accounting for risks and uncertainty.

Risks and uncertainty can be affected by rising labour or material costs, increased project scope, under-budgeting of project outturn estimates, changing economic conditions and technology changes. This becomes an issue for transport agencies as additional funding has to be sought.

ARRB has recently examined some issues relating to improving estimation of the costs of proposed projects and has reviewed a Best Practice Cost Estimation Standard ('the Standard') that was recommended in an Evans and Peck report. As part of 'the Standard', the incorporation of risks should be a necessary step in cost estimation at all stages of a project from identification to scoping, development and delivery.

Two approaches to cost estimation have been defined. The P50 cost value is an estimate of the project cost with a 50% probability that costs will not be exceeded whilst the P90 value has a 90% likelihood of costs not being exceeded.

To assist practitioners in probabilistic risk modeling and financial budgeting, an empirical model using Monte Carlo techniques has been developed



to demonstrate the importance of adopting P90 cost estimation.

Results of the Monte Carlo simulations take into account all risks associated with a project, and the output distributions include a range of possible costs indicating the probability of outcomes. The model results provide an understanding of which cost items or risk drivers should be a focus for practitioners to reduce the project's risks. It illustrates that the P90 cost should be the option adopted by practitioners, otherwise projects will be under-budgeted.

The Best Practice Cost Estimation Standard can be applied to any project and will lead to greater certainty in the project outturn cost estimates. It is hoped that 'the Standard' may over

time, influence agencies to redefine their project phases and cost estimation practices.

ARRB presented a paper on 'Best practice cost estimation in land transport infrastructure projects' at the 2010 Australasian Transport Research Forum (ATRF).

The paper can be accessed at the ATRF 2010 publication website: <http://www.patrec.org/atrf.aspx>.

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Conferences

4th Australian Small Bridges Conference 2011

Melbourne, 10-11 May 2011
<http://www.halledit.com.au/bridges2011>

Road Safety Forum 2011: Directions In Road Safety Research

Adelaide, 12-13 May 2011
<http://roadsafetyforum2011.com/>

Urban Congestion 2011

Sydney, 12-13 May 2011
<http://www.informa.com.au/conferences/transport/infrastructure/urban-congestion>

3rd International Road Surface Friction Conference 2011: Safer Road Surfaces - Saving Lives

Gold Coast, 15-18 May 2011
<http://www.conferenceworks.net.au/friction/>

Environmental Management in Transport Summit 2011

Sydney, 17-18 May 2011
<http://www.informa.com.au/conferences/Environment/environmental-management-in-transport-summit>

2011 LGMA National Congress and Business Expo: Best Practice to Next Practice

Cairns, 22-25 May 2011
<http://www.lgma.org.au>

Smart Conference and Expo 2011

Sydney, 25-26 May 2011
<http://www.smartconference.com.au>

2011 Australian Trucking Convention

Canberra, 25-28 May 2011
<http://www.ataevents.net.au/atc2011/>

50th Roughometer sold into India

ARRB originally developed the Roughometer to provide a cost-effective, simple-to-operate device to monitor the condition of unsealed roads. It replaced the 'Bump Integrator' developed in the 1960s.

The Roughometer has proven to be very popular both in Australia and overseas, particularly in India where we recently celebrated the sale of the 50th Roughometer unit to the Construction and Maintenance Division of the State Highways Department of the Government of Tamil Nadu.

This is a major milestone for ARRB and our Indian partners Taisei International, who have assisted in all 50 sales of the Roughometer. The Roughometer is now in its third iteration with the addition of a GPS function which enables road condition to be displayed in a GIS format.

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Mr LS Sivasankar, vice president of Taisei International presenting the 50th Roughometer to Mr. T. Chandrasekar, Divisional Engineer of the Tamil Nadu State Highways Department. (Photo: Taisei International).

Airport runways testing



Heavy Weight Deflector

Photo: Grontmij | Carl Bro

Airport runways are an interesting example of niche pavement design and usage. Although fundamentally similar to road pavements, the usage and loadings airport runways are subjected to are significantly different. Because of the costs involved for major rehabilitation

works, every effort is made to prolong the pavement life, whilst maintaining the required high safety levels of the surface.

Traditionally, testing has focused on measuring surface friction and runway strength. To reduce the effect of

aquaplaning, runways are usually tined (slotted), which allows the water to drain off the runway. For these tines to work successfully, the runway needs to have the correct cross-slope and the slots free of tyre-rubber build-up. These factors can be assessed using a friction tester, such as the

(continued next page)

Airport Surface Friction Tester T-5 trailer (ASFT), and an ARRB Walking Profiler for the cross-slope.

Pavement strength testing is key to assessing the suitability of different aircraft for that pavement. A Heavy Weight Deflectometer (HWD) is typically used to evaluate the limits of the pavement, generally resulting in a Pavement Classification Number (PCN), which can be matched with the Aircraft Classification Number (ACN) to determine suitable aircraft limits.

Recent testing has looked at the importance of the longitudinal profile. Poor longitudinal profile can result in excessive wear and tear on the aircraft's landing gear as well as cause localised failures in the pavement. Precise profiling, such as with a laser profiler, can help identify problem areas, as well as feed data into advanced modelling software to determine aircraft interaction.

ARRB offers a range of services and devices for airport pavement testing needs. As a developer of road profiling equipment and partner of Grontmij | Carl Bro and



Photo: ASFT

Airport Surface Friction Tester

ASFT, ARRB is able to provide equipment and services to monitor strength, friction and runway profile.

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Luxmoore assisting airports

Luxmoore Parking Consulting (a division of ARRB) is currently assisting Perth, Sydney, Melbourne and several regional airports, with parking design, layout, signage and the installation of access control technologies.

After extensive stakeholder consultation, Luxmoore prepared a Request For Tender (RFT) to replace all the access and revenue control equipment for Perth's short and long stay car parks, and for buses, taxis and staff. The >\$4m purchase is being installed at 11 locations over three months.

The system includes high quality intercoms linked to CCTV, as well as automatic number plate recognition (ANPR), which prints the vehicle's registration number on the ticket. This improves security for parking customers

and reduces the ability for fee evasion through the swapping of tickets.

A similar project is underway to assist Sydney Airport to upgrade parking technology and customer service at the domestic and international terminals. New equipment will include a reservation system for parking bays and a variety of parking products to assist travellers.

Project advice includes guidance systems to provide 'space available' signage for drivers approaching the airports and improved signage for pedestrians.

At Melbourne, Luxmoore has undertaken a detailed GPS based audit of regulatory and instructional signage on all roadways to/and within the car parks.

Luxmoore is also assisting regional airports such as Geraldton WA, with



Photo: Grontmij | Carl Bro

purchasing access control equipment and the introduction of user pay parking to ensure short term bays are not abused by long term stayers and to assist in funding expansion of parking supply.

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Hawkeye Processing Toolkit new features

Version 3.0, release Jan 2011



HAWKEYE

SCALEABLE SURVEY SOLUTIONS

- Toolkit can be launched from hyperlinks
 - ESRI, MapInfo, Excel, Explorer, Internet
 - Click-to-open
 - Windows (XP, Vista, 7)
- International language support
 - Chinese (updated)
 - Japanese
 - Russian
- Additional road profile calculations
 - Bump Integrator calculations
 - Advanced statistics
 - Project batch processing
- All-in-one desktop processing software for all Hawkeye products. Drive,

review, measure, count, process and report on your road network from the comfort of your desk.

For further information on the Hawkeye Processing Toolkit, please contact productinfo@arrb.com.au

ARRB's local representatives

In addition to our offices in Melbourne, Sydney, Brisbane, Adelaide and Perth, ARRB has appointed local representatives in Canberra, Darwin and Hobart.

John Metcalfe in Canberra



John graduated in Arts and Economics from Australian National University (ANU). Prior to joining the Australian Automobile Association he held senior positions in policy areas

of the Department of Industry and Commerce, the Department of Transport and Communications and at the Bureau of Transport Economics. Responsibilities at AAA included policy issues relating to road funding, the environment, including climate change, fuel pricing and taxation, vehicle manufacturing industry, road user charging and road safety.

John was responsible for initiating AusRAP which included using Hawkeye to collect video data for star rating. He has also presented papers to ARRB conferences. Since 2009 John has been employed by ARRB on a part-time basis as Research/Business Manager, ACT where he is responsible for client relationships with ARRB's members in Canberra: the Federal Department of Infrastructure & Transport, ACT local government and the Australian Local Government Association.

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Steven Walker in NT



Steven manages all client relations for ARRB Group in the NT and also contributes to the quality management of various transport planning unit projects. He

is also a part-time Director, Special Projects in the NT Department of Construction and Infrastructure.

Steven has experience in all phases of projects from feasibility studies, benefit cost analysis, EIS preparation, transport network planning, and traffic planning, through to engineering design and managing site phase delivery of projects.

Prior to joining the NT Government, for nine years Steven was responsible for managing the Arup office, and delivering infrastructure programs across remote communities in the NT for the Australian Government. Before this he managed the ACT office and built a transport planning business for Arup.

Prior to joining Arup, Steven was involved in airport planning and development across Australia, including assessment and analysis of several major airport development proposals. He also led the Darwin Airport Redevelopment team that undertook all the planning and preliminary design for a new terminal, apron and land side facilities on the northern side of RAAF Base Darwin.

During the 1970s Steven was engaged as a design engineer for water and wastewater systems in urban and rural communities in Melbourne.

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Geoff Webb in Hobart



Geoff has been an Associate of ARRB since 2008. His primary responsibilities are to act as the principal liaison with the Department of Infrastructure, Energy and

Resources in Tasmania, to carry out tasks commissioned by DIER, local government and private industry in Tasmania, and to support ARRB's activities nationally.



Some recent projects include:

- Compilation of road and bridge maintenance and rehabilitation expenditures from Australia and New Zealand
- Provision of expertise in the management of standard specifications
- Review of DIER's approach to use of SCRIM skid resistance data
- Pavement investigation of an asphalt overlay
- Assessment of sealed road condition for a council
- Development of a revised Pavement Rehabilitation Manual for Brisbane City Council
- Provision of training at the Centre for Pavement Engineering Education (CPEE).

Geoff is the principal of GR Webb Consulting Pty Ltd, an independent Tasmanian-based consultancy providing technical services in infrastructure asset management (including pavement management systems), maintenance management, road condition surveys and pavement technology.

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John, Steven and Geoff would be delighted to hear from you should you need their assistance.

iRAP India 4 states project

ARRB is presently managing the iRAP India 4 states project funded by the World Bank Global Road Safety Facility as part of the Bloomberg *Road Safety in 10 countries* initiative. Road safety is a significant problem in India with more than 300 deaths each day.

The project involves collecting video and pavement condition data across 3,000 kilometres of selected road corridors in the Indian states of Assam, Karnataka and Gujarat and generating star safety ratings for each of the routes. Each state is either preparing to undertake or is undertaking World Bank financed projects on their

road networks and the intention is to implement the key outcomes from the iRAP assessment to ensure these roads are built to be as safe as possible for motorised vehicles including motorcycles, bicycles and pedestrians.

The project was officially launched in New Delhi last November and in January 2011 more than 25 road engineers from the three states as well as Andhra Pradesh (where inspections of three road corridors have already been completed) gathered for a five day iRAP training course arranged by ARRB at the Automobile Association of Upper India facilities in New

Delhi. The core training was undertaken by Ms. Van Hoang from ARRB and Mr. Luke Rogers from iRAP and focussed on teaching the participants how to rate more than 30 different road design attributes that are known to influence the likelihood of a crash and its severity from the video data using ARRB's Hawkeye Processing Toolkit.

The inspection phase of the project commenced in early February and since then each of the road corridors in Karnataka and Gujarat have been surveyed. Next, the survey team will relocate to undertake the inspection of the road corridors in Assam. The survey data is being collected by the Indian Road Survey and Management (IRSM) company using an ARRB Hawkeye 2000 network survey vehicle.

Once the data collection is completed in each state it will be assessed by a local rating team, consisting of those who attended the training in New Delhi, under the supervision of an ARRB expert. The rating will be conducted separately in each state.

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Photo: R. Wix

Improving our knowledge transfer workshops

For our members and industry, one of the most important purposes of ARRB is to share and transfer knowledge. In response ARRB conducts workshops, seminars, conferences and webinars based on the Austroads Guides and other industry related topics. The workshops are delivered to ensure that the information is transferred in a manner which can be applied on the job or in the field, practically and immediately.

The state and territory road authorities, and other workshop participants have indicated that they highly value the workshops, and would value them more if they were accredited.

ARRB is now in the process of finding out how recognition and accreditation can be wrapped into our portfolio of workshops, at the same time ensuring our commitment to Austroads and maintaining innovative content and

quality delivery. Another key criterion for our planning is working out how our offerings can complement those already in the market place. However, we need some information from you to make sure we are giving you what you want.

The Knowledge Transfer team will be contacting a sample of members and past workshop participants.

We would like to know what an accredited workshop means to you and your organisation. Is it recognition in the industry or by your employer to meet your professional development quota; is it to gain a nationally accredited qualification such as a Diploma, Advanced Diploma or Graduate Certificate that adds credibility and proof of knowledge and skills to your Personal Profile? Or maybe it is something else.

If you have not been contacted yet and you would like to participate in this survey, send an email to training@arrb.com.au with the subject line – **Survey - Please Contact Me**. Make sure you include an email signature showing your contact details. Alternatively you may contact Lesley Blefari directly.

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New staff



Dr Chris Blanksby has rejoined the Heavy Vehicles team part-time in Melbourne. Chris led the Heavy Vehicles team for several years, before leaving to pursue his interests

in engineering and sustainability in the energy sector. Chris will provide mentoring and technical guidance to our new and less experienced staff, help investigate some challenging technical issues and assist with the development of Heavy Vehicle's capabilities and services.



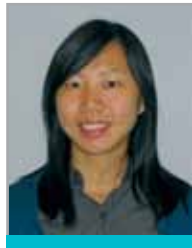
Carolyn Bradshaw has joined the Safe Systems group as a Graduate Behavioural Scientist. Carolyn completed a BBus at Latrobe University and a GradDip and a Postgraduate Diploma in

Psychology with Melbourne University.



Lesley Blefari has joined ARRB as the Registered Training Organisation Implementation Manager. Lesley has more than 20 years experience in RTO and other management

roles in a wide variety of industries and disciplines.



Lydia Chong has completed her Bachelor of Science/Engineering degree. Lydia has joined our Graduate Rotation program and initially will be working with the Heavy Vehicles team.



Anthony Goebel is a new graduate civil/structural engineer joining Carlos Rial's team in Brisbane. He has a BCE from the University of Queensland.



Hilke Harms has joined the ARRB Perth office as a traffic and transport engineer after moving from the Netherlands to Perth. Whilst in the Netherlands she worked in an engineering consultancy. She has

experience in traffic management, traffic and transport planning and intelligent transport systems and services. Hilke has an MSc in civil engineering and a BSc in transport policy, systems engineering and management both from the Delft University of Technology.



Rudolph Kotze has joined our Brisbane office as the new National Technical Leader - Bridges. Rudolph has 29 years' experience in road and rail bridge design, bridge

asset management, maintenance and project delivery. This includes 15 years in senior leadership and management roles in consulting practices in South Africa and New Zealand. At the New Zealand Transport Agency (NZTA) as National Structures Manager, he provided technical support for all major NZTA bridge and tunnel projects. Prior to joining ARRB, he was Principal Bridge Engineer with Opus International Consultants. His qualifications include BEng(Hons) in structural engineering, BComm (transportation economics) and a Diploma in Business Studies (dispute resolution).



Adrian Lim is a graduate engineer in Melbourne following completion of his BEc/Comm and BE degrees with the University of Melbourne.



Max Lay's new book

Dr Max Lay recently launched his new book, *Strange Ways*.

A whimsical and amusing atlas of the weird and wonderful happenings on our roads throughout history, the book is published by Engineers Media, the publishing arm of Engineers Australia.

Dr Lay is a past Managing Director of ARRB, member of the Order of Australia, past President of the Royal Society of Victoria, the RACV and the Australian Automobile Association, and former Director of ConnectEast.

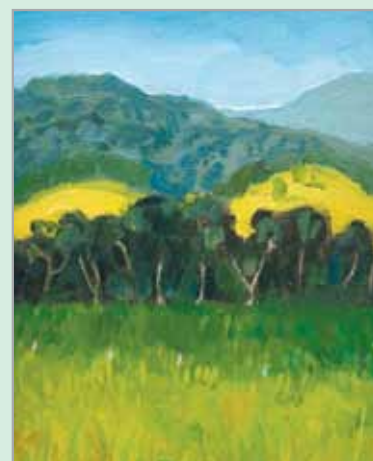
ARRB Conferences - Reducing the carbon footprint

Thank you to all those delegates who ensured their carbon footprint was minimised during the recent ARRB Conferences in Melbourne.

Additional thanks go to those delegates who agreed to pay an optional extra on their Conference registration. This donation raised \$950 towards offsetting

the carbon emissions generated by the Conference.

Through Carbon Neutral, a not-for-profit organisation, the money raised has gone towards planting of native trees and shrubs which are estimated to offset around 48 tonnes of greenhouse gas emissions.



Knowledge transfer program 2011

NEW SOUTH WALES

- An introduction to geotechnical investigation and design, 14 April 2011, Sydney
- Level 1 bridge inspection, 4-5 May 2011, Sydney
- Planning and design of parking facilities, 21-22 June 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

- Managed freeways, 3-4 May 2011, Melbourne
- 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

QUEENSLAND

- Traffic theory and applications, 31 March – 1 April, Brisbane
- An introduction to geotechnical investigation and design, April 2011, Brisbane
- 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
- 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, Townsville

WESTERN AUSTRALIA

- Managing road pavement assets – ROMAN II, June 2011, Perth
- Level 1 bridge inspection, 22-23 June 2011, Perth

SOUTH AUSTRALIA

- Fundamentals of transport modelling, 5-6 April 2011, Adelaide
- Managed freeways, 24-25 May 2011, Adelaide
- Speed limits and speed management, 12 July 2011, Adelaide
- Level 1 bridge inspection, 26-27 August 2011, Adelaide
- Speed limits and speed management, 27 September 2011, Adelaide

TASMANIA

- Fundamentals of transport modelling, 10-11 May 2011, Hobart

AUSTRALIAN CAPITAL TERRITORY

- Speed limits and speed management, 18 August 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 all relevant disciplines and inputs from stakeholders and road users. This workshop will cover these principles so that 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 aims to provide participants with an understanding of the fundamentals of transport modelling 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

(continued next page)

Knowledge transfer program 2011

that those attending are prepared in the event of future representation of their organisation. The workshop is 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 aims to assist participants develop skills to conduct the Level 1 inspection 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. It will be based on 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 case study syndicate exercise to provide hands-on experience applying the latest practice.

Managed freeways: In Australia and New Zealand over recent years 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 background material supporting the Austroads *Guide to Traffic Management Part 11: Parking* with additional information drawn from Australian Standard AS2890.1-5. It will cover best practice techniques, available resources, design principles, on and off-street requirements, special needs of different users, architectural and urban design considerations, and a case study syndicate exercise to provide hands-on experience applying the latest practice.

Speed limits and speed management: ARRB, on behalf of Austroads, is pleased to offer a one day training workshop on 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. The workshop will provide traffic and transport 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.

Other workshops to look out for in 2011

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, aims to equip delegates 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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