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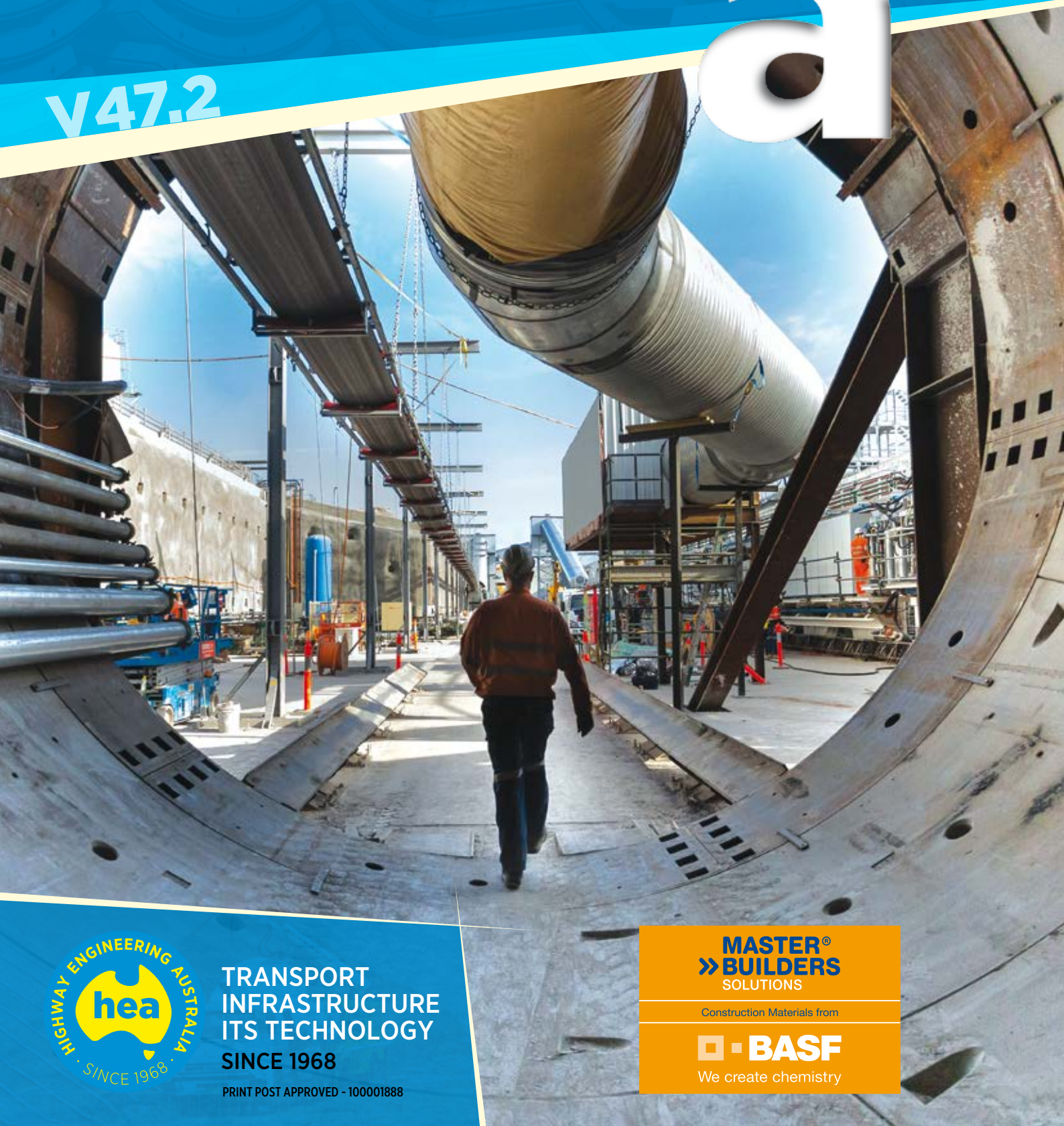

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## About the Cover

Stretching a total of 23 kilometres from Epping to Rouse Hill in Sydney's north west, the $8.3 billion Sydney Metro Northwest Project (formerly the North West Rail Link) is not only Australia's largest public transport infrastructure project, it will also be Australia's first fully-automated metro rail system. As well as featuring the longest railway tunnels ever built in Australia, the project is also unique in that it is the first public transport infrastructure project in Australia to utilise four Tunnel Boring Machines (TBMs) simultaneously.
*Image Courtesy of Transport for NSW*

▶ Turn to Page 22 for the full story.

# Technology critical in meeting the future demands **of our transport infrastructure network**

Dear Readers,

For a country with a relatively small population, Australia is highly regarded for the speed with which we accept and adapt to new technologies. Indeed, our seemingly never-ending appetite for new technology, as well our widespread willingness as 'early adopters' (particularly when it comes to high tech consumer electronics), could in some ways be compared to the theme of the 1980s classic movie *Field of Dreams* - with the exception that rather than ***'build it and they will come'*** it would be paraphrased as ***'build it and they will buy!'***

While this eagerness to 'upgrade, adopt and adapt' may be true from a consumer perspective, unfortunately, the same cannot be said for much of the public and private sector - especially when it comes to transport related technology.

Please don't misunderstand... that comment is in no way intended to detract from the many excellent programs and technological developments that have been introduced or are being trialled across Australia. It is simply an observation in relation to the level of uptake and/or acceptance of many of these technologies.

One only has to look at programs such as the IAP (Intelligent Access Program) for heavy vehicles or, perhaps more alarmingly, the apparent lack of willingness to adopt technologies such as Electronic Work Diaries (EWDs) to see what I mean.

Whether this hesitation in adopting new technologies stems from a lack of understanding of what's available, how it works, or the type of benefits that they can deliver, is largely a moot point. The point is that there are many excellent technologies already available and capable of delivering very real and tangible benefits (safety, productivity and cost) to business and government alike. What's more, many of these technologies are sure to play a critical role in ensuring that our transport infrastructure network will be able to meet the future demands of both our freight and general transport needs.

The first thing we require, however, is a willingness to engage and invest.

## HEA ANNOUNCES STRATEGIC ALLIANCE WITH ITS AUSTRALIA

In keeping with the 'technology' theme of this editorial, I'm proud to announce that ***Highway Engineering Australia (HEA)*** magazine has established a Strategic Alliance with Intelligent Transport Systems Australia **(ITS Australia)**. ITS Australia is the country's leading advocate organisation for the development, promotion and deployment of advanced technologies to deliver safer, more efficient and environmentally sustainable transport across all public and private modes – air, sea, road and rail.

Established in 1992, ITS Australia advocates the application of communication, data processing and electronic technologies for in-vehicle, vehicle-to-vehicle, vehicle-to-infrastructure and mode-to-mode systems to increase transport safety and sustainability, reduce congestion, and improve the performance and competitiveness of Australia's networks. It is an independent not-for-profit incorporated membership organisation representing ITS suppliers, government authorities, academia and transport businesses and users.

Affiliated with peak ITS organisations around the world, ITS Australia is also a major international contributor to the development of the industry.

While HEA magazine has been involved with ITS Australia since its establishment in 1992, this new Strategic Alliance formalises our working partnership and takes it to the next level.

One of the major features of this exciting new partnership, is the inclusion of an extensive, dedicated ITS SPECIAL FEATURE section in each issue of HEA. Featuring the latest in ITS news from across Australia and around the world, together with articles, special features, technical papers and other content from ITS Australia, its members and partner organisations, HEA's ITS SPECIAL FEATURE section is a must read for road, transport and infrastructure industry professionals.

You'll find this issue's ITS SPECIAL FEATURE section starting on Page 27.

As part of this Strategic Alliance with ITS Australia, HEA magazine is also proud to announce that it has been selected as Official Media Partner for the *23rd World Congress on Intelligent Transport Systems,* which be held in Melbourne from 10-14 October 2016.

With the theme *"ITS - Enhancing Liveable Cities and Communities",* the 23rd World Congress on Intelligent Transport Systems is the largest event of its type and is expected to attract over 7,000 attendees from around 60 countries worldwide. HEA is proud to be your source for all the news, announcements and other relevant information in the lead up to this important global event.

Please visit: **www.itsworldcongress2016.com** for information and booking forms for the Congress and accompanying exhibition.

Anthony T Schmidt
Managing Editor

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# Integrating transport and land use planning in Australia's cities

**It is vital for policy makers to consider the importance of integrating transport and land use planning to meet projections of population growth and transport demand, according to a major report into Australian Cities.**

The *State of Australian Cities 2014-15* said adopting an integrated approach recognised that different parts of cities had different transport tasks and different infrastructure needs.

The report – released on 6 July – was prepared by the Federal Department of Infrastructure and Regional Development. It was made public with the report Progress in Australian Regions-State of Regional Australia 2015.

Both publications are designed to better inform investment decisions in urban and regional infrastructure – they provide an understanding of Australia's overall economic and social wellbeing.

Minister for Infrastructure and Regional Development, Warren Truss, said the reports focused on the population, employment, economic and transport trends that were occurring across Australia.

"Building the infrastructure Australia needs for the future is best informed by a thorough understanding of the challenges ahead and these publications will provide vital information for infrastructure planners and communities."

Mr Truss said the release of the publications recognised the interrelated nature of cities and their surrounding regions.

"*State of Australian Cities 2014-15* is an important tool for all levels of government in understanding where our cities are performing well and where there are opportunities for improvement," he said.

"While there is no doubt our cities are vitally important for the nation's prosperity they cannot be considered in isolation from their surrounding regions.

"The Progress in Australia's Regions – State of Regional Australia 2015 report illustrates the different ways that regions change and takes into account aspects like population growth, economic wellbeing and social progress."

The State of Australian Cities report said transport infrastructure played a crucial role in shaping cities, their economies and the urban lifestyles of residents.

The report argued that research into city development emphasised the importance of integrated planning, particularly transport and land use.

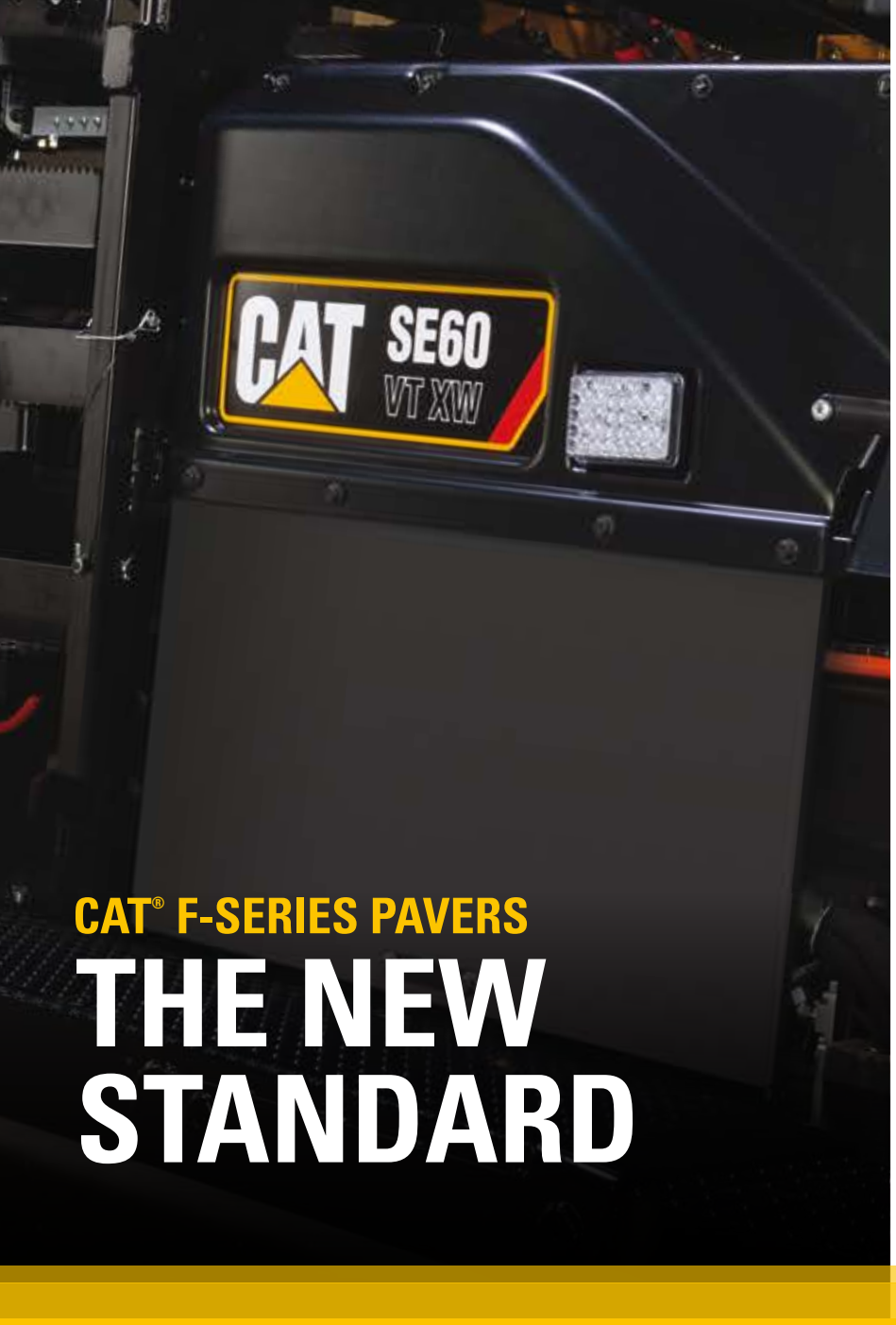
"Integrated planning outcomes will recognise that different parts of the city have different transport tasks and different infrastructure needs. Bicycle paths and light rail may be more important in the inner parts of cities, and feeder buses and private vehicle commuter flows more important in outer parts of cities."

> "While there is no doubt our cities are vitally important for the nation's prosperity they cannot be considered in isolation from their surrounding regions.

The growth of cities, according to the report, had coincided with record levels of car ownership, with every state and territory registering record numbers of vehicles in 2013-2014.

"Given the structure of large parts of Australia's cities, motor vehicle travel is essential if residents are to be able to access jobs and services."

The report contended that increased vehicle usage came at the cost of rising congestion and environmental impacts, which were increasingly becoming a strain on cities and their economies.

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It said the economic extent of congestion in capital cities had been estimated by Infrastructure Australia to grow from $13.7 billion in 2011 to about $53.3 billion in 2031.

The report said rising road congestion that resulted from job growth in high productivity city centres highlighted the important function of public transport.

It said across Australia's cities, a high proportion of jobs were concentrated in central city locations or other employment clusters.

"With such inward-focused travel demand and with space in city centres at a premium – leaving less for parking or for roads – the travel needs of many city centre workers can only be met by mass public transport.

"As Australia's urban economies have transitioned and more jobs are located in city centres, patronage on public transport has grown significantly."


Photo by Mitch Ames CC BY-SA 4.0

The report said in the past decade, the rate of average annual growth in public transport patronage had surpassed the rate of population growth in capital cities – 2.4 per cent compared with 1.8 per cent.

New rail and bus infrastructure had been built in recent years in Perth and Brisbane to meet increased public transport usage. Investment in infrastructure in Melbourne and Sydney had remained largely static despite sharp growth in rail passenger journeys and overcrowding had started to occur.

The report also looks at airports and ports, and their position in the transport network.

In relation to ports, it said the transport of freight was a significant contributor to congestion, particularly on urban roads during peak periods. Freight, especially containerised, was moving through ports at record levels and was projected to further increase.

"This growth in container movements through Australia's urban ports has substantial implications for cities, with road and rail congestion, land shortage and development, and competing land use tension around ports and distribution hubs set to further escalate."

The report said in looking at airports that globally integrated cities tended to have airports which accommodated a lot of business travel.

It said given the increasing economic importance of the knowledge economy to Australia's cities, in addition to the increasing number of Australians undertaking air travel, it was not surprising airport demand was at record levels.

"The transport demand caused by increased passenger movements in airports is felt in the surface transport infrastructure of cities as passengers travel to and from airports."


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# Transport sector goes against national 'retreat' in infrastructure

The transport sector is defying the downward national trend in infrastructure work awarded, according to the latest Australian Infrastructure Metric produced by Infrastructure Partnerships Australia and BIS Shrapnel.

IPA Chief Executive, Brendan Lyon, said the data contained in the report showed a collapse in mining investment was leading the bulk of the $17 billion retreat in infrastructure expected over 2015/16.

Mr Lyon said, however, there were "green shoots" in transport, led by a lift in Sydney major projects.

"Australia needs to pull the asset recycling lever to generate more infrastructure activity and reap the benefits of greater productivity."

"The $17 billion forecast decline represents a further $600 million deterioration since the December quarter Australian Infrastructure Metric forecast, and is on top of a $16 billion decline in 2014/15.

"The nature of infrastructure means it will take time for these contract awards to flow through to actual dollars hitting projects, but the lift in transport is welcome.

"It goes nowhere near making up for the retreat of work won in mining and utilities during the first nine months of 2014/15, compared with the same period the previous year.

"This $17 billion drop will be felt right across the economy and shows why more work needs to be done to boost investment in public infrastructure.

"Australia needs to pull the asset recycling lever to generate more infrastructure activity and reap the benefits of greater productivity," Mr Lyon said.

"NSW and Victoria have embraced asset recycling and their infrastructure agendas are moving ahead as a result. But if Australia's economy is to transition successfully beyond the resources boom, much more needs to be done.

"Queensland's Budget shows that modest reforms only allow for a modest infrastructure program. Despite its huge requirements, there were no new major commitments for infrastructure."

The Australian Infrastructure Metric showed the transport work won index rose to a reading of 77.9 in the March 2015 quarter; however, this still represented a substantial retreat from the high September quarter result.

But off-the-back of a weak June 2014 quarter, the four quarter index for transport nudged 5.8 per cent lower, from a reading of 57.6 to a reading of 51.8. The FY2014/15 also began strongly for transport, with the average reading across the September, December and March quarters up 11.7 per cent on FY2013/14.

The metric said this had been driven by significant rail investment, with contracts awarded for the Sydney Metro North West and the Sydney Light Rail projects, as well as major road projects such as Northconnex.

It showed civil commencements and work done in the transport sector rose through the 2000s, driven initially by large private sector funded projects in roads, but later by new public investments as well as mining-related projects.

A large spike in commencements in the December 2010 quarter was driven in part by new road infrastructure; for example, the Hunter Expressway and Pacific Highway, but mainly by new port and rail requirements for the iron ore and coal mining industries.

Data from the Metric tracked movements in transport work won since March 2010. The Metric spiked in FY2010/11 before progressively retreating over the course of FY2011/12 and FY2012/13. Transport work won picked-up over FY2013/14 and the first half of FY2014/15, and is now only 15 per cent below the long-run trend.

An analysis of transport sub-categories showed movements in the roads and bridges sector tended to dominate the overall transport reading, followed by railways and harbours.

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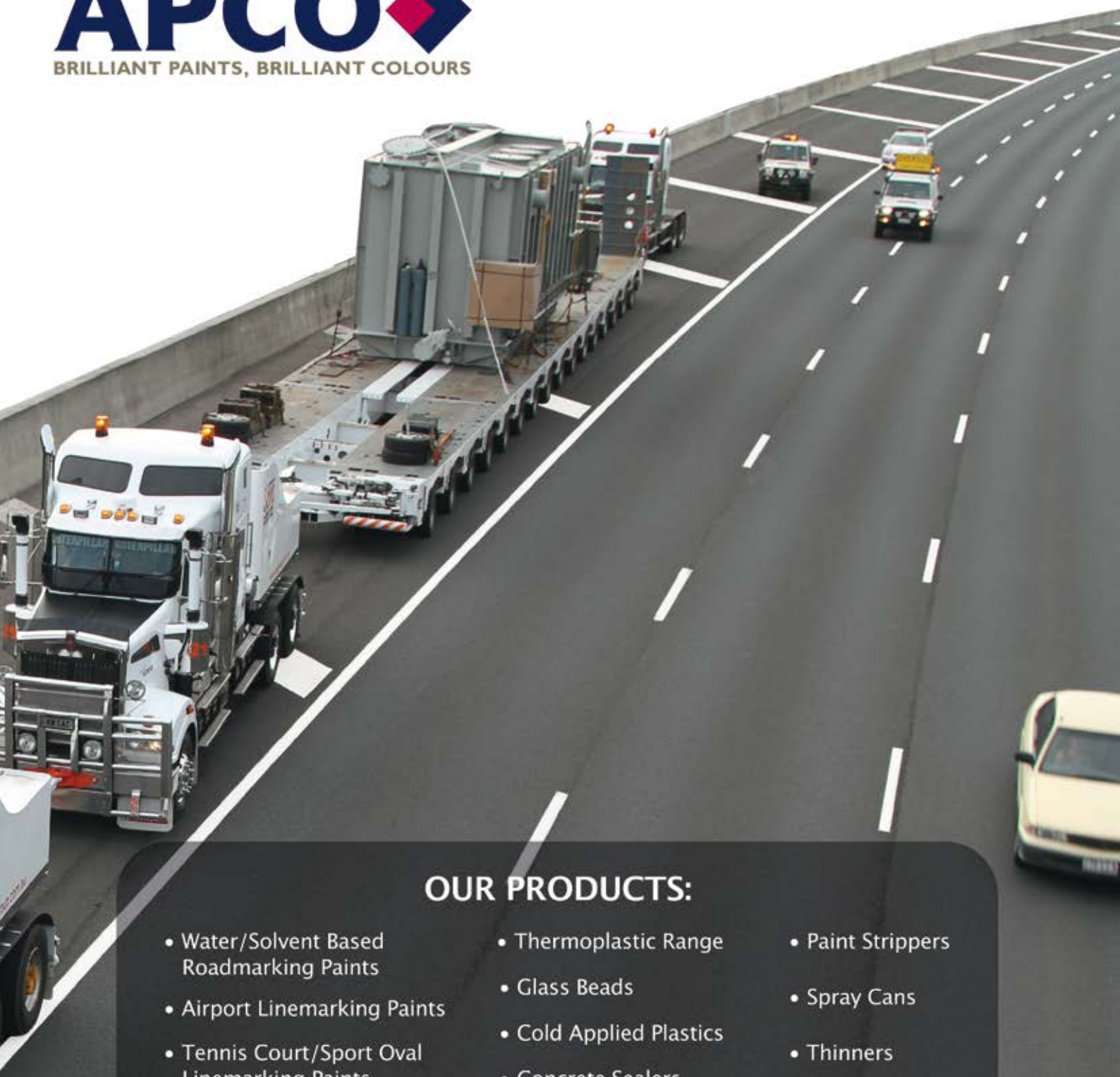

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## Toowoomba Second Range Crossing preferred tenderer

The Nexus Consortium is the preferred tenderer to deliver the $1.6 billion Toowoomba Second Range Crossing project in Queensland's Darling Downs.

The Nexus Consortium comprises Transfield Services and partners; Plenary Group, Cintra Infraestructuras Internacional S.A., Acciona Concesiones S.L., Acciona Infrastructure Australia and Ferrovial Agroman Australia.

The consortium will now work with the Queensland Government to finalise contractual documentation. Construction is expected to begin in late 2015.

The Toowoomba Second Range Crossing will be a toll road with tolling arrangements to be finalised closer to the road's official opening, which is expected in late 2018.

Key features of the Nexus proposed design solution include:

- four lanes (two lanes each way) from Warrego Highway East Interchange at Helidon to Warrego Highway West;
- grade separated interchanges at Warrego Highway West, Toowoomba-Cecil Plains Road and Gore Highway;
- a grade separated connection to Mort Street;
- a 30-metre cutting at the top of the Range as an alternative to the tunnel solution as detailed in the reference design;
- an 800 metre viaduct built over the existing Queensland Rail line; and
- continuity of the New England Highway through a new bridge over the cutting.

Queensland Treasurer, Curtis Pitt, said the appointment of the preferred tenderer was a major step towards the project becoming a reality and the creation of hundreds of jobs.

"This project is expected to support more than 1,800 full-time equivalent jobs during the three-and-a-half year construction phase. The lifestyle and economic benefits this project will deliver to the Darling Downs region and Queensland are significant."

Queensland Minister for Main Roads, Road Safety and Ports, Mark Bailey, said the selection of Nexus was the result of an extensive and rigorous evaluation of three shortlisted proposals.

"These were highly competitive and innovative proposals to deliver value-for-money outcomes through design enhancements for the construction, operation and maintenance of the road," Mr Bailey said.

Transfield Services' Managing Director and CEO, Graeme Hunt, said the company's scope of work included operations and maintenance services to the Toowoomba Second Range Crossing, commencing upon completion of construction, expected to be in late 2018.

"The selection of Transfield Services as part of this consortium endorses our position as a leading operations and maintenance services provider for transport infrastructure.

"This long term partnership with the Queensland Government will provide a strong and expanding revenue base for our infrastructure business."

The Federal Government has committed up to $1.285 billion to fund the project and the Queensland Government has committed $321 million.

## Torrens to Torrens project to enhance Adelaide's transport network

Major works are underway on the $896 million upgrade of Adelaide's Torrens Road to River Torrens section of the North-South Corridor.

This project will boost the productive capacity of the city's transport network and support 480 jobs a year during construction.

The 3.7 kilometre upgrade will deliver a three kilometre section of non-stop roadway along one of the busiest sections of the North-South Corridor, significantly reducing congestion and delays. It also includes a two kilometre section of non-stop lowered motorway as well as an overpass for the Outer Harbor rail line.

The project will deliver six intersection upgrades as well as improved cycling and pedestrian routes.

Up to 52,000 vehicles a day use the road, but once completed, this section of the North-South Corridor will be able to cater for up to 115,000 vehicles. The more efficient movement of freight and commuters along the North-South Corridor will drive economic growth and boost productivity to help build a stronger South Australian economy.

Work on the project is due to be completed by the end of 2018.

Construction is being undertaken by Leighton Contractors and its T2T Alliance partners.

As part of the T2T Alliance consortium, Leighton will undertake the work in joint venture with South Australian company, York Civil. Under the alliance, the Leighton-York JV (LYJV) will be working with design partner, Aurecon Australia.

Coupled with the $620 million Darlington Upgrade, which will begin later this year, the North-South Corridor improvements will support, on average, more than 800 jobs a year.

The 2.3 kilometre Darlington Upgrade is due to be completed in late 2018.

The Federal and South Australian Governments have committed $1.5 billion to ensure these two vital projects are delivered by the end of 2018.

**Left to right: Jamie Briggs, Assistant Minister for Infrastructure and Regional Development; Tony Abbott, Prime Minister; Jay Weatherill, Premier; Stephen Mullighan, Minister for Transport and Infrastructure.**

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## Construction contract for Gateway Upgrade North project

The $1.162 billion Gateway Upgrade North project will be delivered by Lend Lease Engineering Pty Ltd.

The company was selected from what the Federal and Queensland Governments described as a "field of high-quality tenderers".

The upgrade is designed to reduce congestion and improve safety for more than 80,000 drivers using the northern section of the Gateway Motorway each day.

The addition of two extra lanes will significantly increase productivity, saving freight operators time and money and contributing to improved freight competitiveness.

The preferred plan includes widening an 11 kilometre section of the motorway from four to six lanes between Nudgee and Bracken Ridge, an upgrade of the Nudgee Road interchange, and widening the Deagon Deviation to two lanes in each direction.

The project is due to be completed in late 2018. The Federal Government has committed up to $929.58 million and the Queensland Government $232.42 million.

Assistant Minister for Infrastructure and Regional Development, Jamie Briggs, and Queensland Minister for Main Roads, Road Safety and Ports, Mark Bailey, said the infrastructure upgrade would fix one of Queensland's most congested and important motorways which formed a vital link between key freight hubs, such as the Port of Brisbane and Brisbane Airport.

"We know the importance of a safe and reliable road network. Not only will this upgrade deliver travel time savings for drivers, it will generate a vast number of jobs over the life of the project."

## Work on the Tullamarine Freeway a step closer

Three construction companies have been shortlisted to build the Melbourne Airport to Bulla Road section of the CityLink Tulla Widening project.

Lend Lease, Fulton Hogan and Leighton Contractors will now submit a formal bid for the contract, expected to be announced in late-2015.

The upgrade of the eight kilometre section from Melbourne Airport to Bulla Road will include new traffic lanes and improvements to key interchanges, including Mickleham Road, Gladstone Park and English Street, Essendon Fields.

A freeway management system will be installed, including ramp signalling and variable messaging signs, to better manage traffic flow.

On average, drivers will save 16 minutes in the morning peak and 17 minutes in the afternoon peak.

When complete, the project will reduce congestion and will provide a quicker, safer journey for all road users, including those who live along the freeway corridor.

Increasing the capacity of the freeway will make sure it can meet growing freight demand and support the future growth of commercial and residential areas.

The $1.28 billion CityLink Tulla Widening project is being funded by the Federal Government, Victorian Government and Transurban.

The Federal Government is contributing $200 million towards the Tullamarine Freeway widening between Melbourne Airport and Melrose Drive.

Leighton Contractors Pty Ltd has already been appointed to construct the section from Bulla Road to Power Street.

Construction on the project is expected to commence in early-2016 and is expected to be complete in 2018.

## Bidders shortlisted for Darlington Upgrade contract

Construction of the Darlington Upgrade on Adelaide's North South Corridor is a step closer with two bidders shortlisted to tender for the $620 million project.

One bidder is Gateway South, a consortium consisting of a joint venture between Fulton Hogan Construction and Laing O'Rourke – the other bidder is Lend Lease, which is tendering in its own right.

Gateway South has identified Kellogg, Brown and Root, SMEC Australia and Jacobs Group as its exclusive design coalition for the project, while Lend Lease has engaged design firms ARUP, Parsons Brinkerhoff and Golder to support its bid.

Federal Assistant Infrastructure and Regional Development Minister, Jamie Briggs, said the Darlington upgrade would deliver significant travel time savings for commuters travelling through that section of South Road, particularly during peak periods.

"In March, we announced an improved design which will allow thousands of motorists and freight operators travelling to and from Flagstaff Road, Main South Road and the Southern Expressway to avoid three sets of traffic lights.

"Major construction on the Darlington Upgrade is due to start late this year with the project due to be completed at the end of 2018."

South Australia's Transport and Infrastructure Minister, Stephen Mullighan, said the two bidders were identified after expressions of interest were called earlier this year.

"The Darlington Upgrade is expected to support about 370 jobs a year during construction and we will conduct it in line with our Industry Participation Policy," Mr Mullighan said.

"The contenders' local industry participation plans will be weighted by 15 per cent as part of the tender process.

"That means South Australian businesses and employees will leverage the maximum benefit available from the project."

The Federal Government is contributing 80 per cent of the cost of the Darlington Upgrade with the remaining 20 per cent contributed by the SA Government.

## EoI's for Gold Coast Light Rail stage two

Expressions of interest were due to close on 28 August for stage two of Gold Coast Light Rail – a project the Queensland Government calls a "critical step" in the timeline to meet the 2018 Commonwealth Games deadline.

State Minister for Transport and Infrastructure, Jackie Trad, said stage two of Light Rail was a project of national significance in the context of the games, but one that could only proceed with Federal funding.

"Mr Abbott opened the door to consider providing additional funds towards the Commonwealth Games following a discussion with the Premier at a Council of Australian Governments meeting," Ms Trad said.

"The State Government is now preparing a business case to enable this project to move from the drawing board to construction in time for the games – contingent on a Federal funding contribution."

Ms Trad said opening the expression of interest process and releasing the proposed route for stage two was a critical step to complete the submission for the Federal Government.

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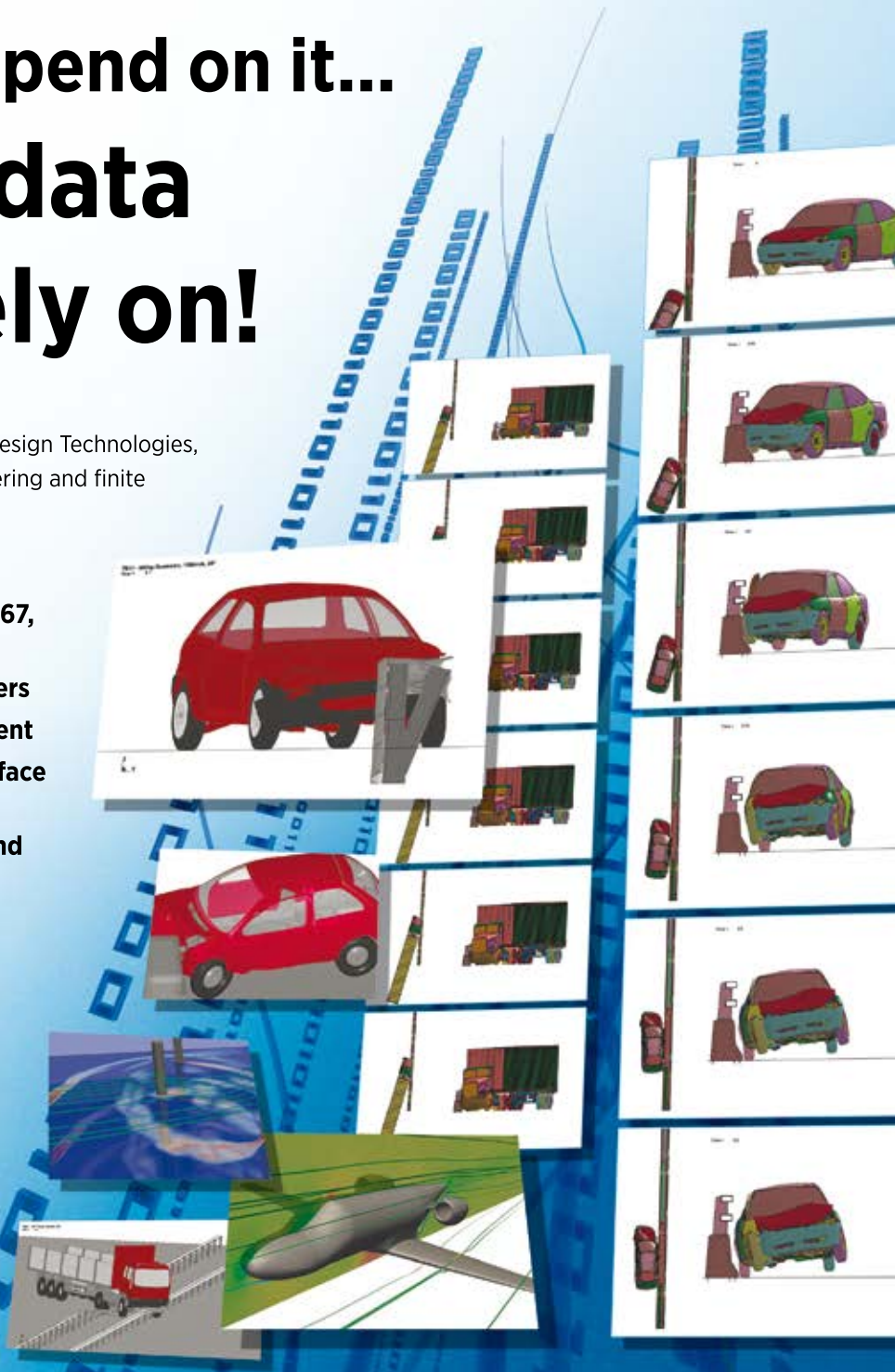

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"Going to market with an expression of interest process will enable us to finalise a revised business case for this key games infrastructure.

"The Queensland Government looks forward to Mr Abbott's urgent assessment and funding commitment to make stage two possible in time for the games."

Ms Trad said GoldLinQ, the operators of stage one of the light rail system, approached the state government with a funding and construction proposal to complete stage two between Helensvale and Gold Coast University Hospital in time for the games.

"The Premier has written to the Prime Minister to inform him the Queensland Government will now work with GoldLinQ and the Gold Coast City Council to prepare a detailed submission and conduct an expression of interest process for the design and construction of stage two.

"In order to prepare our submission, we have released a new route for stage two. The proposed 7.3 kilometre light rail alignment runs from Gold Coast University Hospital Station to Helensvale heavy rail station and bus interchange.

"Importantly, it is possible the new route will be able to be delivered for less than half the cost and within a shortened procurement and construction timeframe."

Ms Trad said a contribution from all three levels of government would be required if the project was to be built in time for the games.

"The government has been supporting this project since the election and lobbying the Federal Government for funding at every opportunity.

"Pending Federal support, the Department of Transport and Main Roads has identified savings within its existing budget to allow for a State Government contribution to this project.

"With the games around the corner, we will continue to advocate for this project and deliver a strong submission to ensure Canberra is on board with the light rail extension.

"If the Commonwealth refuses to come on board with a funding contribution of at least the same proportion as stage one, any chance of this project proceeding in time for the Commonwealth Games will be dashed."

Gold Coast Mayor, Tom Tate, said the Gold Coast needed to seize this opportunity to complete the Light Rail connection to heavy rail as it headed towards the games.

"The state and the city are together on this so all we need now is Mr Abbott to get on board to fund the missing link in this job generating project.

"Once the tender is complete and the best price is locked in, I am sure the Prime Minister will join the other two levels of government to deliver Stage II in time for the games."

## Tunnelling preferred method for Melbourne's Metro Rail

Melbourne's multi-billion-dollar Metro Rail Project is taking shape, with the Victorian Government choosing tunnelling as the preferred method for the crossing underneath the Yarra River.

Tunnel boring machines will be used to excavate the two Melbourne Metro rail tunnels between the new CBD South and Domain stations.

Premier, Daniel Andrews, and Public Transport Minister, Jacinta Allan, said $4.5 billion in funding had already been secured for the transformative project, almost half the total expected cost.

Tunnel boring machines are currently being used to build New York's Second Avenue Subway project and London's CrossRail project.

Mr Andrews and Ms Allan said the use of tunnel boring machines would reduce the environmental impact on the river and limit inconvenience to local small businesses and Melbourne's pedestrians and commuters.

Other techniques, they said, would significantly disrupt the Yarra River and its surrounds by damming or creating an immersed tube tunnel, which involves dredging of the river bed.

Tunnel boring machines allow for excavation through varying ground conditions and have specialised cutting heads designed to grind through soil and rock, with minimal impact on the surrounding environment.

The machines also enable the excavated tunnel to be immediately sealed with a concrete lining.

The tunnel will be 11 metres below the surface and will sit to the east of the Princes Bridge, around seven metres below the riverbed.

The details of the final location, design and construction methodology for the tunnels will be determined by the appointed construction contractor.

Melbourne Metro will deliver two new nine-kilometre rail tunnels and five new stations to Melbourne's rail network, unlocking capacity in the City Loop so more trains can run more often.

"We promised to build Melbourne Metro Rail so more trains can run more often," Premier Andrews said.

"This is the biggest overhaul to our train network since the construction of the City Loop."

Construction of the City Loop started in 1971 and the project was completed in 1985.

Public consultation and planning has begun on the Melbourne Metro project.

The government asked Victorians to share their views and take part in a survey to help ongoing planning and future community information updates.

Melbourne Metro teams visited train stations along the Sunbury and Cranbourne/Pakenham lines to hand out survey information. The survey was open until 28 August.

Minister for Public Transport, Jacinta Allan, said the government wanted the community to help shape the transformation of Melbourne's public transport system.

"Melbourne Metro is a city-shaping project that will transform public transport in Melbourne for thousands of commuters every day, and it's exciting that people have the opportunity to help shape the project."

## Initial tenders for Inland Rail project

GHD has been awarded the tender to provide environmental and engineering consultancy on the first stages of the massive Brisbane-to-Melbourne Inland Rail project.

Minister for Infrastructure and Regional Development, Warren Truss, said the appointment of GHD demonstrated that real progress was being made to boost productivity along the country's fastest growing freight corridor.

"The government has committed $300 million to commence work on the Inland Rail project to create jobs, achieve productivity gains and stimulate economic growth for the future prosperity of Australia, especially the regions," Mr Truss said.

"These first tenders will provide vital input to planning of some of the key segments of the Parkes to Narromine and Narrabri to North Star sections of the project.

"Inland Rail will transform freight movements through south east Queensland,

across regional New South Wales and rural Victoria, linking with the existing national network to move produce around the nation more efficiently.

"With Australia's freight task set to treble along the eastern seaboard, Inland Rail is a crucial project for meeting the demand for a road-competitive freight rail service which will take 190,000 trucks off the road each year."

Mr Truss said applications for providing community engagement services for the Inland Rail in Victoria, New South Wales and Queensland were under review, with further tender opportunities to be announced over coming months.

In another major initiative in the freight transport sector, the Federal Government will develop partnerships with Queensland and the Northern Territory to undertake feasibility studies on two northern rail projects.

The studies will focus on an upgrade of the freight railway line between Townsville and Mount Isa, and the construction of a new line between Mount Isa and Tennant Creek.

Mr Truss said the two rail lines had the potential to improve access to global markets for local producers and deliver economic growth to the entire northern region.

"The Mount Isa-Tennant Creek study will assess the viability of a 600 kilometre link between the two regional centres as part of the government's plan to develop northern Australia.

"Rail remains a key transport mode for getting bulk goods to market, and conducting a Mount Isa-Tennant Creek feasibility study will help determine the best transport links to support business owners and residents between those two centres.

"Likewise, the study into upgrading the ageing Mount Isa-Townsville line is great news for the region, which supports a range of industries crucial to Australia's economic success, including mineral resources and beef cattle exports."

Mr Truss said should the projects prove viable, up to $5 billion in concessional loans was available to the private sector and state and territory governments to build key infrastructure projects including rail.

He said improving transport links in the region would benefit local operators and the national economy more broadly, and send the right message to Australia's major trading partners.

"Obviously many overseas operations are in need of a reliable supply of goods at a competitive price, and delivering these rail links may help service that growing demand."

## Stadium Station construction begins

Construction has started on the train station at the new Perth Stadium site at Burswood – an inner south eastern suburb located immediately across the Swan River from Perth's CBD.

Stadium Station will be completed in 2017 in time for extensive commissioning and testing before it opens for the start of the 2018 Australian Football League season.

Forward works began more than a year ago and involved 'slewing' or relocating the tracks in line with the location of the new station which will cost about $40 million to build.

The station will feature six platforms, 11 lifts and 11 kilometres of tracks. About 340 tonnes of steel will be required to build the concourse and about 180 contractors and subcontractors will be engaged during construction.

A further $60 million will be spent on 11 kilometres of complex overhead wiring and track to support the world-class piece of infrastructure. When complete, it will be the second biggest station on the Transperth network, after Perth.

In coming months, two large tower cranes will be erected on the site to enable the PRISM Alliance – the Public Transport Authority, Laing O'Rourke and AECOM – to start work on four of the platforms and a second set of tracks.

Trains on the existing Armadale/Thornlie Line will then be swapped over to use the new tracks, so work on the final two platforms can be completed.

Visiting the site on 5 August to mark the start of construction, Western Australia's Transport Minister, Dean Nalder, said the government was focused on delivering a smart transport solution for the new Perth Stadium with a series of integrated infrastructure including bike paths, a pedestrian bridge and the new train station.


## Tunnelling site selected for New M5

Government-owned land at Arncliffe, about 10 kilometres south of Sydney, has been selected by the Federal and New South Wales Governments as a key tunnelling location for the New M5 motorway.

The site is located on Roads and Maritime Services and Rockdale City Council land, currently used by Kogarah Golf Club.

It will be used as an access point for underground tunnelling construction activities.

NSW Minister for Roads, Maritime and Freight, Duncan Gay, said the Arncliffe location was the most suitable across all shortlisted tenders, eliminating residential property acquisitions and enabling future upgrades.

"The New M5 twin tunnels will run from Kingsgrove to St Peters, more than doubling the lane capacity along this critical corridor and slashing travel times for hundreds of thousands of motorists every day," Mr Gay said.

"The location removes the need for residential acquisitions and enables early work to be done now for a future WestConnex southern extension, which would bring communities in southern Sydney even closer to the CBD.

"Our priority in delivering WestConnex is to minimise land acquisitions, which is why two thirds of the project is being built 100 feet underground, as well as on government owned land wherever possible."

Federal Assistant Minister for Infrastructure, Jamie Briggs, said the New M5 was a critical part of WestConnex, which is one of the government's key infrastructure priorities.

"The current M5 East is a traffic nightmare for the 100,000 motorists who sit in congestion every day," Mr Briggs said.

"The New M5 will accommodate an extra three lanes in each direction and provide another route for traffic from the airport and port to Western Sydney.

"WestConnex is one of Australia's largest transport infrastructure projects and will generate more than $20 billion worth of benefits to the economy, while creating almost 10,000 jobs during the construction phase alone."

The preferred contractor and design for the New M5 is due to be selected in the coming months – work is expected to start mid-2016 and the New M5 is scheduled to be open to traffic in 2019.

WestConnex Stages:

Stage One: will widen the M4 from Church Street at Parramatta to Homebush Bay Drive and extend the M4 via a tunnel east of Homebush Bay Drive, emerging near the Bunnings Warehouse on Parramatta Road or on Wattle Street, Haberfield.

Stage Two: will deliver the New M5 – to run from the existing M5 East corridor via tunnel to St Peters, as well as an upgrade of the King Georges Road Interchange.

Stage Three: will join the M4 and M5 corridors via a motorway tunnel with three lanes in each direction.

# Roe 8 receives conditional environmental approval

Conditional environmental approval has been given to the Roe Highway Extension (Roe 8) by Western Australia's Minister for Environment.

Roe 8 is a 5.2 kilometre extension of Roe Highway from Kwinana Freeway to Stock Road in Perth's southern suburbs.

It includes a major upgrade to the existing Kwinana Freeway-Roe Highway interchange as well as interchanges/flyovers at Murdoch Drive, Bibra Drive, Progress Drive, North Lake Road, Coolbellup Avenue and Stock Road.

Western Australia's Acting Transport Minister, Bill Marmion, said on 2 July that the environmental stewardship and sustainable development measures planned for Roe 8 reflected international best practice.

"The State Government recognises the environmental sensitivities associated with this location and will use innovative planning, design and construction measures when building this road," Mr Marmion said.

The design was informed in-part by extensive community feedback provided during a public participation process on the project between 2009 and 2011.

Following the Environmental Protection Authority's recommendation in September 2013 that the project could be managed to meet its environmental objectives, 165 appeals were lodged objecting to the EPA's findings.

In assessing the matters raised in the appeals, the Environment Minister was satisfied the EPA had adequately considered the key environmental factors. However, he allowed seven of the 11 appeal grounds by strengthening conditions and adding new conditions.

Mr Marmion said the EPA had commended Main Roads for its approach to the project, saying "from the outset the proponent has recognised the regionally significant environmental values of the area and has sought to apply innovative planning and design measures, and construction techniques. This has set a new standard for major road projects in this type of sensitive environment".

The measures included:

- special construction methods for Roe Swamp bridge to minimise impacts to wetlands;
- rehabilitation of degraded areas of Beeliar Regional Park;
- rehabilitation of cleared areas through replanting of native plant species; and
- underpasses to maintain ecological connectivity for fauna.

"This project is a strategic link in Perth's road network," Mr Marmion said.

"The completion of Roe 8 is critical to fix major road safety issues. Tens of thousands of people using Leach Highway are being exposed to unnecessary risk because this roadway was never designed to carry such a volume of trucks and cars.

"Accident figures show the risk is unacceptable and completing Roe 8 is the safest option for families. It will also deliver great benefits for the WA economy at a critical time." the Acting Minister said.

Now State environmental approvals have been finalised, the Commonwealth Minister for the Environment will consider

the proposal. If all approvals are granted, construction is expected to start in early 2016.

Benefits of Roe 8 include:

- safer communities, with 500 trucks a day removed from Leach Highway by 2031;
- bypassing 14 sets of traffic lights so fewer stop-start traffic movements lessen exhaust emissions and lowers fuel use;
- reduced operating costs for the transport industry, business and commuters through freer flowing traffic;
- better access for residents and road users in the cities of Cockburn and Melville to Kwinana Freeway, Bibra Drive, North Lake Road and Stock Road;
- improved access to Fremantle inner harbour; and
- improved access for the expanding Kwinana industrial area.

## Consultation phase complete on new Western Sydney Airport

The Federal Government and the Sydney Airport Group have wound-up nine months of talks on the government's plan for a Western Sydney airport.

The talks focused on how a new airport would meet the growing needs of the region.

"We expect a Western Sydney airport, which could open for business within a decade, will handle up to five million passengers in its first year and grow steadily over time," Minister for Infrastructure and Regional Development, Warren Truss, said.

"An airport for Western Sydney will be a full-service airport capable of handling domestic and international flights, meaning for the first time, Western Sydney residents would be able to access air services quickly and easily."

Mr Truss said the end of the consultation phase completed the first element of the Commonwealth's contractual obligations under the right of first refusal process.

"We have afforded the owners of Sydney (Kingsford Smith) Airport the first opportunity to develop and operate a second major airport in the Sydney region as part of the terms of the 2002 sale agreement for Sydney (Kingsford Smith) Airport.

"The consultation process involved over 65 meetings over the nine-month period. The meetings allowed both parties to put forward views on the project and saw an open exchange of ideas.

"We will now work through the issues and review the range of options for an airport proposal that will meet Sydney's aviation capacity needs and deliver the best possible outcomes for the people of Western Sydney and the nation, including economic growth and job creation.

"We are aiming for a proposal setting out the government's terms, including technical specifications, contractual terms and a construction timetable, to be put to Sydney Airport Group as early as the end of this year."

Mr Truss said during the consultation period, the government undertook further studies to ensure full benefits could be delivered to the Western Sydney community.

"To support the consultations with Sydney Airport Group, detailed planning and analysis for an operational airport by the mid-2020s is progressing at pace, including the commencement of a new and robust environmental assessment.

"The new airport environmental impact assessment involves a comprehensive examination of the site, including biodiversity and European and Indigenous heritage features, as well as updated noise contours and the development of flight paths.

"The draft Environmental Impact Statement will be open for public comment upon its release later this year."

## Upgrade of key western Sydney arterial goes to tender

Tenders are open for Stage Two of the $114 million upgrade of Narellan Road in Western Sydney – an upgrade designed to meet the rapidly growing population of the region.

Western Sydney is set to grow from two million to three million people over the next 20 years and Narellan Road is a vital link between the Hume Motorway, The Northern Road and the University of Western Sydney.

The Narellan Road project will create a 6.8 kilometre six-lane road between Camden Valley Way and Blaxland Road, ensuring the South West Growth Centre is adequately supported by quality infrastructure.

It is part of the $3.6 billion Western Sydney Infrastructure Plan being implemented by the Federal and New South Wales Governments, and supports major works already underway including Narellan Road Stage One, Bringelly Road and Werrington Arterial.

State Minister for Roads, Maritime and Freight, Duncan Gay, said the Stage Two upgrade would deliver significant benefits.

"Stage Two marks the final stage of the Narellan Road Upgrade and will deliver around 80 per cent of the overall works, widening 5.4 kilometres of the 6.8 kilometre project to six lanes," Mr Gay said.

"The upgrade will also remove two notorious bottlenecks by widening the southbound on-ramps from the Hume Motorway and installing traffic lights at Kenny Hill Road to improve peak hour traffic flow along the Narellan Road corridor.

"Stage Two will connect to the Stage One upgrade, which is progressing well and includes installing additional right turn lanes and access points to the TAFE/University of Western Sydney, removing congestion at this key pinch point."

As part of the project, a new purpose built response facility will be installed on Narellan Road, which will greatly improve accident response times on the road and the Hume Motorway, and ensure traffic is returned to normal sooner.

A new cable-stayed pedestrian bridge will also be installed over the Hume Motorway on the southern side of the existing bridge to improve safety for local residents.

The Federal and New South Wales Governments have committed $53 million and $61 million to the Narellan Road upgrade.

Stage One of the upgrade started July 2014 and will be completed in 2016. Stage Two is expected to start in 2016 and be completed in 2019.

## Early start to WestConnex Stage 2 construction

Construction has begun 18 months ahead of schedule on the King Georges Road Interchange Upgrade – the $130 million project will fix one of Sydney's worst bottlenecks.

The upgrade is the first section of WestConnex Stage Two, which involves widening and extending the M5 motorway.

Of the 100,000 motorists who use the M5 each day, nearly half are stuck at the King Georges Road interchange. The upgrade will cut travel times at the bottleneck by up to half, as well as alleviating delays along the M5 East and King Georges Road.

The interchange will connect to an already widened M5 West, completed in December 2014, and is the precursor for the New M5 tunnel which will provide an extra three lanes in each direction between Beverly Hills and St Peters.

Work at the interchange involves widening and extending the eastbound on-ramp and westbound off-ramp between King Georges Road and the M5 East, increasing ramp lengths by 180 metres.

The upgrade has been accelerated under an agreement between the Federal and New South Wales Governments – the project is due to be finished in two years.

When completed, WestConnex will link the M4 and M5 with a continuous free-flowing motorway, creating 10,000 jobs and injecting more than $20 billion into the state's economy.

The project will increase capacity and reduce travel times from Western Sydney and South Western Sydney to the CBD, Airport and Port Botany.

Congestion currently costs NSW $5 billion every year in time delays and lost productivity.

The NSW Government is providing $1.8 billion to build WestConnex, while Canberra is providing $1.5 billion, in addition to a concessional loan of up to $2 billion.

## Tender awarded for next stage of Kwinana Freeway widening

Perth-based contractor, Brierty, has been awarded the tender for the widening of the southbound section of the Kwinana Freeway from Armadale Road to Russell Road.

The $13.5 million contract involves adding three more lanes for 3.5 kilometres.

More than 52,000 vehicles use the section of the freeway each day and the volume of traffic is expected to rise to 75,000 vehicles by 2021.

Widening work is due to begin in September and the project is scheduled to be completed by mid-2016.

The work follows the freeway widening between Roe Highway and Armadale Road, which was expected to be completed around the end of August or September – several months ahead of schedule.

Western Australian Transport Minister, Dean Nalder, said the addition of a third lane would be a significant safety improvement at a critical freeway merge point.

"This work will be delivered under budget due to a competitive marketplace for road construction," Mr Nalder said.

The Federal Government is contributing $61.9 million to the $77.5 million overall project.

## Work starting on Peninsula Development project

Work was due to start in mid-August on the Mein Deviation project to seal 29 kilometres of the Peninsula Developmental Road south of Coen on Queensland's Cape York.

Civil Mining and Construction is the successful tenderer for the project which is being funded under the $260.5 million Cape York Region Package and will support local communities.

Many of the region's employment opportunities are tied up with mining and the large number of indigenous people in the area.

Civil Mining and Construction was awarded the contract following demonstration of its capability to include employment and training opportunities for Indigenous businesses and individuals.

Federal Member for Leichardt, Warren Entsch, said improved transport links were essential for remote communities in Far North Queensland and the project would create over 17 positions for Indigenous people as part of the deal.

"While I welcome the signing of the contract to ensure that this work commences sooner rather than later, I'm disappointed that local contractors haven't been given the opportunity to tender," said Mr Entsch.

"I will continue to lobby that local businesses are given the opportunity to be the primary contractors on future works in accordance with our intent to maximise the benefits within local communities where this work is occurring.

In 2014, 34 kilometres of the Peninsula Developmental Road was sealed with funding provided through the Federal Government's Cape York Region Package.

The Mein Deviation project is being jointly funded by the Australian and Queensland Governments.

Queensland's Cape York peninsula

## Revised layout for Bruce Highway Upgrade

A revised layout for the Bruce Highway upgrade between Caloundra Road and the Sunshine Motorway places increased emphasis on environmental factors.

The new layout is based on several years of planning and community consultation. The differences to the original, which was released in April 2013, take into account extensive feedback from the consultation.

Queensland's Minister for Main Roads and Road Safety, Mark Bailey, said environmental factors were a higher priority under the revised layout.

"The project team has had to work within a constrained corridor," Mr Bailey said.

"These constraints included the Jowarra section of Mooloolah National Park, the Mooloolah River flood plain, the Mooloolah Cemetery and existing private and commercial properties."

Mr Bailey said the new design reduced the effect of the project on the Beerwah State Forest by 11 hectares, compared with the previous draft plan.

"This means only five per cent of the forest will be affected.

"The Department of Transport and Main Roads (TMR) is evaluating alternative layouts for the Caloundra Road interchange, in a bid to further reduce the effect on the forest.

"The revised layout makes the boundaries for the upgrade corridor clear and also allows for potential enhancements during the detailed design phase."

Industry briefings will begin in coming months and an Expressions of Interest process is proposed to begin in September. Work on the upgrade is likely to start next year.

During the detailed design process, TMR will work with businesses, environmental groups and the community to further reduce impacts where possible.

## Final stage of Moree Bypass opens

Traffic flow and safety will significantly improve at Moree in northern New South Wales following the opening on 3 August of the Moree Bypass Stage Two project.

The opening meant traffic started using the final stage of the project six months ahead of schedule.

The work included constructing 1.8 kilometres of new road through east Moree and creating a southern town entry so traffic could bypass Moree township.

The Bullus Drive and Newell Highway intersection at the southern end of the bypass was upgraded to include traffic lights, replacing a T-intersection, deemed to be unsafe. The bypass is designed to reduce traffic congestion in the town centre.

Before it was constructed, 1,700 heavy vehicles a day travelled through central Moree, the equivalent of one truck per minute during the day and one truck every one-and-a-half minutes at night.

The bypass will remove the heavy vehicles from Moree, reducing travel time and costs for freight operators and businesses which rely

heavily on the Newell Highway – a key north/south route between Melbourne and Brisbane.

Work on the second stage of the bypass provided employment for up to 80 workers on site at any one time and 19 local businesses which provided supplies and services.

The bypass builds on a number of other critical upgrades the New South Wales Government has delivered along the highway, including an extra eight overtaking lanes and heavy vehicle rest areas.

The Federal and NSW governments each provided $15 million towards the second and final stage of the project.

Stage One was fully funded by the Federal Government, with the $56.2 million project opened in December 2010.

## Use of Southern Expressway up by two thirds since duplication

More than 26,000 extra vehicles are using Adelaide's Southern Expressway on weekdays since the South Australian Government completed duplication of the road.

Before the duplication, 39,690 vehicles were using the expressway on weekdays, and in the year since the project was completed, usage has jumped to 66,130.

The bulk of the increase has been on city-bound trips, with that figure jumping from 20,164 before the duplication in 2010 to 35,210 this year.

Southbound trips have also gone up substantially, from 19,526 in 2010 to 30,920 this year.

Overall, the increase in weekday trips has jumped by more than 66 per cent and, as a result, the amount of traffic on arterial roads in Adelaide's southern suburbs has significantly decreased.

The $407 million Southern Expressway duplication project was opened last August, 15 years after the Liberal Party built the one-way motorway. It will link into the $620 million Darlington Upgrade, which is due to get underway late this year.

## Design work contract awarded for M1 Pacific Motorway

Detailed design work on the M1 Pacific Motorway upgrade between Kariong and Somersby in New South Wales will be undertaken by Hyder Consulting Pty Ltd.

The contract was awarded to Hyder following environmental approval of the project.

The Kariong to Somersby upgrade is one of four projects in the $392 million M1 Productivity Package, which will reduce travel times between Newcastle and Sydney, improve road freight efficiency and provide for the expected growth of commuter and freight traffic.

The project will widen an eight kilometre section of the M1 Pacific Motorway between the Kariong and Somersby interchanges from four to six lanes.

It will involve upgrading three of the four ramps at the Kariong interchange and adding an extra lane in each direction on the M1.

The upgrade is expected to be completed in 2019. The Federal Government is providing $195.8 million and the New South Wales Government $196.2 million to the M1 Productivity Package.

# SYDNEY METRO NORTHWEST

## Changing the face of public transport in Sydney *and beyond*

Stretching a total of 23 kilometres from Epping to Rouse Hill in Sydney's north west, the $8.3 billion Sydney Metro Northwest Project (formerly the North West Rail Link) is not only Australia's largest public transport infrastructure project, it will also be Australia's first fully-automated metro rail system.

Together with extensive above ground rail infrastructure - including a 4 km long elevated 'skytrain' section of rail line between Bella Vista and Rouse Hill - the Sydney Metro Northwest project also includes the construction of 15.5 km twin tunnels between Bella Vista and Epping.

As well as featuring the longest railway tunnels ever built in Australia, the project is also unique in that it is the first public transport infrastructure project in Australia to utilise four Tunnel Boring Machines (TBMs) simultaneously.

One of three major contracts covering the construction and delivery of Sydney Metro Northwest, the $1.15 billion tunnelling contract was awarded to the Thiess John Holland Dragados (TJHD) joint venture on 24 June 2013. The contract involves building the twin tunnels, together with excavation works for five new stations at Cherrybrook, Castle Hill, Showground, Norwest and Bella Vista, a 'crossover cabin' and service facilities.

A combination of tunnel boring machines and road header machines are being used to excavate the tunnels.

The four TBMs were specifically manufactured to meet the design specifications of the project, and were in the ground by January 2015.

As is often the case with these massive TBMs, the four TBMs used on Sydney Metro Northwest have each been 'christened'. TBM1, affectionately known as *Elizabeth* and TBM2, *Florence*, were launched from Bella Vista and are travelling 9 km through to Cherrybrook. TBM3, known as Isabelle and TBM4, which is named *Maria* were both launched from Cherrybrook and are travelling some 6 km through to Epping.

With a diameter of 7.5 metres, the four double-shielded NFM hard rock TBMs each resemble a huge mechanical worm about 120 m long. Each TBM weighs more than 900 tonnes and deploys a team of 15 working in various parts of the machine. On average, 120 m of tunnel is cut every week. Between them, the four tunnel boring machines utilise over 29 km of conveyor belts to remove the crushed rock from deep underground.

Tunnelling work sites have been established at Bella Vista, Showground and Cherrybrook. Each of the three sites will include support services such as power, fresh air ventilation, spoil (crushed rock) handling systems and a cement grout mixing plant. Rock conditions along the corridor are about 60 per cent Sydney sandstone, and the remainder shale.

As well as generating a lot of heat and dust, tunnelling through Sydney sandstone generates a 'sticky' residue that can adhere to and clog the TBM cutterheads. This not only reduces the speed of tunnel construction, it can also significantly reduce the operational life of the cutterheads - resulting in increased maintenance costs and downtime.

These issues have been overcome through the use of Master Builders Solutions MasterRoc® ABR 5, Liquid anti-abrasion agent from BASF.

Specifically designed for use with hard rock and earth pressure balance (EPB) tunnel boring machines, MasterRoc® ABR 5 substantially reduces dust formation during excavation, cutterhead clogging and abrasive wear to the cutting tools. It also results in better cooling of the cutterhead, improving the rubber seal durability and extending the life of the cutter bearing.

In addition, by improving the transfer of the muck from the cutterhead, MasterRoc® ABR 5 also reduces the risk of blockage - resulting in cleaner cutter discs and a cleaner cutterhead area, making maintenance easier and reducing the time required to change the cutter discs.

Importantly, by reducing TBM downtime and extending the time between cutter changes, MasterRoc® ABR 5 helps to maximise available excavation time and productivity. In addition, by reducing dust formation, it also leads to a considerably improved working environment for TBM personnel.

BASF is also providing a number of other Master Builders Solutions products for the Sydney Metro North West TBM operations, including MasterRoc® TSG 6 and MasterRoc® TSG 7 tail sealants for shielded TBMs.

## Precast Tunnel Segments

Master Builders Solutions products are also playing a critical role in the production of the precast concrete tunnel segments that line the project's twin tunnels.

Incorporating over 150,000 cubic metres of concrete, the tunnel segments are being manufactured in a dedicated precast yard located adjacent to the project. The precast yard operates two production lines side-by-side.



*All images courtesy of Transport for NSW.*

Ensuring that there is a sufficient supply of precast segments ready to be installed by the four TBMs working on the project is a critical factor in preventing delays in the tunnelling process.

With that in mind, the precast yard has a production target of 100 segments per shift, per production line to ensure there is a sufficient supply of completed segments.

Needless to say, mix design plays a critical role in meeting these targets, and Holcim, TJHD and BASF technical staff dedicated many hours developing mix designs and conducting lab and site trials.

Besides requiring a very low initial slump, the concrete mix for the precast tunnel segments needed to achieve early slump loss and high early strength. This was predominantly due to the fact that the segments are required to be finished by hand (while remaining in the mould) after 10-15 minutes. The low slump was required to provide thixotropy and minimise 'sagging' in the newly cast segments caused by the curvature of the mould.

This combination of low slump, early slump loss and high early strength has been achieved through the addition of Master Builders Solutions' MasterGlenium® SKY 8885 high performance superplasticiser from BASF.

The mix is working extremely well and the precasting and tunnelling works are on schedule. The TBMs in tunnel 3 and 4 are expected to be finished by mid November, while the TBMs 1 and 2 should be completed in February 2016.

### Shotcreting Works

As part of the tunnelling works, an underground rail crossover cavern has been built to the east of the new Castle Hill Station. Once the new rail link is operational, the crossover will allow trains to move safely from one track to the other.

The rail crossover enables train services to continue running when service disruptions or maintenance works occur in one of the tunnels. This underground area will also house mechanical ventilation equipment.

The cavern is 160 m long and 23 m wide. Most of the cavern has an internal height of 14 metres; however for 30 metres at the southern (city) end, it has an internal height of 17 metres to allow for mechanical equipment to be installed.

The rail crossover is being constructed using road headers and excavators to cut through and remove rock. The walls of the cabin are being rock bolted for extra support. Shotcrete is being applied to both the roof and walls for extra strength.

The same road header and excavator construction methods were also used for the large underground maintenance cabin constructed at Epping and the new underground stations. To date, over 15,000 cubic metres of shotcrete has been used in the construction of these facilities.

## How the TBMs Work

- Grippers extend out to the rock surface, allowing the front shield and cutting head to move forward
- Rock is crushed by high strength alloy steel discs on the cutterhead
- Crushed rock is scooped into the machine's head and on to a conveyor belt
- The conveyor moves the rock through the machine shield and out of the tunnel behind it
- Precast concrete ring segments are delivered to the ring building area
- Concrete ring is built by putting together the precast segments using a special vacuum lifting device
- The completed ring, about 1.7 m long, is connected to the previous concrete ring then pushed out the back of the shield section
- The gap between the concrete ring and the rock is filled with grout, helping to keep water out of the tunnel
- The machine moves forward about 1.7 m and then the process is repeated

TBM #2, affectionately known as 'Florence', breaking through at showground station early this year.

*Images courtesy of Transport for NSW.*

Supplied by Holcim from the Pendle Hill and Blacktown concrete plants, the shotcrete for the Sydney Metro Northwest project was batched with Master Builders Solutions MasterGlenium® SKY 8345 high range water reducer and MasterRoc® HCA 20 stabiliser from BASF.

MasterRoc® HCA 20 is a high quality, liquid, non-chloride chemical admixture which can be used with dry and wet concrete mixes to control the dynamics of cement hydration. It delays hydration by suspending the hydration process and enables re-activation hours or even days later with no loss of quality in the hardened sprayed concrete.

Specifically developed for use in tunnelling and mining temporary and permanent support applications, as well as for slope stabilisation, annulus grouting (TBM) and cementitious injection systems, MasterRoc® HCA 20 can keep concrete mixes workable for up to 3 days, providing fully flexible delivery options for sprayed concrete mixes.

With travel times between the batch plant and shotcreting site ranging from 1 - 3 hours, MasterRoc® HCA 20 provided the ideal solution for the Sydney Metro Northwest project - ensuring the shotcrete arrived at the site in excellent condition, despite the travel time delays.

For the majority of the shotcrete, the hydration process is reactivated at the spray nozzle with Master Builders Solutions MasterRoc® SA 160, an alkali-free, liquid high-performance set accelerator for sprayed concrete also from BASF.

The shotcrete used in the crossover cabin and maintenance cabin is being reactivated using MasterRoc® SA 167 alkali-free set accelerating admixture.

Specifically developed for use in applications where high early and ultimate strength development and thick layers are required, MasterRoc® SA 167 delivers rapid early strength development for ground support, whilst still providing excellent long-term strength and durability. This combination of fast setting coupled with continual high early-age strength development proved to be the ideal solution for the 'cabin' structures, which required 'in-cycle' shotcreting due to the tight construction timeframe.

# Obtaining Assurance Through a Certified Telematics Service

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### Contemplating the use of telematics

to deliver a program or service, and seek assurance that your objectives are accurately translated into functional and technical requirements, including having the service certified as a CTS

### A telematics provider

and provide services that could benefit from being certified as CTS

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- **How to assure product conformance to standards**
- **National & International Speakers on Compliance Risks**

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**SYDNEY – Tuesday October 13th, 5.30pm-8.30pm**
**MELBOURNE – Thursday October 15th, 5.30pm-8.30pm**
**CHRISTCHURCH – Monday October 19th, 5.30pm-8.30pm**
**AUCKLAND – Tuesday October 20th, 5.30pm-8.30pm**
**BRISBANE – Thursday October 22nd, 5.30pm-8.30pm**

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- Australia and New Zealand are part of a global supply chain and building & construction products are now being sourced from both overseas and local manufacturers and suppliers. Alarmingly, there is increasing evidence that many suppliers of products, regardless of where they are made, are not providing evidence that they meet Australian and New Zealand Standards and building requirements, and hence they may not comply.
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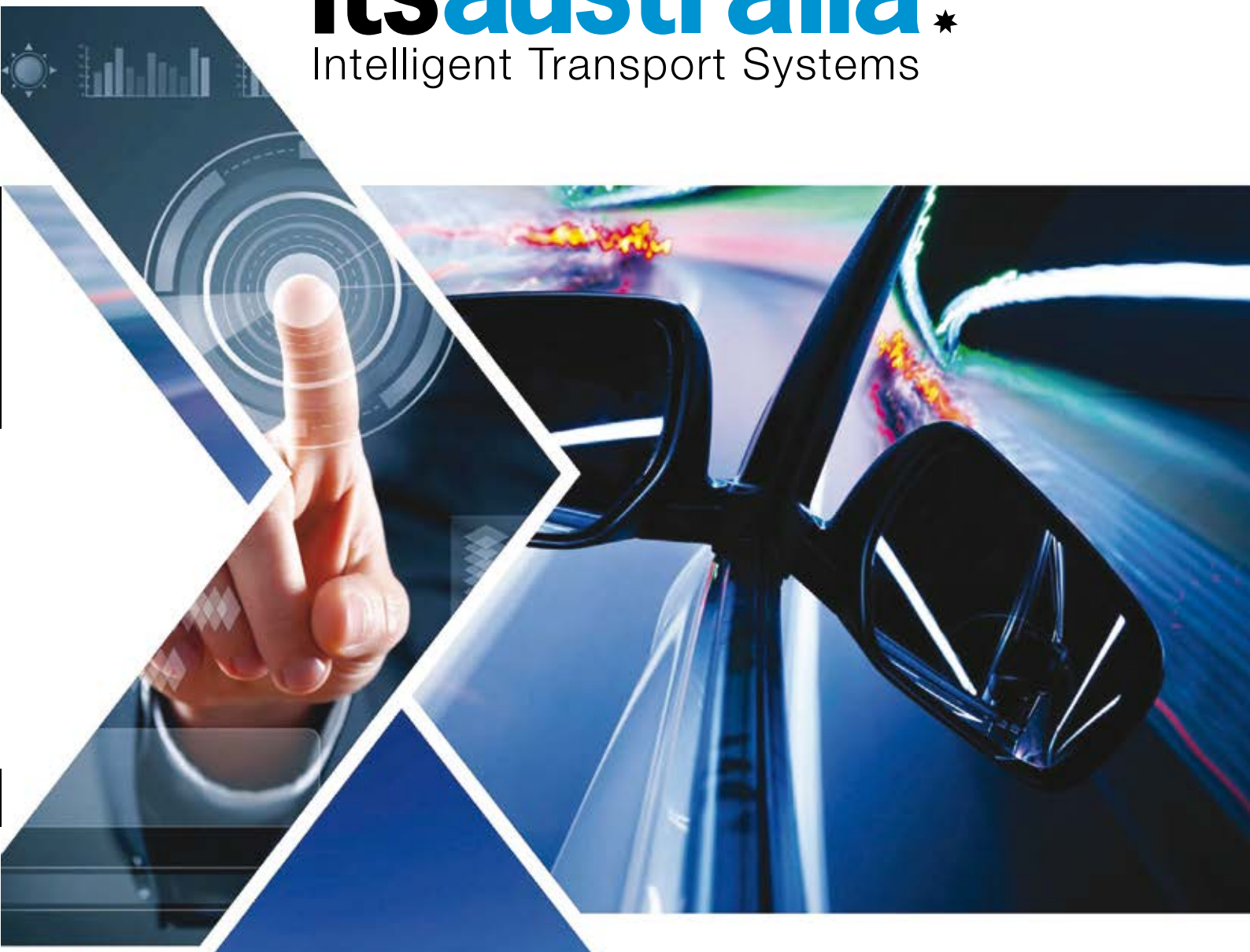
Intelligent Transport Systems




# ITS SPECIAL FEATURE

Intelligent Transport Systems
News and Feature Articles

# FOCUS ON
## BORDEAUX WORLD CONGRESS AND TOWARDS MELBOURNE 2016

The ITS World Congress in Bordeaux later this year will be an opportunity for Australia's delegation to exchange knowledge on the latest global developments in intelligent transport systems and renew relationships with colleagues from the Asia-Pacific, the Americas and Europe.

The Australian delegation to the Congress will be led by ITS Australia Chief Executive, Susan Harris, and Brian Negus – President of ITS Australia and General Manager, Public Policy, RACV. Brian and Susan are also members of the ITS World Congress Board of Directors.

Bordeaux is a major business centre and port in the south west of France and the World Congress is being staged there from 5-9 October.

Australia's delegation will comprise leaders from the intelligent transport sector, road and transport agencies, academics and researchers who specialise in the ITS field, together with Federal and State Government representatives.

"Our industry will be invigorated by the knowledge which our delegation to Bordeaux will bring home," Ms Harris said.

"We're very excited about the showcase that Bordeaux is putting on and the fact that we're going to be able to bring back learnings from the technology on display there, to invigorate the Australian transport sector.

"It's a really exciting time in the ITS industry – we're looking at getting the latest information on connected and autonomous vehicles so we can provide that knowledge to local jurisdictions and be ready to launch in Australia.

"But we won't just be learning; we'll be showcasing our world-leading knowledge, our expertise in areas such as vehicle-to-vehicle technology, vehicle-to-infrastructure technology, telematics devices and traveller information."

Mr Negus said Bordeaux was the home of the Keolis Group – the largest private sector transport company in France – and the operator of Melbourne's Yarra Trams.

# MEET IN ASIA PACIFIC FOR THE WORLD'S LEADING TRANSPORT TECHNOLOGY EVENT

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23rd World Congress on Intelligent Transport Systems

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"Melbourne has the biggest tram network in the world and our delegation will explore advanced technology for tram operations and safety while we're in Bordeaux.

"We're always looking to learn from colleagues about the technologies they are developing and to ensure Australia and the Asia Pacific regions stay ahead of the game.

"That way we can deliver improved safety and mobility to our communities through the implementation of intelligent transport systems," Mr Negus said.

Ms Harris said, importantly, the Australian delegation would also be observing the Bordeaux event very closely so it could ensure that Australia built on its success and took next year's World Congress in Melbourne to the next level.

"Promoting the Melbourne event is a really important part of our delegation's work in France. We're going to be well equipped to market Melbourne and inform conference delegates just what our city and Australia have to offer.

"It's our opportunity to explain to an international audience of specialists in intelligent transport systems that Melbourne is a modern, advanced, technological city."

Ms Harris said the positive impressions of the World Congress Board of Directors who visited Melbourne in May this year helped to build a great impression of the technology and opportunities that delegates will experience at the 2016 World Congress; to create an exciting platform for an event which is expected to attract about 7,000 to 10,000 attendees.

"Planning for 2016 is moving ahead smoothly; we have a really high level of organisation in place for an event that will be a global showpiece."

Mr Negus said the Australian delegation would join with the ITS Board and staff in a strong promotion of Melbourne 2016, which had the theme of "ITS Enhancing Liveable Cities and Communities".

"We already have committees working on all aspects of next year's event in Melbourne; committees dealing with the program, technical tours, demonstrations and exhibitions, sponsorship, media and marketing and social and cultural events.

"The theme for the conference brings Melbourne's reputation as the world's most liveable city into the spotlight as we explore the benefits that ITS delivers to enhance our liveability and many elements of our daily life.

"The key themes we've adopted for the Melbourne event are a continuation of what we saw in Tokyo (home of the 2013 World Congress), Detroit (2014) and this year in Bordeaux."

Mr Negus said the themes included:

- the challenges and opportunities of big and open data;
- smart cities and new urban mobility;
- cooperative and automated vehicles;
- vehicle and network safety;
- mobile applications;
- future freight including shipping and air;
- ITS policy, standards and harmonisation; and
- environmental sustainability.


**"In more recent times, Melbourne has been a world leader in freeway management systems, including advanced ramp metering. Australia was one of the first countries in the world to adopt and implement free-flow tolling and our emergency alert and management systems on the freeway network are world class."**

Mr Negus said Australia had long been an early adopter of intelligent transport systems to improve safety and mobility.

"We've been a leader right from the late 1960s/early 1970s with our world class SCATS traffic management system – even now SCATS is operating in around 250 countries.

"In more recent times, Melbourne has been a world leader in freeway management systems, including advanced ramp metering. Australia was one of the first countries in the world to adopt and implement free-flow tolling and our emergency alert and management systems on the freeway network are world class."

Mr Negus said the spread of ITS would bring global benefits. He said one of the challenges associated with its development was to ensure developed countries shared advances with developing nations to ensure a better quality of life.

"Western countries are rapidly advancing in ITS to improve safety and mobility, but we're also seeing huge developments in China, in India and these will bridge-off into other less developed nations.

"Vietnam is already embracing ITS technology, and that shows a challenge for the Asia-Pacific region of which Australia is part; for us to share our research and development with colleagues in the region.

"That collaboration will ensure those benefits are translated into really meaningful improvements in society in lesser developed nations."

Mr Negus and Ms Harris said after the Australian delegation returned from Bordeaux, a call would be made for papers for the 2016 World Congress in Melbourne.

They said there were a number of Premiere Partners on board for the Melbourne event, including the Victorian Government, VicRoads, Transport Certification Australia, RACV, Intelematics, Traffic Technologies and JYW Consulting.

"Now is the time to join us in sponsoring, exhibiting or arranging a demonstration for the ITS World Congress in Melbourne," Mr Negus said.

**Further information can be found at the ITS Australia website: http://www.its-australia.com.au/**

The next issue of Highway Engineering Australia will feature coverage of the Australian delegation's trip to Bordeaux and also look towards Melbourne 2016.

# TRANSPORT CERTIFICATION AUSTRALIA'S ROLE IN ASSURING THE ITS SOLUTION IS FIT FOR PURPOSE

Transport Certification Australia (TCA) is playing a key role in the major task of establishing standards to support the efficient, cost-effective deployment of connected vehicles on a global basis.

TCA is a national government body responsible for providing assurance in the use of telematics and related intelligent technologies. The National Telematics Framework, which is managed by TCA, provides a nationally-agreed, sustainable environment to support the current and emerging needs of government, industry sectors and end-users, and complements the principles contained in Policy Framework for Intelligent Transport Systems in Australia.

It is the Australian lead on the International Harmonisation Task Groups which also comprise the European Union, the US Department of Transport and certification bodies from other countries.

The task groups are charged with achieving security harmonisation standards and models to ensure intelligent transport systems can be deployed globally and relied upon to be fit for purpose.

Those standards would give a high assurance of interoperability and interworking of deployed equipment irrespective of where in the world the systems are deployed.

"It's about harmonising security that goes with connected and autonomous vehicles – the key role we have is to translate technical and operational security elements into policy consequences for governments to consider," said Chris Koniditsiotis, TCA Chief Executive Officer.

Mr Koniditsiotis is also a Director of ITS Australia and a member of the Australian delegation to October's ITS World Congress in Bordeaux.

"There are many implementation questions being posed and we're presently working through those. But I need to stress there is a big difference between having a semi-autonomous or autonomous vehicle in a controlled environment – a test track setting – and the real world where there are vehicles which are not autonomous and are controlled by humans. That requires more thinking, more investigation and especially, in our space, an understanding of what the real world business scenario means for the transport task. How will transport operate?"

Mr Koniditsiotis said the business models covering the deployment of such vehicles were still being contemplated and developed.

"The key business question that we're dealing with is will autonomous vehicles be acquired and used in the same way we use cars today? Will you buy a car as you do now and leave it in the garage when you're not using it or does the availability of an autonomous vehicle create a business and operational environment in which you purchase access to a vehicle? A vehicle which you will use for a period of time and somebody else will use for a period of time," Mr Koniditsiotis said.

"There are many of these business, policy, security, technical and operational questions which are being posed, but we don't have all the information yet to answer them. As indeed we do not have all the questions as yet either.

"One of the biggest challenges, I think, is the security of future vehicles from an identity and data component standpoint. We have to realise the vehicles we're talking about will be effectively computers equipped with a set of wheels. Government and the public will be concerned to make sure these new vehicles can't be hacked.

"Government and industry are going to have to play a major role to explain to and convince people that they're secure and safe."

Mr Koniditsiotis said he'd been in vehicles with varying degrees of automation and he had to go through a cultural adjustment even though he was a person in the ITS space.

"We need to be cognisant that these assistance systems are not only going to be rolled out to an 18-year-old who's going to drive a car for the first time, but to people who drive now. So a lot of effort will need to be spent in what I call the psychology space; the human factor space. We probably have spent a lot of time on the engineering and now we need to spend more time on the psychology of driving so you can let go of the steering wheel and have the confidence and comfort that things will be right."

Mr Koniditsiotis said his biggest hope was that the World Congress in Bordeaux would provide a forum where stakeholders could start talking about steps to achieving "the end game".

"How do we provide for the deployment of autonomous vehicles in a manner that manages our risks, our processes and takes all stakeholders along with it?

"It's now important to deliver pathways and I think Bordeaux will go a long way to highlight that; I know my presentations will focus on that."

Looking forward to 2016, Transport Certification Australia is the Official Demonstrations Partner for the ITS World Congress in Melbourne.

Mr Koniditsiotis said TCA was delighted to be continuing a fruitful relationship with ITS Australia to put the future of such technical enabling capability on the national agenda.

Chris Koniditsiotis, TCA Chief Executive Officer.

"As a national government body supporting the growing use of telematics and related intelligent technologies, TCA is uniquely positioned to coordinate practical, real-world demonstrations for the congress.

"Demonstrations of Co-operative ITS (C-ITS) applications and autonomous vehicles are an important way to demonstrate their potential value.

"Technical demonstrations and tours that showcase applications of the latest ITS technology will provide an opportunity for policy makers, practitioners, researchers and ITS providers to share information on social needs, opinions and technical developments."

ITS Australia released a statement in February 2015 calling for interested parties to participate in the 2016 World Congress demonstration program.

"We anticipate that the calibre of demonstrations at the congress will achieve the desired impact of informing and convincing government, decision makers, general public and media of the benefits of ITS," said Mr Koniditsiotis.

He said TCA was encouraged by the innovation and diversity of responses to the call for demonstrations.

"This coincides with the Industry Framework for Trialling Road Freight ITS and Associated Technologies that is being led by TCA and VicRoads, and we hope to see this Victorian ingenuity showcased at the Congress.

"Melbourne's hard earned reputation as the most liveable city in the world makes it the ideal host for the 23rd ITS World Congress, which will have the theme of ITS – Enhancing Liveable Cities and Communities. We look forward to welcoming the ITS community to our home in 2016."

Mr Koniditsiotis is Chair of the Demonstrations Sub-Committee for the Melbourne ITS World Congress.

# WORLD CONGRESS
## KEY FORUM FOR PROGRESSING ITS MARKET

The head of an Australian company which is a world leader in the telematics industry believes the 2015 and 2016 ITS World Congresses in Bordeaux and Melbourne are critical to enhancing communication between key players in the intelligent transport systems sector.

"The accelerating pace of technology in transport means these events are critical forums to advancing the dialogue between stakeholders that is necessary to enable the ITS market to develop," Adam Game, CEO of Intelematics, said.

"Bordeaux and next year in Melbourne are timely events because they will allow the regulators, the road operators and the electronics and automotive sectors to assess the move towards autonomous driving, the sharing economy and privacy.

"Congresses are becoming more and more topical and time critical for these issues to be discussed.

"The timing of the Melbourne Congress was fortuitous. Melbourne was awarded the 2016 event before the move of ITS from a largely technical discussion to a reality that even consumers are engaged with now," Mr Game said.

"I remember the early days of being involved in car navigation where you would have to explain the concept at a cocktail party and be met with the response; 'it'll never take-off because I've got a Melway' (street directory).

"Now it is taken for granted that navigation is fundamental to the way people live. We're on the cusp of a second wave of technological advance where we will see a fundamental change over the next 15 years in how people own, use and interact with the road transit sector, and that's exciting."

Mr Game has been Chief Executive Officer of Intelematics since 2000 and is a member of the ITS Australia delegation to the October World Congress in Bordeaux.

Intelematics has been operating telematics programs for auto industry companies for more than a decade.

It has been working with leading companies including Toyota, General Motors, Mitsubishi, and Navman.

Intelematics' portfolio of telematics services includes crash detection and intervention, remote diagnostics, usage based insurance, vehicle tracking and car finders, remote unlocking, and fleet management services.

Mr Game said the ITS World Congress was also unique because it addressed the interfaces between the segments of the ITS sector.

"A V2V communications infrastructure is sub-optimal if it doesn't have access to data that's collected by infrastructure; so the interfaces between these disparate players/systems are critical to harnessing the opportunity."

Adam Game, CEO of Intelematics

Mr Game said historically, there had been a lack of communication between parties in the ITS sector, but that environment was fundamentally changing because of the opportunities of vehicles to "talk to infrastructure".

He said road authorities weren't necessarily adept at communicating with other stakeholders in the intelligent transport system space.

"They're good road builders and managers, but not familiar with understanding their place in a complicated ecosystem that is going to be largely driven by consumer demand.

"There's been a view that ITS is a system that needs to be built as opposed to an ecosystem that needs to be engaged with to unleash consumer demand."

Mr Game said at a government level, the Federal Government had a critical role to play in the positioning of automation in the transport industry.

"The Federal Government is particularly important because it regulates anything to do with vehicles in terms of Australian design rules (ADRs) and anything to do with spectrum. Spectrum is critical for some of the advanced technologies that are on the horizon.

"Markets are going to move quite quickly, quite soon and there is a risk of us; for instance on the spectrum for vehicle-to-vehicle communication, being left behind if spectrum isn't quickly confirmed."

Mr Game said Australia was largely a "taker" of connected vehicle technology, but there were companies here, including Intelematics, whose growth was driven by opportunities elsewhere.

"So it would be disappointing if Australia wasn't an early adopter.

"Rapid adoption today, in the absence of local car manufacturers, primarily means paving the way for international solutions to be deployed as part of a standard solution at an original equipment manufacturer level.

"You might be selling in Germany, Brazil or California – it needs the same solution with the most minimal adaption, if any, to be capable of operating here, otherwise invariably their temptation would be to de-specify."

Mr Game said the Australasian market could only be described as unique because of New Zealand's current situation.

"We operate in New Zealand as well as Australia, but in almost all of the future road map for ITS in passenger vehicles there is now a divergence.



# Technology
## On the Move


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"New Zealand has drifted from the Australian position and we no longer factor NZ as a long-term compatible market for much of the next generation of vehicle technology.

"New Zealand's challenge," Mr Game said "was its grey market for second-hand imported vehicles which meant it had ended up with a soup of offshore-spec vehicles which now represent half its 'new vehicle sales'.

"These vehicles are equipped with Japanese technology which is unique to Japan. Even Japanese car makers don't deploy it in other markets; they adapt either the European or American platforms for the new vehicle market.

"New Zealand has this real mess on its hands when it comes to any sensible technology road map and this is a risk Australia faces if the ADRs are watered down to allow significant second-hand vehicle imports here that aren't compliant with connected vehicles standards.

"There's one issue for Australia really; whether to adopt the European or US set of standards and how, if there's any localisation required, to ensure the quirks of the Australian network are addressed.

"But to be honest, that's not very hard, because the ADRs almost always follow the European regulatory structure, and it's quite achievable unless we were silly enough to come up with an independent sort of standard."

Mr Game said there were always challenges for Intelematics in its market space.

"We're working on two major projects in terms of our research and development, and they're related to the connected vehicle space.

"In the manufacturing segment we're continuing with our work for the Toyota and Lexus Group, but it's not our position as yet to foreshadow what the next generation of that work will be.

"In the after-market space, we're engaged with motoring clubs around the world on exploring opportunities to address the fact that vehicles have an average life span of about 20 years and an average age of about 10 years.

"That means there's a very large number of vehicles that didn't roll out of the factory with connective capabilities, and so there's an exciting road map we're working on with regard to retrofitting technologies to the existing vehicle fleet, whether it's for remote diagnostics or supporting usage-based insurance calculations, or driver fatigue and safety applications."

Mr Game said the after-market represented a huge opportunity.

"Even if half the vehicles in the market in 10 years were autonomous and the rest were connected, there's 10 million vehicles out there that need to work through their 20-year life cycle.

"That's a very significant and interesting market to explore," Mr Game said.

# DRIVERS TO 'EMBRACE' AUTONOMOUS VEHICLES

Paul Gray – the Chief Executive Officer of Australia's advanced V2X provider, Cohda Wireless – predicts people will be using autonomous vehicles in a "hands off the wheel" sense by the end of this decade.

Mr Gray, a member of the ITS Australia delegation to the World Congress in Bordeaux in October, said he believed drivers would readily embrace autonomous vehicles.

"Once they've seen how an autonomous vehicle works a couple of times and compare that with the mind-numbing tedium of an hour's commute in heavy traffic, they'll be happy to give up controlling the vehicle."

Mr Gray said he enjoyed driving when he was on an open road on a Saturday afternoon when the sun was shining.

"But on a daily commute, I'd be happy to relinquish control and do something more interesting and productive."

Cohda Wireless manufactures key hardware and software components in what is referred to as Vehicle-to-Vehicle (V2V) communication, Vehicle-to-Infrastructure (V2I) communication or the collective term, V2X.

Mr Gray said the South Australian-based company would be part of the demonstration program at the World Congress in Bordeaux; the event would provide an opportunity for Cohda to demonstrate its new product, V2X Radar.

V2X communication is an essential technology for autonomous vehicles.

Mr Gray defined V2X Radar technology as a non-line-of-sight sensor with 360-degree coverage which extended a driver's horizon of awareness.

"It uses DSRC (Dedicated Short Range Communication) to detect objects from which signals are reflected."

DSRC is a low-latency V2V and V2I communication protocol.

"V2X Radar is different to regular radar," Mr Gray said. "Regular radar is directional, whereas this is omnidirectional and we can achieve it with software upgrades to the V2X system."

Mr Gray said the radar was quite advanced at this stage.

"It utilises the V2X system, so it can be incorporated into the first vehicles that are V2X enabled.

"For example, GM is going to be the first car maker to deploy the V2X system with the start of production at the end of 2016 and we could provide software upgrades to that system to add the radar capability.

"I think it's definitely the first of its kind in the world. Technically speaking it's bistatic radar using wi-fi like signals."

Bistatic radar refers to the basic measurement of range made by a radar system with separated transmitter and receiver. The receiver measures the time difference of arrival of the signal from the transmitter directly, and via reflection from the target.

As well as being a key participant at the World Congress in Bordeaux, Cohda Wireless is also taking part in the first trial in Australia of a driverless car. It is one of the companies involved in the testing to be staged in Adelaide in November.

The Adelaide trial involves the same Volvo vehicle from Sweden that is being used in that country's "Drive Me Project". That initiative aims to make driverless or self-driving cars available to customers by 2017.

"The South Australian Government has shown a lot of leadership in terms of driverless cars and its work on legislation to provide for those vehicles on the road," Mr Gray said.

The government plans to legislate before the end of 2015 to pave the way for future technological change on SA Roads.

"The government's involvement creates the potential for South Australia to be a hub for driverless car development in Australia.

"At a Federal level, the government can really play a role in the area of design rules; setting rules surrounding what the car is actually doing," Mr Gray said.

# ITS UPGRADE MAKES FOR A SAFER MONASH FREEWAY

Motorists on Melbourne's M1 Monash Freeway have a more reliable journey with the new Intelligent Transport System between High Street, Glen Iris, and Warrigal Road, Chadstone.

The ITS was activated in mid-August, six months ahead of schedule.

The $19.7 million Monash Freeway Managed Motorway upgrade includes new overhead electronic signs and closed circuit television cameras.

The overhead signs help to advise drivers when lanes are open and closed, and allow for speed limits to be adjusted to suit traffic conditions.

The speed limit on the section of freeway remains at 100 kilometres an hour.

The CCTV cameras relay live traffic information to the VicRoads Traffic Management Centre allowing VicRoads to manage road works and respond more effectively to incidents, including crashes and broken down vehicles.

When an incident occurs, lanes can be closed quickly and traffic can be routed to bypass the incident ensuring motorists face fewer delays.

The upgrade allows motorists to drive from the M80 Ring Road at Altona North in Melbourne's west to Warrigal Road, Chadstone in the city's east.

"It will improve traffic flow and safety for the more than 176,000 motorists who use the Monash Freeway each day, Luke Donnellan, Victoria's Minister for Roads and Road Safety, said."

"The lane use management system means we can better manage the freeway network.

"By using the overhead signs and CCTV cameras, we can better monitor and manage congestion, road works and incidents, meaning road users will have a more reliable journey.

"Drivers are already familiar with this technology, which is already installed from the M80 Ring Road to Clyde Road," Mr Donnellan said.

"Motorists who travel on this section of the freeway have been constantly frustrated with congestion and delays on this important transport corridor, particularly during peak periods," Federal Minister for Infrastructure," Warren Truss, said.

"Regular users of the M1 would have noticed the work that's been happening over the past few months, particularly the installation of four new gantries to hold the overhead signs."

"As part of the managed motorway, drivers must obey and observe these overhead electronic signs for speed limits, incident information and lane availability."

The Federal and Victorian Governments each contributed $9.9 million towards the project.

# ITS AUSTRALIA
## BACKS FIRST DRIVERLESS CAR TRIALS ON AUSTRALIAN ROADS

ITS Australia says demonstrations and trials of driverless cars such as the one proposed in South Australia later this year are the first steps to exposing a wider local audience to exciting transport related technology.

The advocacy body for the development and deployment of advanced technologies in the transport sector was responding to the announcement that driverless cars would be tested on Australian roads for the first time in November.

The trials will be staged under the auspices of the Australian Driverless Vehicle Initiative.

Through the initiative, the ARRB Group is supporting governments in bringing together leading local and international experts from industry and academia to run Australia's first driverless vehicle demonstration trials.

Stakeholders include technology partners Telstra, Bosch and Cohda Wireless, and automotive partner Volvo.


ITS Australia Chief Executive Officer, Susan Harris, said automated vehicles had the potential to deliver safer, more efficient mobility solutions for Australians.

"Local demonstrations and trials such as this one proposed in South Australia are the first steps to exposing a wider local audience to this exciting technology," Ms Harris said.

"Trials such as these are critical to understanding how to manage the introduction of automated vehicles onto our roads in line with our international peers."

When announcing the South Australian trial on 21 July, ARRB said by applying international research to the local road environment, the partner organisations would seek to understand what was required to make driverless technology appropriate for Australian roads and safe for road users.

The trials will take place on Adelaide's Southern Expressway on 7 and 8 November – a number of Volvo vehicles will conduct manoeuvres such as overtaking, lane changing, emergency braking and the use of on-and-off ramps.

The initiative is supported and hosted by the SA Government, and will closely follow a Driverless Vehicle Conference to be hosted by the state on 5-6 November.

ARRB Group Managing Director, Gerard Waldron, said automated vehicles were far from science fiction, but rather a short-term reality for which Australia needed to be prepared.

"The advent of driverless cars is an opportunity to foster technological innovation and revive Australia's manufacturing industry – the South Australian Government has been quick to recognise this," said Mr Waldron.

Premier, Jay Weatherill, said: "This trial presents a fantastic opportunity for South Australia to take a lead nationally and internationally in the development of this new technology, and open up new opportunities for our economy."

Mr Waldron said ARRB Group's national research initiative put Australia on the map along with the UK, the US and Sweden as international leaders in automated vehicle research.

"ARRB will establish how driverless technology needs to be manufactured and introduced for uniquely Australian driving


behaviour, our climate and road conditions, including what this means for Australia's national road infrastructure, markings, surfaces and roadside signage."

The trials in South Australia will be the first of many trials nationally, with discussions underway in a number of jurisdictions. ARRB Group is calling for additional states, territories and partners to support the national research initiative.

"Driverless cars have a range of benefits that could significantly improve road safety and the quality of life of Australians, add to the nation's economic competitiveness and help relieve rapidly growing congestion that is crippling our infrastructure and creating productivity deficits in our capital cities.

"We're seeking technology and automotive industry partners to assist us in Australia's driverless vehicle innovation," Mr Waldron said.

Mark Jackman, Regional President, Vehicle Safety Systems of Robert Bosch Australia, said: "We're excited to be a part of the ARRB Australian Driverless Vehicle Initiative and anticipate this will be a major step forward in advancing Bosch automated driving technologies in Australia for now and into the future."

Kevin McCann, Managing Director of Volvo Car Australia said: "As a leader in the development of autonomous drive technologies, Volvo's aim is to make this technology realistically available for customers in production cars in the near future.

"At Volvo we believe autonomous drive will lead to significant consumer and societal benefits, including improved traffic safety, improved fuel economy, reduced congestion, and the opportunity for improved infrastructure planning.

Vish Nandlall, Telstra's Chief Technology Officer said: "We look forward to working with ARRB and seeing how we can use our technology and networks expertise to help make autonomous vehicle use in Australia a reality."

Penny Gale, RAA General Manager Public Affairs, said that by 2020 all cars that come off the production line would have some ability to drive themselves, and Australia needed to prepare.

"This type of technology has the potential to be a real win for road safety and mobility," Ms Gale said.

"Removing the need for a driver will open up a whole new transport opportunity for many of our members, particularly people with disabilities and the elderly.

"And removing the reliance on human behaviour will undoubtedly save lives.

"This trial will help us gauge the opportunities and issues road users might face, and help us better prepare our members for the future transport that is rapidly approaching."

**"This trial presents a fantastic opportunity for South Australia to take a lead nationally and internationally in the development of this new technology, and open up new opportunities for our economy."**

# ITS AUSTRALIA

## PART OF NEW 'INDUSTRY SHAPING' INITIATIVE

ITS Australia is working with the Automotive Cooperative Research Centre (CRC) in an initiative that has the potential to significantly advance the intelligent transport systems sector in Australia.

It is collaborating with AutoCRC to support a bid for an Innovative Transport Cooperative Research Centre.

AutoCRC was established in 2005 as part of the Cooperative Research Centre Program to develop new technologies in the Australian automotive industry.

It was set-up by a consortium of Australian vehicle manufacturers, component suppliers, state governments, universities and research organisations. Its research activities focus on vehicle electrification, gaseous fuels and sustainable automotive manufacturing.

AutoCRC said the proposed Innovative Transport Cooperative Research Centre would enable Australian companies in the ITS industry to develop and deliver products for what it called a "data driven world".

It would also enable Australian industry to achieve increased productivity and reduced costs.

Ian Christensen, CEO of the AutoCRC, said ITS companies, research organisations and government agencies should be involved in the new body because it would help the companies and Australia to compete on the world stage.

ITS Australia CEO, Susan Harris, said it was looking to access funds from the next round of CRC funding to put together an Innovative Transport CRC to advance the ITS sector and deliver real benefits to the Australian community.

"We're working with our industry to contribute a certain amount of funding and then looking to bid for complementary funding from government to be able to finance a range of exciting and innovative initiatives in the ITS space," Ms Harris said.

"Cooperative Research Centres represent really exciting opportunities to bring together a number of players to look at complex research problems.

"We're looking at cracking those really tough problems that can't be resolved by one organisation on its own – problems that really require a collaborative effort."

# RECOGNISING EXCELLENCE IN THE ITS INDUSTRY

**NOMINATIONS ARE OPEN FOR THE ITS AUSTRALIA NATIONAL AWARDS WHICH RECOGNISE EXCELLENCE IN THE INTELLIGENT TRANSPORT SYSTEMS INDUSTRY.**

The 2015 awards will be presented at a dinner on 18 November at the Sydney Opera House. The dinner will be attended by approximately 150 prominent industry professionals.

The aim of the ITS Australia National Awards program is to recognise professional ITS expertise and to help educate government and the community about the benefits of ITS technologies.

Intelligent transport system technology researchers, developers, infrastructure providers, manufacturers and young ITS professionals are encouraged to submit applications in five award categories.

The categories are:

## GOVERNMENT AWARD

- Developed or deployed a significant new innovative ITS system or service over the course of the previous year.
- Can demonstrate deliverability over the course of the previous year.
- Whose new system and/or service fostered advanced deployment of ITS services.
- Has been developed or deployed in Australia.
- Is an organisation that plays a leading role in the ITS Community.
- Has delivered benefit to the Australian community.
- Chance to be nominated by ITS Australia for the ITS World Congress Achievement Award.

## INDUSTRY AWARD

- Developed or deployed a significant new innovative ITS product or service over the course of the previous year.
- Can demonstrate deliverability over the course of the previous year.
- Whose product and/or service played a key role in accelerating development and deployment of ITS in its region.
- Has been developed or deployed in Australia.
- Is an organisation that plays a leading role in the ITS Community.
- Has delivered benefit to the Australian community.
- Chance to be nominated by ITS Australia for the ITS World Congress Achievement Award.

## YOUNG PROFESSIONAL AWARD

- Under 30 years of age (at 31 December 2015).
- Working in the ITS field and or undertaking graduate or post-graduate studies at an accredited institution within Australia.
- Is able to travel to attend the 23rd ITS World Congress 2016 to be held in Melbourne, 10-14 October 2016.

## RESEARCH ACADEMIC AWARD

- Open to universities, research organisations and designated research units of commercial organisations or government.
- Research has appeared in or is eligible for inclusion in a peer reviewed journal or trade publication.
- Research relates specifically to ITS and is original in subject or method of enquiry, or outcome/s.

## LIFETIME ACHIEVEMENT (MAX LAY AWARD)

The prestigious Lifetime Achievement Award recognises an individual who personifies achievement of the ultimate standard for a leader in the ITS field and in the organisations they have led. The award recognises that they are a champion of vision of ITS and its fulfilment within the community.

The award is named in honour of Dr Maxwell Lay (AM), an Australian pioneer and ITS researcher, engineer, project implementer and advocate for advancement of ITS.

The deadline for nominations for the 2015 Awards is 30 September and nominations can be submitted to ITS Australia: admin@its-australia.com.au

The winners of two award categories at the 2014 Awards will be considered for international recognition at October's ITS World Congress at Bordeaux.

They are Intelematics Australia, the winner of the Industry Award category, and the Queensland Department of Transport and Main Roads, the winner of the Government Award category.

Intelematics Australia was recognised for the Toyota Connected Vehicle Programs, a world market leading approach to in-vehicle connected technology.

The award related to the company's work on a flexible connected vehicle platform for Toyota Motor Corporation.

Intelematics spent more than two years developing the state-of-the-art platform, which provides motorists with access to a range of travel-related information and assistance services through an interactive vehicle dashboard (and supporting web, smartphone, and agent-assisted interfaces).

The Queensland Department of Transport and Main Roads, Queensland Public Safety Business Agency, Queensland Fire and Emergency Service, Queensland Police Service and Transmax were recognised for the Emergency Vehicle Priority system in Samford Road, Brisbane.

This TMR-led project is a traffic signal pre-emption solution which has displayed measureable emergency vehicle arrival time savings and has clear, ongoing and possibly lifesaving safety benefits.

ITS Australia National Awards 2015

# **HERE** Traffic
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With services offered across 100% of the roads in 50 countries, HERE keeps people moving.

HERE Real Time Traffic is built on our highly accurate map and enhanced by billions of GPS data points and more than 100 data sources – from global information hubs to road works data providers and our own traffic operations centre.

We transform this complex data into useable insights, updating it every 60 seconds with current traffic conditions and incidents that could cause delays.

With 30 years of experience, HERE is your trusted partner to help ensure drivers get to their destinations efficiently and stress-free.

Drivers may keep their eyes on 1 road. We keep our eyes on 100% of the roads.

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here

# BIG DATA
## the key to unlocking the future of traffic, transport and infrastructure

While most of you have no doubt heard the term 'big data', other than recognising the obvious (that it refers to an extremely large amount of data), for many people big data remains somewhat shrouded in mystery. Hardly surprisingly considering the numbers that are usually associated with big data processes.

Put simply, for many people, these numbers are, more often than not, too big to comfortably comprehend. Even in a world where people routinely carry around and utilise computing power (and have digital storage capabilities) that as little as 20 years ago were almost unimaginable, for many people the sheer size and scope of big data collection and processing still seems to reside more in the realms of science fiction than reality.

That said, big data is very much a functional reality for a number of key industry sectors. What's more, thanks to companies like HERE, big data is helping to shape the future of traffic, transport and infrastructure - across Australia and around the world.

Whereas in the past data relating to the road and transport networks once relied on 'traditional' input sources such as road loops, traffic lights, signalling systems, traffic cameras, etc., we now live in a world where location data is, quite literally, everywhere.

Most people, regardless of their mode of transportation or location, now generate accurate location data from at least one device, around the clock; and many people are generating this data from more than one device simultaneously. What's more, with the advent and rapid development of 'the internet of things' we are all becoming more 'connected' as each day passes.

In short, the greater majority of people (and an ever-increasing amount of inanimate objects) generate a truly staggering amount of location based data... every minute, of every day, regardless of their location.

With all of this data being generated, the real big data questions are:

- What data is out there?
- How do we collect it and manage it?
- What are the potential benefits?

Brent Stafford, Director, Enterprise Sales Asia-Pacific with HERE, commented:

"Together with the obvious technical challenges that come with capturing, collating and analysing big data from a variety of sources, one of the biggest challenges with big data is to know exactly what data is available to collect and the most efficient way to collect it."

"Then, when you have the data, you need to work out what answers it can provide and what benefits can be derived."

"The key to managing and utilising big data is not trying to know everything," Brent Stafford added, "it's about working out how to extract the data that we actually need from the total data pool, without getting bogged down with additional data which is of no consequence for the job at hand."

## About HERE

A global leader in maps and traffic, HERE was formerly part of Nokia, however it was recently purchased by a consortia of BMW, Daimler and Audi. Working with a focus on data and software rather than hardware solutions, HERE builds high-definition (HD) maps and combines them with cloud technology to deliver bespoke solutions for businesses, consumers and a number of global and local enterprise partners.

HERE has created maps for 196 countries with more than half navigation grade. In addition, HERE has developed public transit maps in more than 950 cities and floor-by-floor indoor maps for more than 90,000 buildings across over 11,000 venues.

HERE has a staff of over 1,200 Geographic Analysts working in 188 offices across 50 countries, together with an additional 2,000+ Geographic Technicians in 6 production centers across the globe.

And it's precisely this ability to interrogate the available data - extracting what's needed and disregarding what's not - that has placed HERE firmly at the global forefront of big data management, mapping and location-based solutions.

HERE collects and processes over 2,000,000,000 (yes 2 Billion) traffic probes each day, and a staggering 93,000,000,000 (again, that's 93 Billion!) road data transactions per month globally. Knowing how to collect, manage and extract beneficial information from such a massive data pool is clearly the key to HERE's global success and growth.

Together with data from traditional field sources such as traffic control systems, road loops and traffic management centres, HERE collects a constant stream of anonymous GPS data points from all manner of connected devices, providing a constant and highly accurate traffic data stream across all transport modes - from motorised traffic, through to cyclists and even pedestrians.

From a mapping perspective, HERE uses this data, together with data collected by its dedicated fleet of over 400 LiDAR equipped field cars to create 3D point cloud maps of unprecedented quality and detail, including floor-by-floor indoor maps for more than 90,000 buildings.

### Using the Past to Predict the Future

While the practical applications for a big data stream such as this are many and varied (and constantly being developed by HERE, both through in-house projects and in conjunction with their many enterprise clients), the pool of collected data has already proven itself invaluable in a range of practical applications - many of which, until recently, would have been considered unachievable or fanciful to say the least.

From a road network management perspective, big data analytics provide an incredibly accurate picture of road network usage and demand. By utilising data from road loops, signalling systems and GPS data points, together with data collected at HERE's own network of Traffic Management Centres, HERE's cutting-edge data processing technology is able to deliver highly accurate and up-to-the-minute data relating to current traffic conditions, including slower than normal traffic flows and traffic congestion caused by incidents, accidents and road works.

Importantly, HERE's big data analytics capability is not limited to accurately reporting current traffic conditions, it also extends to the provision of highly accurate predictive traffic data.

With a data set stretching back to 2011 - containing highly accurate traffic data at 5-minute intervals for the entire road network - HERE's Predictive Traffic and Traffic Analytics data processing engines use advanced statistical algorithms to compare current data with historical data to provide a highly accurate and detailed predictive traffic model for the road network.

The predictive data, which also takes into account time of day, day of week and seasonal historic demand, provides road users and road network managers alike with a never before seen level of pre-planning capability.

From trip planning, freight/delivery scheduling, public transport scheduling and even on-road services scheduling (such as garbage collection, street sweeping, etc.) through to traffic signal timing, route prioritising, lane closures and works/maintenance planning, HERE's highly accurate predictive modelling capability is a true 'game changer' for traffic and transport network management.

### Traditional Traffic Counting a thing of the Past?

Not surprisingly, another key aspect of this big data capability is the impact that it is expected to have on network infrastructure planning.

Put simply, the level and accuracy of the available trip data - including historical data at 5 minute intervals stretching back over 4 years for the entire road network - has effectively consigned the practice of traditional traffic counting to the annals of history.

While old style traffic counts (using either road counter tapes, vehicle detection units or manual counting) can provide data relating to specific points, it does not provide any wider route information. Traffic Analytics data provides a total picture of all traffic from source to destination across the wider road network - including flow / speed data, congestion points and incident data across a given time period.

For the first time, road authorities, Local Governments and planning authorities are able to garner a highly accurate, network-wide picture of actual use and demand. This not only provides critical data in relation to maintenance of existing road network assets (including bridges and other structures) it also provides an invaluable tool for planning additional roads and expanding the network to meet future needs.

"Big data analytics for road and transport networks is about much more than simply counting vehicles monitoring what has happened," Brent Stafford said.

"In the past, the data being collected from the road network - from loops, signals or other traditional monitoring methods - could have meant any number of things."

"By combining that data with the data that we're able to anonymously collect from personal location devices, we're not only able to provide a complete and highly accurate picture of what has happened across the network, we are also able to predict future trends and demands with an extremely high level of confidence," Brent Stafford concluded.

**For further information please contact HERE, ph: +61 3 9420 5952 or visit:**
**here.com/heretraffic**

# Modelling and laboratory studies on the adhesion fatigue performance for Thin-Film Asphalt and Aggregate System

This article is based on extracts from a research paper prepared by:
- Dongsheng Wang from the School of Transportation Science and Engineering, Harbin Institute of Technology, Harbin, China;
- Junyan Yi from the Institute's School of Transportation Science and Engineering, and School of Chemical Engineering and Technology; and
- Decheng Feng from the Institute's School of Transportation Science and Engineering.

The article was first published in June 2014 by Hindawi Publishing Corporation. *Highway Engineering Australia* has utilised extracts because of space limitations and the complete presentation can be found at http://www.hindawi.com/journals/tswj/2014/819083/

## Abstract

Adhesion between asphalt and aggregate plays an important role in the performance of asphalt mixtures. A low-frequency adhesion fatigue test was proposed in this paper to study the effect of environment on the asphalt-aggregate adhesion system.

The stress-based fatigue model had been utilized to describe the fatigue behaviour of thin-film asphalt and aggregate system. The factors influencing the adhesion fatigue performance were also investigated.

Experiment results show that asphalt has a more important effect on the adhesion performance comparing with aggregate. Basalt, which is regarded as hydrophobic aggregates with low silica content, has better adhesion performance to asphalt binder when compared with granite.

The effects of aging on the adhesion fatigue performance are different for PG64-22 and rubber asphalt. Long-term aging is found to reduce the adhesion fatigue lives for rubber asphalt and aggregate system, while the effect of long-term aging for aggregate and PG64-22 binder system is positive.

Generally the increased stress amplitude and test temperature could induce greater damage and lead to less fatigue lives for adhesion test system.

## Introduction

Moisture damage is one of the important reasons inducing premature failure in asphalt pavement, which is thought to occur either within the binder (fracture of cohesive bond) or at the binder-aggregate interface (failure of adhesive bond).

Among them, the interfacial adhesive bond is considered to play a more important role in moisture damage. Therefore researchers had conducted a lot of studies on the interfacial adhesion mechanisms, experimental methods and evaluation index in the past years.

As to the basic adhesion mechanisms, it had been classified as electrostatic forces, chemical bonding, and adhesion due to surface free energy. Among them, the surface free energy method is most popularly used to investigate the adhesion bond between aggregate and asphalt binder.

In addition to the surface free energy theory, the mechanical test had also been utilized to study the adhesion performance. To date, a standard method to accurately determine the mechanical bond strength between asphalt and aggregate has still not been established.

The existing researches in recent years mainly utilized the devices or methods in other industries; for example, pneumatic adhesion tensile testing instrument (PATTI) in the coatings and adhesive industry.

The thin-film tension tests using PATTI were employed in pavement engineering to investigate the adhesion bond performance between aggregate and asphalt binder with water conditioning and dry conditions.

The adhesion bond performance was also presented to be more vital to the durability of porous asphalt mixes. With fewer fines in the mix, the bond between asphalt and aggregates is much more susceptible to traffic loading and environmental effects.

To characterize the adhesion bond strength, the researchers from Delft University of Technology (in the Netherlands) developed the thin-film adhesion test method and investigated the adhesion fatigue performance under traffic load.

The frequency for this fatigue test was 10 Hz, which was usually used to characterize the effect of traffic load. However, as to the environmental effects such as moisture and freeze-thaw, a lower load frequency was expected to be more suitable.

In this paper, a low-frequency adhesion fatigue test was proposed to study the adhesion performance between aggregate and asphalt binder under the effect of environment.

Different kinds of aggregates and asphalt binders (unaged, short and long term aged) were selected to analyze the factors influencing their adhesion fatigue performance.

## Materials and Experimental Methods

Two types of binders, PG64-22 and rubber asphalt (RA), were used in this study. Rolling thin-film oven test (RTFOT) and pressure aging vessel (PAV) test were utilized to simulate the short-term and long-term aging for asphalt binder.

The shear dynamic moduli G* of the binders at different frequencies and temperatures were tested using conventional DSR and their master curves at 20°C were plotted in Figure 1.

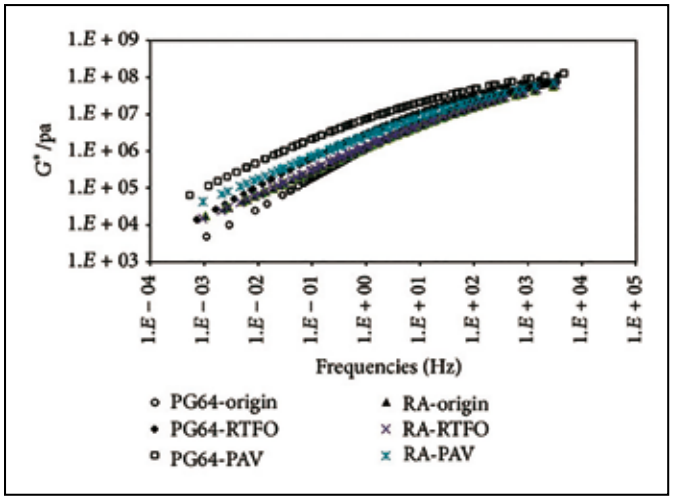


**Figure 1: Master curves of G* for two kinds of asphalt at 20 degrees C.**

As shown in the figure, short-term and long-term aging have significant effects on the modulus of PG64-22, while less effect for aging is found on the modulus of rubber asphalt. When frequency is high enough, the effect of aging can be ignored for both of asphalt binders.

Granite and basalt were selected to be the test aggregates. The silicon dioxide contents are 47.95% for basalt and 66.43% for granite, respectively.

## Sample Preparations

The column aggregate samples were prepared through cutting and coring the rock. The final column aggregate had a diameter of 5.72 mm and length of about 15 mm, as shown in Figure 2.

The adhesive bond mechanisms between aggregate and binder can be generally classified as mechanical interlocking and physical or chemical bonds.

The physical and chemical bonds, as mentioned before, are generally classified as weak boundary layers, electrostatic forces, chemical bonding, and adhesion due to surface free energy. And the mechanical interlocking is determined by the aggregate surface morphology.

This paper mainly focused on the physical and chemical bonds between aggregate and binder; thus the surface of aggregate samples was sanded and polished to keep the same surface texture.

The asphalt film thickness plays a critical role in investigating the adhesive bond performance between asphalt and aggregate.

Many researchers had presented that the asphalt film thickness is about 6 to 10 microns for asphalt mixes with dense gradations, on the basis of calculating the asphalt content and aggregate surface area.

As to the porous asphalt mixtures, the required asphalt film thickness was larger for the less aggregates and higher asphalt content. Therefore the Chinese specification recommends that the asphalt film thickness for porous asphalt mixes should be more than 14 microns. At last, 20 microns were selected to be the test film thickness for asphalt binder.

The conventional aluminum plates for DSR equipment were replaced with aggregate cylinder samples as shown in Figure 2. Thus a sandwich structure, which means two aggregate samples bonded with 20 μm asphalt film, can be setup and utilized to investigate the adhesion fatigue performance between aggregate and asphalt.

## Experiment Program

The adhesion fatigue tests with stress-controlled mode were conducted using dynamic shear rheometer (DSR). The normal stress-time curve under fatigue load can be shown in Figure 3.

In this paper, the environmental effects such as moisture and freeze-thaw had been studied. The effect of moisture can be realized by using the water bathing system of DSR.

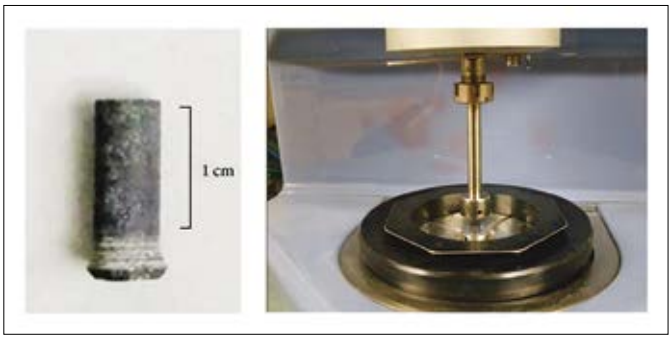


Figure 2: Column aggregate sample and setup of sample

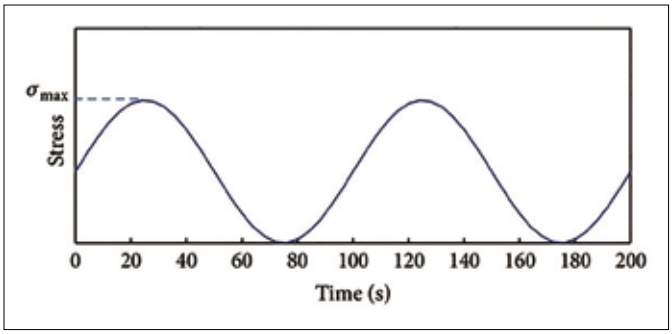


Figure 3: Stress-time curve for fatigue test

As to the frost expansion of water, it is clear that this effect varies along with the change of temperature. Therefore 0.01 Hz was finally selected to be the test frequency, which had been used to investigate the low-temperature fatigue performance of asphalt mixtures [19]. The experimental plan can be shown in Table 1.

In fatigue test, the definition of failure point is important. For each loading cycle, the modulus can be calculated through dividing peak stress by peak strain. In this paper, the 50% of initial modulus was finally defined as the failure of adhesion between asphalt and aggregate.

**Table 1: Experimental plan for adhesion fatigue test.**

| Aggregate | Asphalt | Test temperature /°C | Stress amplitude/ MPa |
|---|---|---|---|
| Basalt | PG64-22 unaged, RTFO, PAV; RA unaged, RTFO, PAV | 5<br>10<br>20 | 0.6, 0.8, 1.0, 1.2<br>0.6, 0.8, 1.0<br>0.2, 0.3, 0.4, 0.5 |
| Granite | PG64-22 unaged, RTFO, PAV; RA unaged, RTFO, PAV | 5<br>10<br>20 | 0.8, 1.0, 1.2<br>0.6, 0.8, 1.0<br>0.2, 0.3, 0.4 |

## Conclusions

The adhesion experimental method for thin-film asphalt and aggregate system was firstly developed to investigate the effect of environmental factors in this paper. Then the factors influencing the adhesion performance between asphalt and aggregate were studied.

The used fatigue model can successfully predict the adhesion fatigue lives for different types of asphalt and aggregates. When applied stress amplitude and test temperature increase, the adhesive fatigue lives between asphalt and aggregate deteriorate rapidly.

Modified asphalt (rubber asphalt) has better aging-resistance and stronger adhesion to aggregate comparing with unmodified asphalt (PG64-22). The RTFOT and PAV aging to PG64-22 can improve its adhesion to aggregate.

However, the function of long-term aging is different for rubber asphalt. It is found that the long-term aging has negative effect on the adhesive fatigue performance between aggregates and rubber asphalt.

Basalt, which is regarded as hydrophobic aggregate, has better adhesive fatigue performance to asphalt binder compared with granite. However, the effect of aggregate property is reduced if applied stress amplitude increases.

To sum up, the influence of asphalt property is more dominant to the adhesion fatigue performance between modified asphalt and aggregate. If used binder in asphalt mixture is unmodified asphalt, the effect of aggregate property cannot be ignored.

# Cold recycling used to rehabilitate key Brazilian highway

The time-saving, cost-efficient and environmental benefits of the cold recycling process have been utilised in upgrading one of Brazil's key motorways – the SP-070 or Ayrton Senna Highway.

The SP-070 is an important transport link between São Paulo and Campos do Jordão, Vale do Paraíba and Rio de Janeiro, as well as being the main access route to Guarulhos International Airport.

Since 2009, it has been operated by Ecopistas, which has a 30-year concession for the maintenance of the Ayrton Senna Highway.

Structural repairs have been carried out on a 35 kilometre section – the stretch between the 11 and 46 kilometre marks – which extends from São Paulo in an easterly direction.

The upgrade was undertaken because the 25-centimetre cement-bound base course that lies under the asphalt was severely damaged due to the high daily volumes of about 125,000 vehicles in each direction, of which 15 per cent comprise heavy goods vehicles.

## Cold recycling in-situ

Ecopistas and Fremix Engenharia e Comércio Ltda., the company contracted to rehabilitate the road surface, decided to use the technology that would deliver the best results in the fastest construction time: recycled material with foamed bitumen, produced in Wirtgen's mobile cold recycling mixing plant KMA 220.

When selecting the optimum rehabilitation method, the contractors also needed to meet one strict condition: on working days, construction on the vital transport route was restricted to an eight-hour window from 9 p.m. to 5 a.m., since even minor closures for road works could cause major traffic hold-ups.

The tight timeframe meant that a thick asphalt pavement was out of the question. While the thicker asphalt layers produced in conventional rehabilitation processes need to cool for about four days, Wirtgen's cold recycling technology allowed the pavement to be repaired section by section before being immediately reopened to traffic.

"During the daytime, no lanes can be closed between the São Paulo city limits and the airport, due to the high volume of traffic," said Elio Cepollina Junior, Commercial Manager at Fremix.

**With a maximum milling depth of 320 mm, the Wirtgen cold milling machine W 1900 can remove entire pavements comprising the surface, binder and base in a single pass, saving time and ensuring high productivity.**

"That's why the work was carried out at night during the week or at weekends."

Further advantages of using this process include rapid completion of the works, a minimal number of transport journeys and the complete recycling of the reclaimed material. This adds up to a cost-effective and eco-friendly process.

## Cold milling machines and jaw crushers clear way

The approximately 10-centimetre asphalt surface course and the underlying 25-centimetre cement stabilisation layer, both requiring rehabilitation, were milled out separately and loaded into trucks.

For this task, Fremix used two of Wirtgen's large milling machines, the W 1900 and the W 200.

The reclaimed material was transported to a mixing location set up near the site where it was crushed using a Kleemann MC 110 Z EVO track-mounted jaw crusher to ensure the grain size did not exceed 20 millimetres and the material had an optimal granulometric composition.

The mobile crusher can be used for a variety of applications, including the preparation of both natural stone and asphalt, and materials that have been quarried or mined.

**The high performance Wirtgen cold recycling mixing plant KMA 220 has an impressive mixing capacity of up to 220 t/h when producing high-quality cold mix from recycled construction materials.**

Using two Wirtgen mobile cold recycling mixing plants KMA 220, the reclaimed material was then recycled into a top quality mix with foamed bitumen (BSM).

The KMA 220 is easy to transport and can be quickly set up on site. The two plants were installed next to the motorway, greatly reducing the number of material transfers.

Juliano Gewehr, Product Specialist at Ciber Equipamentos Rodoviários, said: "The cold recycling mixing plant allows us to re-use the reclaimed material.

"We optimise it by adding binders and supplementary materials to deliver a pavement with a very long service life and optimum material properties."


The SUPER 1300-3i road paver by Vögele is extremely compact and yet has a high laydown rate and pave width of up to 5 m.

## Precision metering of binders

Loudon International and its engineers were in charge of the mix design and quality monitoring. Working with the technicians from JBA Engineering and Consulting Ltda., they provided support for the preliminary investigations and project execution.

Using the results of preliminary tests carried out in the Wirtgen laboratory, the quality of the foamed bitumen and the optimum composition of the mix could be identified before construction work commenced. The formula finally selected comprised one per cent hydrated lime and two per cent bitumen.

The hot bitumen is foamed in the expansion chamber of the KMA 220 by adding air and water. This produces foamed bitumen which is 20 times the volume of the original product.

The foamed bitumen is combined with the hydrated lime and the reclaimed material to produce a homogeneous mix. The recycled, reclaimed material was paved in two layers.

A 20 centimetre-thick first layer was compacted by a 14-t Hamm 3414 compactor and a 9-t Hamm HD 90 tandem roller, and then the HD 90 completed the compaction of a 13 centimetre-thick second layer on its own. The Vögele SUPER 1300-3 tracked paver was used to apply an unusually thin two-centimetre surface course. A Hamm GRW 280 rubber wheeled roller took care of the final compaction of the asphalt mix.

Cold recycling technology has a reputation for excellence worldwide and Valmir Bonfim, Technical Manager at Fremix, said he could now see further potential for cold recycling in Brazil.

"There is no doubt that this project will set a precedent for future road works in Brazil."

Ten different Wirtgen Group machines were involved in the SP-070 project – they were selected by Mr Bonfim.

"On a construction site of this size, where the rehabilitation of the various sections has to be completed within one day, we couldn't afford to take any risks.

"That's why we decided to use Wirtgen Group's reliable machines and its state-of-the-art technologies and application processes."

Alvaro Rodrigo Pinheiro, Engineering Manager at Ecopistas, the concessionaire, said the cold recycling technology was an excellent solution for the structural repair of the Brazilian road network. Based on the excellent results obtained, Ecopistas is planning to make further investments in this technology in the coming years.

"There is no doubt that this project will set a precedent for future road works in Brazil."

# F-SERIES PAVER EXPERIENCE

**Performance improvements and technology with a customer-friendly interface are key benefits of the new F-Series Pavers from Cat® Paving Products.**

## FUEL CONSUMPTION

Several features help improve fuel economy while maintaining high performance levels.

Engine performance is aided by the 167 kW (225 hp) Cat C7.1 ACERT™ engine, which meets European Stage IV and U.S. EPA Tier 4 Final emissions regulations without sacrificing power.

On some F-Series models, a Cat C7.1 engine is also available that meets emissions equivalent to US EPA Tier 3 and E.U. Stage IIIA. It provides power of 186 kW (249 hp).

Eco-mode is standard on F-Series pavers. When used with automatic engine speed control, Eco-mode efficiently manages engine RPMs to optimise fuel economy, reduce sound levels and keep the paver running cool. The control automatically adjusts RPMs when the engine reaches a high load threshold or needs additional cooling.

## SCREED HEATING SYSTEM

An integrated generator, the power behind a new screed heating system, is another fuel-saving enhancement. Exclusive to Caterpillar, the F-Series generator was developed by the same team that designed and engineered the innovative Cat D7E Dozer.

The integrated generator is directly connected to the paver engine and operates as a core part of the machine. The SE60 Series screeds' refined heat distribution combine with the generator to bring the screed to the proper temperature in approximately 15 minutes, compared with the previous 30-45 minutes.

The F-Series pavers run at about 1,300 rpm while heating, compared with the more common 2,200 rpm of some competitive machines. The lower rpm requirement lessens sound levels and can lead to earlier start times in residential areas.

## TECHNOLOGY

Touch screen displays provide increased flexibility for operating and adjusting the machine while the colour display offers high visibility and more user-friendly options.

New feature controls are accessed through the touchscreen – the most frequently used functions are still controlled by switches.

The new single-switch auto-fill feeder system simplifies setup and helps provide consistency for operators of varied experience and skill levels.

The screed-heating system diagnostics enable uninterrupted paving in the event a screed temperature sensor fails. The system automatically compensates, allowing consistent, uninterrupted paving.

Ratio control for the conveyors can now be controlled from the screed. Likewise, the tractor operator can now adjust the mix height for increased flexibility. Previously only the tractor operator could control conveyor ratio.

A pendant control that enables the screed operator to stand alongside the machine is now available.

## OPERATOR CONSOLE

The operator console features enhanced functionality. Controls are as simple as contractors need and as flexible as they want. Crews who prefer limited options have an organised, efficient control system at their fingertips – and mostly in the same locations as on earlier models. Those who want to utilise more functions can do so by accessing various menus through the touchscreens.

Exclusive propel and feeder system settings transfer between stations with the touch of a single switch. Speed, as well as operation and travel modes, also is automatically adjusted at both stations.

Paver operators can make various screed adjustments without leaving their seats. Cat Grade Control now can be operated from the tractor consoles if desired.

## SIX FEATURES FOR YOUR CREW

1. **Quiet Generator**
   The screed can be heated in only 15 minutes at a quiet and fuel-efficient 1,300 rpm.
2. **2-Speed Screed Extenders (Variable Speed)**
   They offer improved responsiveness near obstacles and more precise control on machine applications.
3. **Single-Touch Auto-Fill Feeder System**
   The system simplifies setup and helps provide consistency for operators of varied experience and skill levels.
4. **Mat Quality**
   Easy setup optimises smoothness and density for improved quality.
5. **Airflow Design**
   The exclusive design pulls fresh air from the sides of the paver, cooling components for maximum durability. Discharge air is directed upward and forward through the top-mounted front radiator, keeping the crew cool and alert.
6. **Cat® Grade Control**
   The technology now can be operated from four locations: both tractor consoles and each side of the screed.

A single-button autofeeder system does the work of four switches. An auto-fill button alternates between running the augers and conveyors, helping operators build a proper head of material from the start.

A warm-up/cleanout mode runs the feeder system at a reduced speed, enabling the operator to perform wash-down duties. It also automatically lifts the auger for simplified transport.

If a crew doesn't want to utilise all controls and the associated technology, "lockouts" are provided on the screed to prevent accidental access.

### THE HOPPER

Two hopper designs include a standard-entry height and a low-entry height. The length of both hoppers has increased by 90 mm (3.5 in.) over the previous model, providing more clearance for tailgates on haul trucks.

The standard-entry design features an inclined flat floor plate and large tie-down loops on the sidewalls, making it ideal for use with hopper inserts.

The design includes a narrowed entry width of 3,224 mm (10 ft. 7 in.) for improved visibility in narrow paving applications.

The low-entry design accommodates a wider range of truck heights. It reduces the entry height by 33 mm (1.3 in.) and maintains the lower height for 529 mm (21 in.). The hopper is 3,490 mm (11 ft. 6 in.) wide and features improvements that reduce spillage.

### MOBIL-TRAC™ UNDERCARRIAGE

The F-Series pavers feature innovative undercarriages. Fully-bogied support rollers maintain contact with the surface regardless of irregularities. The oscillating bogies minimise deviations and tow-point movement, leading to smoother mats.

The Mobil-Trac System (MTS) features oscillating bogies and a rubber belt instead of the standard steel track. The rubber belt is friction-driven and is available with treaded or smooth tracks. MTS enables travel speeds that match the pace of wheeled pavers. The system essentially combines the traction of track pavers with the speed and mobility of wheeled pavers. Enhanced manoeuverability is another key benefit.

### WHEELED UNDERCARRIAGE

Wheeled F-Series pavers offer six-wheel drive as an option. Six-wheel drive utilises enhanced hydraulics to optimise traction and provide 200 per cent more front pull force over previous models. A front wheel assist or four-wheel drive option increases front-wheel pull-force by 50 per cent over previous models.

A new radial tyre offers increased traction. When testing on compacted gravel base and asphalt, the tyre provided 20 per cent more pull force over existing radial sand-rib tyres.

### OPTIONS

Three screed options are available: SE60 V, SE60 V XW and the SE60 VT XW. The XW models share common frame structures, with the V XW providing vibratory only and VT XW offering vibratory and tamper bars.

Screed plate life is extended with the utilisation of abrasion-resistant steel that is proprietary to Caterpillar. The same steel is used in motor grader cutting edges as well as the AS3301C, AS3251C and AS4252C screeds.

Screed extensions are equipped with exclusive two-speed proportional control for enhanced responsiveness near obstacles and more precise control on highway applications. A pendant control adjusts the height of optional hydraulic end-gates, as well as extender width and tow-point height. The control provides the screed operator with much more flexibility regarding their location.

The addition of a machined screed frame eases installation of the screed plates, which bolt flat to the frame. The SE60 V screed delivers excellent ride and mat qualities, while providing versatility in urban areas, thanks to its smaller footprint and lighter weight. This screed replaces the current AS3301C vibratory screed.

The SE60 XW-Series screeds deliver extremely tight mat textures, with higher densities. The XW-Series also features full hydraulic control of crown, extension slope and extension height at the full width of 10 m (33'). This is important in wide-width paving applications to ensure optimal mat texture and density.

### EASE OF MAINTENANCE

Much of the F-Series engineering has focused on reducing owning and operating costs.

The integrated generator is designed for the life of the paver. Screed plates, conveyor chain guards and conveyor floor plates are easier to change, helping reduce labour costs.

The exclusive Cat screed heating system monitors heating elements for failure conditions and enables the system to continue heating in the event of an element failure.

An F-Series paver was on display at the 16th annual Australian Asphalt Pavement Association (AAPA) International Pavement Conference, held September 13-16 on the Gold Coast.

Attendees had the opportunity to see features of the new paver. Experts from Caterpillar Paving were available to answer any questions about the machine's features.

## NEW CONSOLE FEATURES

- User-friendly, raised buttons help operators more quickly identify functions.
- The console is highly water resistant and built for demanding environments.
- If repairs are required, separate sections of the console can be replaced for a cost-effective solution versus other designs.

# Downer and City of Boroondara lead way in renewable asphalt trial

Downer EDI Limited (Downer) and the City Boroondara in Melbourne's inner east will monitor, on a regular basis, a trial section of road comprising a world-first 99 per cent renewable asphalt.

The renewable asphalt demonstration was undertaken on a 30-metre stretch of access road in Macleay Park in suburban Balwyn North.

Bruce Dobson, Director Environment and Infrastructure with the City of Boroondara, said Downer EDI approached council asking for a site where it might be able to trial the 99 per cent renewable asphalt.

Downer is one of council's annual supply contractors for asphalt.

"We supported the idea of a trial, and decided the most appropriate location would be the stretch of access road in Macleay Park," Mr Dobson said.

The work was carried out on 5 June, which was World Environment Day.

"It took around three hours to complete and the recycled asphalt was made from reclaimed asphalt pavement, recycled toner cartridge, recycled glass, recycled waste oil and recycled tyre rubber, with only one per cent of crude oil-derived bitumen," Mr Dobson said.

Downer EDI said the waste items used in the asphalt would typically be stockpiled or sent to landfill.

Downer's Executive General Manager Road Services, Dante Cremasco, said that current best practice in Australia was for asphalt to include 30 to 40 per cent renewable materials with some limited facilities achieving higher production levels.

"This demonstration, in partnership with the City of Boroondara, proves that with the right technology and capability we can produce 99 per cent high quality renewable asphalt," Mr Cremasco said.

"Improved recycled material availability and process improvements for large scale production means that we can work with progressive and environmentally conscious suppliers and customers to achieve world's best practice."

Downer has consulted extensively with recycling companies such as Close the Loop to tailor the recycled asphalt to suit a road construction application.

The team also worked closely with Ammann, a world-leading supplier of mixing plants to design the latest HRT Series (High Recycling Technology) asphalt plant at Bayswater to allow high levels of diverse recycled materials to be incorporated.

"Our relationship with Downer is one of partnership where we work together to further improve the way we design and manufacture our plants to continuously deliver more effective, efficient and sustainable products," said Paul Vandersluis, Managing Director, Ammann Australia.

"This close relationship has enabled us to continually set industry benchmarks."

Boroondara's Councillor, Judith Voce, said the city was proud to partner with Downer on such an important undertaking.

"It is exciting to be involved in such an innovative project, which offers great sustainability outcomes for our city and fantastic possibilities beyond Boroondara," Cr Voce said.

"By showcasing this initiative on World Environment Day, it gives council and Downer an opportunity to raise global awareness and highlight projects that are having a positive environmental impact.

"In partnership with Downer, we are leading the charge in setting a new benchmark in sustainable asphalt."

Ten thousand tonnes of 99 per cent renewable asphalt, a typical annual volume used by a Victorian council, could include:

- 24.7 kilometres of re-used asphalt;
- 7.5 million recycled glass bottles;
- 1,250 used car tyres saved from landfills; and
- 425,000 recycled printing cartridges.

These components not only contribute to lower CO2-e emissions, the recycled materials and innovative product mix and design increases the fatigue life of the asphalt.

This improves the durability and resistance to fatigue cracking.

The 99 per cent recycled asphalt has also achieved:

- a 30 per cent improvement in deformation resistance, increasing product ability to resist damage from heavy traffic; and
- a 16 per cent improvement in stiffness, improving bearing capacity to carry heavy traffic, providing the ability to lay a thinner surface, even further lowering CO2-e emissions.

# Stormwater Report


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# Update on Brown Hill Keswick Creek Stormwater Project

Adelaide's Brown Hill Keswick Creek Stormwater Project has released the results of a six-week community consultation process regarding proposed flood mitigation works for upper Brown Hill Creek (Part B works).

As reported in the previous issue of Highway Engineering Australia, the community consultation process ran from May 13 to June 23 and attracted 818 public respondents, with 85 per cent of them indicating support for the project's preferred Option D.

Option D includes upgrading the capacity of upper Brown Hill Creek at critical sections. Among respondents who own creek properties likely to be impacted, support for Option D was evenly divided.

The consultation process was undertaken by an independent consultant team engaged by the BHKC Stormwater Project on behalf of the five catchment councils – Adelaide, Burnside, Mitcham, Unley and West Torrens.

It was designed to inform key stakeholders and the community about:

- the outcomes of investigations on the eight potential options for Part B works;
- the identification of, and reasons for, the identification of a preferred option – Option D;
- how they could provide feedback on options for Part B works;
- seeking feedback from key stakeholders and interested members of the public regarding:
  - how important they consider it is to undertake flood mitigation works in the Brown Hill Creek catchment;
  - their level of support for Option D in comparison with other options;
  - seek additional feedback from owners of properties traversed by upper Brown Hill Creek regarding their specific concerns and opportunities relating to proposed rehabilitation and creek capacity upgrade works (under Options D, B1 or B2); and
  - report on the outcomes of the engagement to assist councils in making a final decision regarding Part B works.

Respondents were asked to rate from '1: not important' to '5: very important', how important it was to them that flood mitigation works were undertaken to reduce the impact of major flooding in the creek catchment.

Responses from creek property owners and owners/occupiers in the catchment councils indicated a moderate level of importance (62% for a combined rating of 4 and 5), with a slightly lower level of importance for members of the wider community (60% for a combined rating of 4 and 5).

The Part B Report outlines eight flood mitigation options for upper Brown Hill Creek, of which Option D – Creek Capacity Upgrade – is identified as the preferred option.

Option D involves upgrading the capacity of the upper Brown Hill Creek at critical sections – including an estimated 66 private properties – as well as creek rehabilitation works along the full length of the creek.

The five catchment councils will now determine their respective positions on proposed flood mitigation works for upper Brown Hill Creek.

Based on their decisions, a final recommendation on Part B works regarding upper Brown Hill Creek will be made by the project, by about October, to the South Australian Government's Stormwater Management Authority.

# WA Shire completes water harvesting upgrade

The Shire of Wyalkatchem in Western Australia's Wheatbelt region completed a stormwater harvesting project just in time to make the most of good rains in June.

The shire received a grant in the 2014 Department of Water's Community Water Supply Program (CWSP) of $50,350 to significantly build on its level of water efficiency.

The grant was used to refurbish the stormwater catchment area for the local 16,000 kilolitres capacity dam and the installation of new 100kL and 175kL tanks in the town.

State Water Minister, Mia Davies, said a 25 per cent decrease in the average rainfall in the past 10 years had highlighted the shire's need to develop strategies to establish non-potable water supplies.

The harvested water will provide an extra 14,000-16,000kL of non-potable water per year to irrigate the townscape, supply emergency farm water and to fight fires.

"There have been limited off-farm water supplies in the area until now and this water harvesting project will make the most of any rainfall flow for that purpose," Minister Davies said.

"The harvested water is expected to now be piped into town and be distributed between existing dams and new tanks to provide an important fit-for-purpose supply for townscape irrigation and the off-farm supplies.

The Shire of Wyalkatchem contributed $27,471 to complement the State Government funding for the project.

Since 1996, more than $4.7 million has been allocated to nearly 100 projects as part of the government's Community Water Supply Program.

Government grants are designed for dryland communities receiving less than 600mm average rainfall – average rainfall has reduced from 323mm annually since 1910 to 242mm in the past 10 years, a 25 per cent decrease.

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- **Cast Iron Boxes:**
  Water, gas, gas tight sealed, stop valve, hydrant and sub soil.
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- **Lifting tools / keys** (short and long handle)

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## Record funding for WA road safety

Record funding of $111 million has been allocated from the Road Trauma Trust Account to help reduce road trauma in Western Australia.

The money will be used for road safety initiatives which the State Government says have a proven record in reducing crashes.

Road Safety Minister, Liza Harvey, said $46 million would go towards road safety treatments to address run-off-road crashes including shoulder widening, audible line edging, wire rope barriers and overtaking lanes.

"Run-off-road crashes represent 33 per cent of people who are killed or seriously injured on WA roads. The figure is even higher in regional areas and represents 62 per cent of serious crashes in remote WA."

The Minister said $12 million would fund safety treatments at metropolitan intersections including modified traffic signals, roundabouts and speed management treatments, such as speed humps.

"Intersection crashes represent 33 per cent of people killed or seriously injured on WA roads. In 2013, 860 people were killed or seriously injured at Perth intersections."

Mrs Harvey said $5.5 million would be allocated to increase drug and alcohol testing of motorists.

"There is also an extra $1.56 million to support the government's alcohol interlock program aimed at serious drink drivers."

More than $15 million has been allocated for road safety education programs and campaigns, research and analysis as well as road safety policy and co-ordination.

The Minister said the government would remain relentless in further reducing road trauma through safer roads, enforcement and education.

Every dollar in fines from speed and red light cameras goes into the Road Trauma Trust Account

## Developing 10-year road safety strategy

A 10-year road safety strategy with the long-term vision of zero deaths or serious injuries has been launched by the Tasmanian Government.

Rene Hidding, State Minister for Infrastructure, said on 15 July that the government's target was ambitious, but was the only acceptable number of deaths or serious injuries on the roads.

Mr Hidding said the current Road Safety Strategy 2007-16 was nearing the end of its life.

It had incorporated Road Safety Levy funding to support a range of initiatives including safer road projects across Tasmania, the Learner Driver Mentor Program, electronic speed limit signs in school zones, and the Australasian New Car Assessment Program.

The next 10-year strategy, Mr Hidding said, would continue to invest in these types of safe system projects, as well as looking for new and innovative measures to drive the road toll towards zero.

"While progress has been made under the current strategy, the sad reality is that 3,287 people have been killed or seriously injured over the last 10 years.

"This figure illustrates how road trauma touches a great many Tasmanians and why it is so important that we all take responsibility for road safety," Minister Hidding said.

"We are starting the development of the next 10-year strategy right now and we want to hear from both stakeholders and the wider community.

"The extensive consultation will be conducted over two stages, with a public discussion paper expected to be released next year."

## Improved safety for Gold Coast Highway

Work is underway to enhance safety on the Gold Coast Highway at Palm Beach – the $445,000 project will make the southern section of the highway safer for motorists and pedestrians.

Additional median lighting is being installed from south of the Thrower Drive intersection at the Palm Beach Parklands to Currumbin Creek bridge.

This work is expected to take about two months to complete, depending on rainfall.

It follows the completion in May of a 240-metre median pedestrian fence, north of the intersection of Thrower Drive near Palm Beach Parklands.

## Safety improvements complete on Moss Vale Road

Completion of the $5.3 million Gilmore Safety Package in New South Wales is a step closer with safety works complete on Moss Vale Road at Barrengarry and Cambewarra Mountains.

The Gilmore Safety Package is delivering road safety upgrades to the south coast of New South Wales.

The Moss Vale Road component involved widening the road to allow heavy vehicles to pull over and let other vehicles pass. The upgrade will improve commute times for many residents, with locals beginning to see a vastly improved road network.

Moss Vale Road provides an important link between Nowra and Bowral, while also linking the Princes Highway with the Hume Highway.

The work aims to provide a safer route for motorists, particularly those travelling to the historic village of Kangaroo Valley and to the Southern Highlands towns of Bowral, Moss Vale and Mittagong for work.

Upgrades are also being progressed on Turpentine Road, which will enhance the road's capacity and improve safety for road users.

The Federal Government fully funded the $690,000 Moss Vale Road upgrade and is contributing $5 million towards the upgrade package.

Road crashes cost the national economy an estimated $27 billion per year.

## Chain of Responsibility Reforms

The National Transport Commission (NTC) is assessing stakeholder responses to a discussion paper dealing with chain of responsibility law reform for Australia's transport industry.

The discussion paper was released on 8 July and detailed the proposed specific requirements of participants in the supply chain.

The release followed in-principle support being given by Australia's transport ministers to reforms to chain of responsibility laws to provide a more outcomes-based approach focused on primary duties.

Ministers also agreed to better align chain of responsibility requirements with Australian workplace health and safety laws to reduce duplication and inconsistencies for industry.

NTC Chief Executive, Paul Retter, said the proposed reform would allow operators to work out the best approach for their company.

"This reform will provide an opportunity to consolidate or remove more prescriptive obligations in the law, helping industry remain compliant while potentially reducing costs."

Consultation over the past three years with industry, governments and regulators included a taskforce established in 2012, an options paper in 2013 and a high level discussion paper in late 2014 which resulted in the framework receiving in-principle support from ministers.

The NTC's Discussion Paper Primary Duties for Chain of Responsibility Parties and Executive Officer Liability provided draft proposals and canvassed options for:

- how a primary duty on operators, prime contractors and employers could be structured to ensure the safety of their transport operations;
- how role specific duties of other parties could be structured;
- the standard of care to be applied;
- the relationship of primary duties to existing chain of responsibility offences;
- penalties; and
- how the reforms could be applied to executive officers of corporations.

Mr Ritter said feedback from stakeholder submissions would inform a policy position paper to be considered by ministers this November.

## Centenary Highway safety enhancement

Motorists travelling from Brisbane's western suburbs to the city will soon have a safer journey.

Work is underway on the $2 million Centenary Highway on-ramp upgrade to remedy a crash hotspot at the highway's inbound on-ramp, near the Mt Ommaney Shopping Centre.

Main Roads and Road Safety Minister, Mark Bailey, said there had been several collisions near the merge of the inbound on-ramp at the Mt Ommaney interchange from Dandenong Road.

"Better acceleration and merge lanes for motorists entering the highway via the on-ramp will enhance safety, along with lighting improvements.

"Thousands of motorists will benefit from these works, whether they are travelling to work, picking up the kids from school or ducking into the shops."

The project is expected to be completed in late 2015, weather and construction conditions permitting.

Minor delays are expected during works, with temporary lane closures at night, reduced speed limits, traffic control and lighting towers.

## Reducing 'black spots' in Victoria

Funding of $39.1 million has been allocated by the Federal Government for 138 Black Spot projects across Victoria.

The funding is part of the government's record commitment of $500 million to the Black Spot Program in the 2014 Budget which includes an additional $200 million to fast-track investment in world class infrastructure across the country.

As a result of the additional investments, an extra 84 projects will be funded in Victoria over 2015–16.

These extra projects are expected to save an additional 10 lives and prevent 512 injury crashes over 10 years, and deliver economic dividends of around $169 million.

The Victorian panel which reviews priorities for the program includes representatives of the Royal Automobile Club of Victoria, Victorian Transport Association, Victoria Police and state and local government.

The government broadened the eligibility criteria for project applications in 2015-16 and 2016-17 to ensure local communities have greater access to the $200 million in additional funding for road safety upgrades.

# STAFF IMPROVEMENT AND PRODUCT DEVELOPMENT KEY TO INGAL SUCCESS

A Sydney company that is expanding its reach in the road safety industry based on a philosophy of ongoing staff improvement and new product development is securing overseas markets in addition to its operations in Australia and New Zealand.

Ingal Civil Products is headquartered at Minto – about 50 kilometres south west of Sydney – where it develops and manufactures road safety barriers, car park and industrial barriers, work zone and traffic control products and delineation and guide posts.

"The fundamental philosophy that underpins everything we do is continuous improvement, both around developing our people and providing increased value to customers through new product development," said John Dignam, Ingal's Managing Director.

Mr Dignam said Ingal principally serviced the permanent road barrier market in Australia and New Zealand, and was increasingly exporting its technology, particularly the Ezy-Guard Smart Guardrail system.

"We've licensed our technology into Mexico and Malaysia where we have a subsidiary, and we're exploring prospects in the Middle East.

"They're developing markets where the populations are starting to demand better performance in terms of the hardware on their highways, as well as increased emphasis on road safety."

Mr Dignam said the Ezy-Guard Smart guardrail crash barriers were approved for use by all road authorities in Australia and New Zealand.

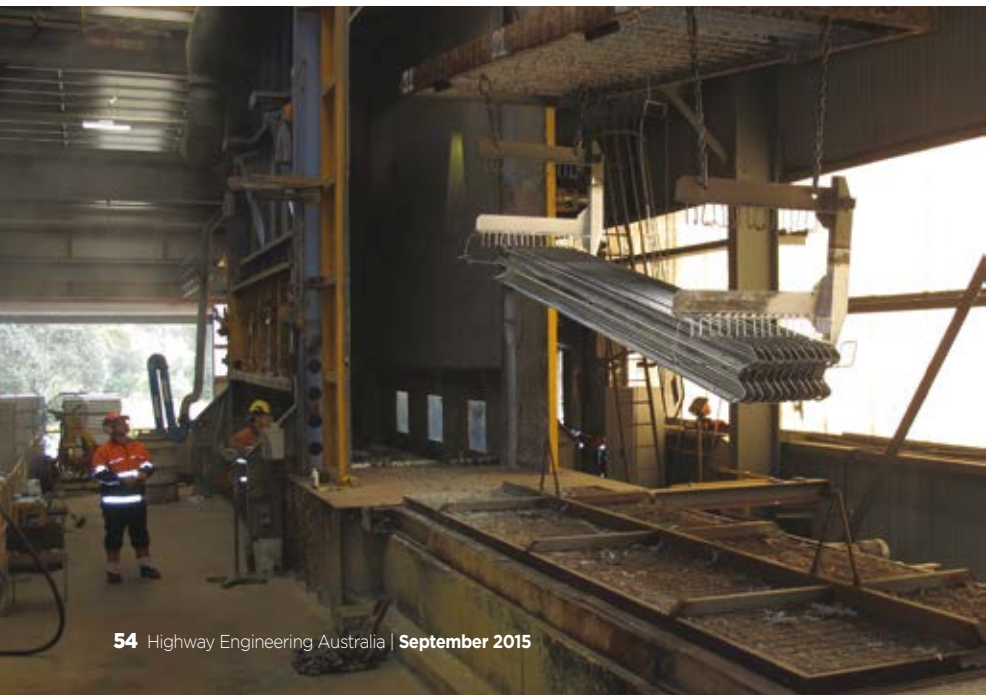
He said the system had been fully crash tested and evaluated according to the specifications laid down by the US standard – the MASH Test Level 3. The standard provides for the containment of a 2,270 kilogram vehicle impacting the barrier at 100 kilometres-an-hour at an angle of 25 degrees.

"At the moment, it's Australia's only guardrail product to meet the MASH standard accepted for use in all states. Ezy-Guard has also been approved by the US Highway Administration and that approval is recognised in many other countries such as in Mexico, the Middle East and parts of South America.

"It's a product that performs at a higher level than comparable traditional guardrail systems currently used in Australia; from a use of steel perspective, it uses less steel and is more cost effective in terms of installation.

"The guardrail has patented components that allow the rail to 'capture the vehicle' and redirect it safely onto the road.

As the crash barrier redirects the vehicle, the energy of the impact is dissipated which, as a result, reduces the risk of injury to the occupant .



"The standards we test product to are designed to ensure products can work in run-off-road accidents such as where a motorist falls asleep and there is no driver intervention before the vehicle hits the barrier.

"It's designed for a 'last resort scenario' to prevent the vehicle from impacting whatever object the barrier is shielding.

"The barrier allows the vehicle to avoid whatever object the guardrail is shielding such as a culvert, a steep drop, the side of a bridge or a tree," Mr Dignam said.

Mr Dignam said Ezy-Guard had been used in key road projects around Australia.


"It's been incorporated in multiple upgrades on the Pacific Highway as part of the highway duplication, on the M5 widening in Sydney, the Western Highway upgrade in regional Victoria, and the Southern Expressway Duplication in Adelaide.

Mr Dignam said Ingal's ongoing focus on product would be around the efficient use of materials, and bringing product to market that performed at a higher standard.

"Vehicles are generally getting heavier and their centre of gravity is becoming higher.

"As the vehicle fleet changes, there's a requirement for us to assess those altered conditions and respond to them."

Mr Dignam said Ingal drew on some experience from overseas in developing product. However barriers like Ezy-Guard were developed within the business. "We actively seek feedback from our customers and this is an important ingredient in our product development process.

"Our products must be independently tested – crash tested – and we do draw on the experience and expertise of the testing organisations.

"They provide us with feedback on potential improvements during the development process, but at the end of the day we maintain control of the process ourselves."

Mr Dignam said staff training and a positive work culture was a priority with Ingal because the training was a benefit to employees at a personal level and an engaged workforce resulted in a better functioning business.

He said the company was proud to have been selected by TAFE Western Sydney Institute as the 2015 Apprentice Employer of the Year.

The award was for the organisation which provided the best apprentice/ trainee program incorporating TAFE NSW - Western Sydney Institute.

"In 2014 we entered into a traineeship arrangement with TAFE Western Sydney with the aim of improving safety and efficiency for our main manufacturing facility at Minto where we employ almost 100 people," Mr Dignam said.

"Nineteen of our people achieved nationally recognised qualifications in Competitive Systems and Practices. This resulted in decreased waste and improved production, and developed a culture of continuous improvement throughout the business."

Mr Dignam said the training had been of real benefit to Ingal's operations people and its customers through improved service.

"It's given our people an ability to be able to problem solve at the machine level – that's good for the company as well as the individual.

"In addition, some of our staff who undertook training last year are now pursuing higher qualifications and we're supporting them with a view to developing future leaders."

**SMART CUSHION**
Speed Dependent Crash Attenuators

# STACKING UP THE SAVINGS

## SMART CUSHION proves it delivers value in more ways the one following initial impacts in Australia and New Zealand

**While in these days of tight budgetary constraints and ever-increasing demands to 'do more with less' it may be tempting to opt for a product or solution with a lower initial cost, when it comes to road safety barriers, 'whole-of-life' cost benefit analysis is a critical consideration. Simply, low initial cost does not always equate to getting a good return on the investment.**

**This is particularly true for impact protection systems, which, by their very nature, are extremely likely to require repairs and/or replacement parts following a vehicular impact.**

**Put simply, what may appear at the outset to be a 'better value' solution can, in fact, end up being an extremely expensive selection, with repair costs quickly adding up to multiples of the initial purchase price.**

**If every impact results in a majority or even total replacement of the unit, perceived savings can soon disappear – and the costs will continue to escalate... year after year!**

In recent weeks SMART CUSHION crash cushions have been deployed in major motorway projects in both Sydney and Auckland with a total of 30 units installed since June 2015. At the time of writing this article there have been a total of nine impacts (5 in Auckland and 4 in Sydney) and the savings in spare part replacements alone to repair and/or reset the SMART CUSHION units compared to all other crash cushions on the market is estimated to be tens of thousands of dollars.

Then there are the labour cost savings and the reduction in risk to crew at the worksite. Indeed, despite the different angles of impact and varying degrees of severity, all of the nine repairs were completed in an average time less than an hour. What's more, 8 of the 9 repairs only required the replacement of two 1/4" shear bolts – resulting in a total spare parts cost of less than $5 per unit reset. The ninth impact also required the replacement of the end delineation panel with a replacement cost of less than $150.

The arrival of the SMART CUSHION crash cushion on North American markets in 2005 has had a profound influence on what both contractors and departments of transport (DOTs) regard as good value in crash cushion selection.

However SMART CUSHION delivers value in more ways than incredibly low cost of spare parts... and there are more happy stakeholders than just contractors.

SMART CUSHION is manufactured by Work Area Protection (WAP) in Illinois. Fifteen years ago an innovation group within WAP were assigned to design a crash cushion that delivers greater safety and better value. They were required to present a unique solution. The result is not only unique and writ in simplicity, from an engineering perspective, it is an elegant solution that could also almost be considered a thing of mathematical beauty - enabling full and accurate expression of the laws of physics and hydraulics.

Simple components, complex responsive interactions of forces, efficient use of materials and, above all, engineered safety regardless of the operation: installation, use, repair, removal, reinstatement or maintenance. A product of extraordinary value.

WAP Sales Manager Jeff Smith said that in the US market, momentum took a few years: *"...they needed the field experience. The contractors were so conditioned to buying spare parts to restore the crash cushions, any cushions, that they did not understand it was a needless expense and a waste of precious time. But they soon learnt. Well, the smart ones have learnt."*

## Delivering Value in Road Safety

So in the US what is considered good value? What does "value" look like? This question has exercised the minds of many State DOTs in the USA in the last half dozen years when the statistics were making it more evident day by day, month by month, that when life-cycle costing is considered, SMART CUSHION was the smart selection for high impact low maintenance areas. In fact it was becoming a no-brainer – if SMART CUSHION was first choice then daylight was second.

So in recent years in the US the Federal Highways (FHWA) and some DOT groups have been conducting surveys and webinars to discuss and to assess the available technologies. Most of the these are available in the public domain through FHWA, AASHTO and academic websites like the University of Nebraska's.

The following comments of three DOTs are the AASHTO *"Highways for Life"* webinar on *"Severe Duty Crash Cushions"* in January 2013.

A Kansas DOT Engineer stated that a severe duty crash cushion has the following characteristics:

1. Devices that exhibit acceptable crash performance.
2. Devise that have reliable/consistent repair characteristics
3. Devices that are uncomplicated to repair and provide safe operation after repair
4. Devices that provide acceptable life cycle costs

The Engineer then noted that with respect to products that are uncomplicated to inspect and make repairs, that *"...all steel products such as the SMART CUSHION are easy to inspect in the field."* Further, that there is a need to select cushions that expedite maintenance and reduce exposure to motorists.

## BIG SAVINGS WITH SMART CUSHION

In an earlier submission (for the California DOT nomination to the AASHTO Technology Implementation Group on 9 September 2011) Caltrans gave the following statistics based in their 5 year experience from November 2006 to August 2011 (when there were approximately 140 units installed on California roads):

- ✔ Estimated saving on frontal impacts is $2.7M. Additional side impact savings are estimated at $1.4M+.
- ✔ An estimated 370 crew dispatches were not required because of no damage on side impacts.
- ✔ For estimated repairs, there are savings on frontal impacts and side impacts when compared to alternate attenuators.
- ✔ Savings can be significant due to the low cost of repair parts (approximately $40), decreased repair time (usually under 30 minutes) and reduced worker exposure.
- ✔ It is possible to repair the attenuator during incident management thereby eliminating a future site visit and lane closure.

At the time of writing this article, there are currently more than 300 SMART CUSHION SCI100 units in use in California.

One of 27 SCI100 SMART CUSHION units installed along one of Sydney's motorways.

The Nevada DOT Engineer stated that:

1. The DOT's main consideration is getting crews in and out as quickly and as safely as possible when resetting or repair a system; and
2. to select the type of system to be installed the main factors are survivability and lifetime costs, with life-cycle costs the key consideration.

This speaker then noted that only SMART CUSHION attenuators are used in the Las Vegas region and explained why SMART CUSHION is the predominant crash cushion in Las Vegas:

1. We need a system made from components that can survive the harsh environmental conditions in Las Vegas;
2. Use of one system reduces confusion;
3. Use of one system simplifies training;
4. Ease of repair;
5. The tool kit is in supervisors trucks;
6. Ability to repair or reset during initial accident call;
7. Reduced system down time;
8. Minimal out of service to the travelling public equals a safer highway system;
9. 15-30 minute repair or reset time reduces the exposure of the people working on the system to hazardous high speed traffic;
10. Lifetime costs - especially in locations with high hit counts.

Finally the Engineer concludes that the SMART CUSHION system has proven to be an extremely safe and easy to work on and relatively inexpensive system to reset.

## REPLACEMENT PARTS

When it comes to spare/replacement part costs after an impact, the SMART CUSHION is truly in a league of its own.

Due to the strength and durability of the side panels, the SMART CUSHION crash attenuator requires only a minimal inventory of spare parts, with the most commonly replaced parts being the two 1/4" shear bolts, with a total cost of less than $5. Side impacts and reverse angle impacts within NCHRP 350 specifications should also not damage the attenuator.





Pictured above:
Impact # 1: SMART CUSHION sled displaced less than 1.5 metres;
Impact # 2. SMART CUSHION sled displaced less than 0.5 metres.
Impact # 3. SMART CUSHION system fully compressed with displacement of 5.1 metres;
Impact # 4. SMART CUSHION displaced approximately 1.2 metres.

*"Our goal is to reset the damaged SMART CUSHION prior to the accident being cleaned up. This is accomplished 90% of the time if crews are on duty and if we are notified (of the accident)."*

*"We average at least three resets or repairs a week in Las Vegas. SMART CUSHION units can be reset numerous times with proper inspections and maintenance. We have SMART CUSHIONs that have been reset 20 times without any major repairs before they show signs of needing to be replaced." "In the last 5 years we have installed 80 SMART CUSHION SCI100 systems to replace older type systems."*

The Californian DOT Engineer said Caltrans suggested criteria for low maintenance and or self restoring units is based on:

1. History or expectation of multiple impacts per year;
2. Systems that recover or can be easily pulled/reset to their original shape, position and capabilities after being impacted with minimal need for additional parts;
3. Sites that require short repair time limitations or are difficult to assess; and
4. Repair costs parameters and thresholds for repair time may be considered.

The Caltrans Engineer then makes the following comments about SMART CUSHION:

1. Caltrans repair time experience is 15-30 minutes
2. Caltrans has 232+ units install state wide
3. Average cost for parts is less than $50
4. Average repair cost per impact for high impact locations is less than $100
5. Length of system advantageous in short gore areas.

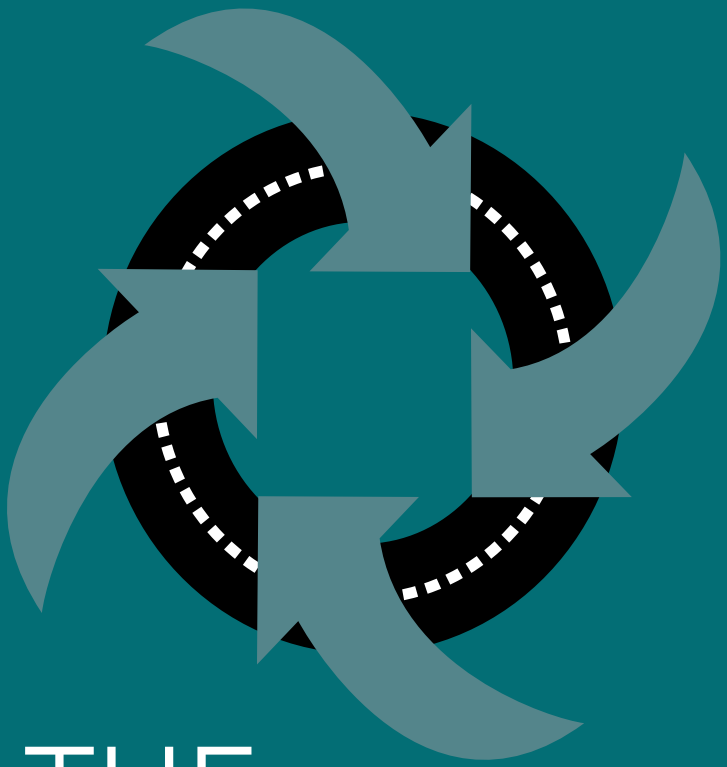
On 15 June 2015, the Virginia DOT issued the following specification for state funded roads (that is, projects with no federal funding). The specification directed that only SMART CUSHION attenuators be used.

✔ **Impact Attenuator:** *"This work shall consist of replacing damaged impact attenuators by furnishing and installing impact attenuators as directed by the Engineer. Replacement impact attenuators shall be SMART CUSHION Products Model SCI70GM or SCI100GM."*

The SMART CUSHION story in the US is bigger than just these four states. It can be seen that not all DOTs have exactly the same value propositions, however all these expressions of value involve noting the key elements of safety and life-cycle costs.

Based on the results of the initial nine impacts in Australia and New Zealand, SMART CUSHION is once again highlighting its value, and the importance of life-cycle costs to road authorities, contractor and councils alike.

For further information on the SMART CUSHION crash attenuator, please visit the website: **www.smartcushion.com.au** or contact LB Australia Pty Ltd, Ph: (02) 9631 8833 or Email: roadsafety@lbaustralia.com.au



# THE *Aust* Stab UPDATE

AustStab released a new strategic plan and announced its new Executive make-up at its 20th Annual General Meeting and Gala Dinner in July. The AGM was held at the Yarra Valley Lodge, Chirnside in Melbourne, from 27-29 July. AustStab's new President is David Berg, CEO Stabilised Pavement of Australia, and the new Vice-President is Stewart Geeves, Civil Engineer with Andrew Walter Constructions.The event was also the stage for the release of the winners of the highly regarded AustStab Awards of Excellence. The AustStab Update in this issue of *Highway Engineering Australia* features articles on the new executive and some of the key winners in the Awards of Excellence.

# AUSTSTAB EXECUTIVE COUNCIL 2015

At AustStab's annual conference and AGM in July, the new AustStab Executive was elected.

The new President is David Berg, CEO Stabilised Pavement of Australia, who has had a long term association with AustStab and has been an active member of Council since 2013.

David comes to the role with the support of his peer group. He sees education of the industry as one of the key challenges that is before AustStab, and has recognised this importance by supporting the inclusion of education as a key pillar to the AustStab Strategic Plan for 2015-2018.

Stewart Geeves, Civil Engineer with Andrew Walter Constructions (AWC), is the new Vice President. Stewart is a long term member of the AustStab Council, with 12 years' service.

AWC is one of AustStab's longest term contracting companies, and Stewart is able to provide insight on the industry from a niche section of the stabilisation market in Tasmania.

Heath Curnow, CEO with the Stabilime Group, has retired as President of AustStab, but will remain an active member of Council moving forward.

Leah Fisher will continue as CEO with AustStab and Greg White will stay-on as the Executive Officer, providing continued stability to the industry.

The AustStab Council endorsed a new strategic plan at the conference, building on the previous strategic plan.

The new pillars of the association will be to work in three key areas, as the technical centre of stabilisation expertise in Australia:

- Education - to continue to deliver work-leading education throughout metropolitan and regional Australia;
- Collaboration - to retain and build important working relationships with state road agencies, national road research organisations such as ARRB, working with tertiary institutions to educate and encourage research, as well as to continue to work with other associations such as AAPA, IPWEA and CCAA; and
- Narration - to continue to tell the stories of success and learnings through vehicles such as the *Awards of Excellence*, the AustStab website and publications such as *Highway Engineering Australia.*

**Pictured below:** The new AustStab Executive. Back row: David Berg, Greg White, Stewart Geeves, Warwick Dingle, Brad Brown, Mark Pilgrim, Allen Browne. Front row: Warren Smith, Heath Curnow, Leah Fisher, Brett Fulloon, David Scicluna

# Keep road projects moving with **Limil lime.**


Building a road is a big job. Which is why an increasing number of road construction projects are turning to Sibelco lime to stabilise soil and prevent unnecessary delays. And though we've changed our name from Unimin, we haven't changed the quality of lime you've come to expect from us. Whether it's Quicklime, Hydrated Lime or one of our many other limestone products you require, the Limil brand comes with 135 years of lime manufacturing expertise, the security of long-term supplies and a level of quality and consistency that our ISO9001:2008 Quality Program delivers.

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# CONTINUAL IMPROVEMENT PROGRAM

## Active Blind Spot Detection for ALL Mobile Plant

Stabilime was the winner of the AustStab Awards of Excellence 2015 category for Workplace Health and Safety for a unique active blind spot detection system that has been installed on all plant.

Stabilime operates in local, state and federal government jurisdictions – it works in pavement stabilisation and other civil works.

It operates in accordance with an integrated Management System which incorporates the international standards for safety AS/NZS 4801:2001, quality AS/NZS ISO 9001:2008 and environmental management AS/NZS ISO 14001:2004 as well as adopting a risk management system.

The subject of the Award was based on a continual improvement model of business management.

At the design and development stage of a particular project, a risk assessment for the project was completed. This identified improvements that could be made onsite to assist plant operators with site safety - particularly in the area of plant operation.

A gap was identified between standard factory fitted beepers and spotters used to assist vehicle movements.

The gap analysis found the view from some of the plant did not allow for the operator to confidently negotiate the full operating environment without experiencing blind spots. The plant that was assessed included:

- Centrally mounted stabiliser;
- Computer controlled binder spreader;
- Grader;
- Water truck;
- Padfoot roller;
- Smooth drum roller; and
- Site vehicles.

Two types of devices were installed to allow safe operation of all equipment onsite, even if a spotter was not assessed necessary.

### 1. Reversing Cameras

These are standard safety devices that you will find on most plant such as cars and trucks, but some of their specialised plant did not have these factory fitted. As a result, a visual Active Blind Spot Detector was fitted to each fleet vehicle.

### 2. Pulsed Radar Object Detection Sensors

These devices integrated seamlessly with other safety devices and gave an extra level of safety that was unattainable with standard safety devices.

The device detected stationery and moving objects behind the vehicle and alerted the driver with lights and sound, which became progressively louder as the object got closer.

Importantly, this system incorporates a pulsed radar which detects objects through particulates such as mud, rain and dust (lime, concrete and crushed rock). Under normal operation, dust is a constant safety concern on insitu stabilisation worksites.

The pulsed radar detection sensors were:

- Energy efficient;
- Easily fitted; and
- Adaptable to extreme weather conditions.

As a result of the installation of the two devices in conjuction with each other, the operation has experienced:

- A significant reduction in minor damage and associated repairs;
- A significant reduction in near-miss incidents and improved employee morale.

# CATEGORY 2: EXCELLENCE IN RESEARCH OR EDUCATION

The winner for Category 2 of the AustStab Awards of Excellence 2015 in Research or Education was ARRB Group (formerly Australian Road Research Board) for its continuing research in all areas of pavement stabilisation.

## ARRB in conjunction with Austroads

ARRB over the last few years has been carrying out research on pavements which has been initiated and funded by Austroads. The scope of research has been widespread; however there have been three particular projects that have or will greatly advance the practice and use of stabilisation in Australia.

## TT1358 Procedures for the Design of Pavements on Lime stabilised Subgrade Materials.

Until the release of this report there was very limited information relating to the structural contribution of lime stabilised subgrades and the design guide is quiet on the subject.

Three out of five SRA's did not allow for the structural contribution of lime stabilised subgrades; the other two had different methods.

The report gives:

- The mechanistic design of pavements which include lime stabilised subgrades; and
- The use of empirical design charts for design of pavements with lime stabilised subgrade material.

This research has the ability of greatly increasing the use of stabilised subgrades and will be included in the next edition of the Austroads design guide.

## TT1825 Design and Performance of Foamed Bitumen Stabilised (FBS) Pavements

There is an interim procedure for the design of FBS pavements; however there was concern that this was not well founded as other conventional pavements. This meant many Australian jurisdictions were unwilling to use FBS to any great extent.

The objectives are:

- Improve the Austroads procedures for the design of FBS materials;
- Identify distress modes; and
- Improve and harmonise national mix design.

Although there is still two years to run on this project, the interim reports have advanced knowledge on FBS to the extent SRA's are greatly increasing the use of the procedures.

Following the positive interim results of the work, the level of interest and engagement in this area has increased across all states.

### TT1897 Increasing the Use of Low-cost Modified Granular Materials

The purpose of this project is to provide tools to make use of low cost modified granular materials.

The report will look at the design and use of lightly bound pavements with a UCS in the range of 1 to 2 MPa. This product has been previously ignored due to lack of research. There are many examples of the use of this product giving a high rut resistant pavement without the negative effect of detrimental cracking.

The research will hopefully develop a design and construction method that will give road designers confidence in using lightly stabilised pavements, especially where conventional pavements are not viable due to geography or local natural materials.

ARRB, by this research, will give many Australian road designers economical and sustainable pavement options which they currently do not use.

# INNOVATION IN SUSTAINABILITY THROUGH SURFACE MINING TECHNOLOGY

In March 2015 Accurate Asphalt & Road Repairs (AARR) was awarded the Roads and Maritime Services Contract for the Pavement Rehabilitation of two sections of the New England Highway near Murrurundi in New South Wales.

This project's innovative pre-treatment of the pavement surface using a surface miner, in an insitu stabilisation project, was the subject of the AustStab Awards of Excellence 2015 Category three Highly Commended Award Winner at the Yarra Valley in Victoria.

The contract consisted of:

- Full service in-situ stabilisation of existing pavement material including pre-milling, spreading and incorporating additive as nominated at the respective sites; compaction and trimming to provide a heavily bound pavement of UCS > 4MPa, meeting the ride requirements of Roads and Maritime Services specification R75.
- Final trimming including saw cutting centre lines and edge lines at 120mm depth 48 hours after trimming, with pavement to be returned to existing levels and cross fall.
- Removal of excess spoil associated with trimming.
- Sealing of stabilised pavement in accordance with Roads and Maritime Services specification R106, and
- Line marking in accordance with Roads and Maritime Services specifications R141 and R142.

The total area of work required to be stabilised was:

- Site 1 New England Highway at Liverpool Range 11,500m2; and
- Site 2 New England Highway at Kankool 29,300m2.

### Operating Environment

Stage One of the project involved the in-situ stabilisation of 11,500m2 @ 380mm with three per cent 60/40 Slag/Lime blend on the southbound lane of New England Highway at Liverpool Range.

The client provided preliminary core testing results at tender that indicated the presence of some bound pavement layers in limited sections of the work area.

To mitigate these bound layers and to improve overall in-situ mixing, AARR included the use of a 2m Metrecut Profiler to pre-mill the top layer of the entire work area.

Following the normal process for pre-milling AARR crews began to mill the top section of the pavement, with the intention of then running the stabilisers to the full-depth.

However the stabilisers were unable to cut through the bottom layer due to the pavement's excessive hardness. As a result, the operating strategy had to be amended to include pre-milling and side-casting of the top layer, pre-milling of the bottom layer, replacement of side-cast material and then stabilising to full-depth.

The excessive hardness of the pavement to full-depth was found throughout the work area in contradiction to the qualitative assessment of the core testing provided.

The excessive pavement hardness experienced throughout the work area resulted in unexpected time delays, increased difficultly with heavy traffic flows through the work area as a result of the side-cast material and significant damage to profiling and stabilising plant teeth and blocks.

### Challenge and Innovation

Prior to commencing Stage Two of the project a de-briefing was held to assess the impact the excessive pavement hardness had on our operational strategy. It was clear this unexpected factor had caused significant challenges during Stage One.

It was identified that pavement hardness was now a significant factor for Stage Two. The additive rate was also to be increased to five per cent 60/40 Slag/Lime further highlighting the need for efficiencies.

The project team queried, how could an excessively hard pavement through to full-depth be pre-milled to ensure efficient in-situ mixing?

## Conventional Approach

The conventional approach to this challenge involves pre-milling and side-casting of the top layer, pre-milling of the bottom layer, replacement of side-cast material and then stabilising to full-depth. The disadvantages of this approach are that it is costly, time consuming to contractor, client and public, would create traffic control issues on this site and expose more material than necessary to the open environment.

## Innovative Approach

After considering the drawbacks of the conventional approach the operations team carefully researched what other plant options might be available to pre-mill the pavement to full-depth in one pass.

It was discovered there are surface mining machines used primarily in mining operations that have significantly higher power and cutting depth than a conventional road profiler.

After consulting with a number of industry experts AARR procured a 1,000HP Wirtgen Surface Miner that could profile to a depth of 600mm in one pass to a width of 2.5m, as a pre-treatment for the hard surfaces.

This was the first time a surface miner had been used on the Roads and Maritime Services road network in New South Wales. It was an innovative pre-treatment solution, used prior to traditional stabilisation using a centrally mounted mixer with moisture control.

## Results

The innovative approach adopted by AARR in utilising the Surface Miner to pre-mill stage two to full-depth generated a number of important benefits for the industry.

**Economic** – mitigation of excessive pavement hardness to full-depth, reduction in project time, improved in-situ mixing to full-depth, and reduction in delay costs to commercial transport enterprises

**Social** – reduced road closure time for the public, industry and the RMS on a major arterial road of the state

**Environmental** - mitigation of traffic control restrictions, increased work area on-site due to not having to side-cast; so greatly improving site safety, reduction in material exposure to the open environment (i.e. dust, sediment etc).

# PAKENHAM RACECOURSE SYNTHETIC TRACK

The category three winner for innovation or excellence in stabilisation was McMahons for the installation of the Pakenham Racecourse Synthetic Track – Tynong.

The Pakenham Racing Club, in conjunction with Racing Victoria Limited, undertook construction of the new Pakenham Racecourse at Tynong. The new facility provides a synthetic track inside the course proper.

Stabilisation of the synthetic track subgrade was required due to the high water table in the surrounding area, with the racecourse located on Nar Nar Goon-Longwarry Rd in the Koo Wee Rup Swamp. Localised ground water springs also required separate solutions to provide greater bearing capacity.

The construction of the synthetic track was staged around an active training track, with limited hours of operation due to the daily training activities held in the early mornings.

Stabilising works were required to be completed in a short space of time to meet deadlines for the opening race at the new facility. Treatment area for the synthetic track (including chutes) was in excess of 38,000m² of lime stabilisation.

This was followed-up with a concurrent treatment of cement stabilisation, again in excess of 38,000m². These treatments, as well as localised sections of Double Lift stabilisation and isolated patches at 'off track' sites, totalled over 76,600m² of stabilisation in one week.

The three main objectives of the initiative were to:

- Water-proof the subgrade to allow year-round operation without soft clay contamination and moisture influence of the pavement lavers (comprised of No Fines Crushed Rock and Open Graded Asphalt to facilitate drainage).
- Produce a pavement that will be robust enough to withstand the loadings of horses' hoofs and maintenance vehicles.
- Provide a stable subgrade/construction platform for drainage and pavement works.

## Operating Environment/Context

There are several different types of treatment required at Pakenham Racecourse due to the high point loads on the pavement from the horses' hoofs. These treatments ranged from 300mm stabilisation of the insitu subgrade material (dispersive in nature), up to double-lift stabilisation in areas prone to water ingress from localised ground water springs.

Limited construction hours were available due to the need to minimise disruption to horse training. To achieve this tight timeframe, two stabilisation construction crews were run concurrently.

## The Initiative

**20mm No Fines Crushed Rock Removal** – Construction had begun conventionally, with proof roll on the untreated subgrade being carried out. Following proof roll, the placement of the drainage layer of 150mm thick 20mm No Fines Crushed Rock had been carried out on approximately 15,000m$^2$ of the track. When wet weather was encountered, problems in the subgrade became evident. Without stabilisation, construction of the track would not have continued on schedule.

**Lime Stabilisation** – The subgrade material was treated with three per cent lime. The lime treatment of the existing material was to assist in drying the existing base prior to cementing providing all weather access. The lime in this treatment helped to waterproof areas of the track affected by localised ground springs.

**Cement Stabilisation** – The base material was then treated with three per cent cement. The cement treatment of the subgrade material provided a bound layer that gave additional strength and was designed to mitigate material migration from the base into the drainage layer.

The stabilisation process was completed in seven days for 76,666m$^2$ of treatment area, over a variety of treatment depths and methods, which was far more efficient than other treatment methods considered.

## Alternative Options

Alternatives considered included the use of a Geo-Composite Membrane to waterproof the subgrade and provide a physical barrier between the subgrade and the drainage layer or delaying works until a dryer season.

The Composite Membrane was comprised of two A24 Bidim fabrics, welded to either face of a polyethylene liner. This option was:

- Significantly more expensive than the stabilised alternative;
- Increased the required construction time due to procurement lead time, as well as installation/welding of the liner;
- Carried a higher risk - the liner could have been damaged during excavation and installation of the drainage lines, and by other construction traffic; and
- Geo-Composite may not have delivered the same structural integrity as Lime and Cement Stabilisation.

Addition of a Class 2-20mm crushed rock layer – rejected due to possibility of contamination from the untreated sandy clays in the subgrade, as well as the associated impacts to the construction program and budget (supply and haulage, as well as placement).

## Outcomes

**1. Productivity**

By providing additional resources, two crews were able to run concurrently to reduce the project duration and complete works in time to allow others to install subsequent pavement and synthetic track.

**2. Protection of Pavement and Endurance of Track**

The lime and cement stabilisation process eliminated the reoccurring problems with structural integrity and water ingress that have existed in the past with the subgrade in this locality.

# HUGHENDEN AIRPORT RESTORATION PROJECT

Hughenden Airport Resortation project was the Category Four winner of the AustStab Awards of Excellence 2015 for Stabilisation in Local Government.

In 2012, devastating floods caused saturation damage to western Queensland's Hughenden Airport. Considerable repair work was required to the airport pavements and in April 2014 Flinders Shire Council appointed FKG Group to rehabilitate the runway, taxiway and parking apron. The $6.5million contract also included the full installation of aeronautical ground lighting.

The project faced considerable challenges including a tight 12-week turnaround, a remote site location and limited availability of local materials.

Through an innovative and collaborative partnership and a focus on sustainable environmental management, the airport project was delivered on-time, absorbed an extra 23 per cent in scope and produced considerable environmental benefits, including spoil-neutral completion and the limited usage of local resources.

The key objective of the project was to deliver rehabilitated pavements at the airport ahead of the client's funding deadline of 30 June 2014.

The client, Flinders Shire Council, commissioned the use of Foamed Bitumen Stabilisation (FBS) pavement material with recycling of the existing pavement material.

Applying FBS methodology meant that scarce local pavement materials could be utilised at an increased modulus, allowing the overlay thickness to be reduced; decreasing reliance on virgin quarried material.

FKG Group's role was to ensure the recycled existing material and imported FBS pavements would meet specifications. In addition FKG Group would work with the client to stabilise the unsuitable subgrades with a lime/cement additive which alleviated the need to import gravels to achieve a working platform.

Specifically, FKG Group was contracted to:

- Provide in-situ engineering stabilisation solutions to unsuitable materials resulting in re-use of 16,000 tonnes of existing materials;
- Co-ordinate overseas laboratories to conduct FBS design mix testing within required timeframes;
- Manage logistics at a rural and remote project site to ensure materials arrived on time or could be delivered if required; and
- Safely manage multiple on-site concurrent activities.

## Challenge 1: Scarce Local Pavement Materials

Pavement materials are scarce in western Queensland and Flinders Shire Council faced a major environmental challenge in how to best manage this limited resource.

That challenge involved striking a balance between using some resources from local quarries whilst ensuring there remained enough local materials available for future works. The next closest quarry – in Townsville – was a nine hour return trip and this was a cost the project could not afford.

The solution involved applying FBS technology to the local material. This not only made the project affordable, but also injected money into the local economy. To support the FBS base pavement, the existing pavement was cement stabilised to provide an increased modulus to support the new base material.

## Challenge 2: Un-expected poor Subgrades

Too often existing materials are not utilised because they do not offer a consistent formula that can be specified. However, due to the collaborative project delivery approach of Flinders Shire Council and FKG Group, the project team was able to propose a method which would recycle the existing materials using a blend of lime and cement to stabilise the subgrade.

During construction a larger quantity of unsuitable subgrade materials was discovered than expected. To address this concern two options were examined by Flinders Shire Council and FKG Group.

### Removing and replacing unsuitable materials with engineered material

This approach was rejected as local quarries could not supply the additional materials in time and the imported material was outside budget constraints and took longer to establish the bridging effect over the softer materials.

Applying a treatment incorporating a mix of lime and cement into the existing material became the accepted option. It took less time to bridge the soft subgrades, accounted for the variability in the in-situ material and allowed all other operations to continue as planned.

### Foamed Bitumen design mix testing

The pavement design for the rehabilitation of Hughenden Airport included FBS of new base course material. The documented specification had been compiled by a consultant using various standards from around Australia and overseas. FKG Group's in-depth understanding of this product allowed variations to be proposed to suit local materials and processes, all of which were approved by the client.

Flinders Shire Council chose FBS over other traditional materials such as asphalt. For the council, this solution was not only cost-effective but it also meant materials could be sourced locally. The 12-week construction timeframe caused challenges for the project team including its ability to conduct foamed bitumen mix design testing.

After reviewing material available from two local quarries FKG Group determined the FBS product could be manufactured to the required specifications.

A further challenge was that the Department of Transport and Main Roads' (DTMR) materials laboratory could not complete the mix design testing in the required timeframe, due to the volume of other FBS works requiring testing.

The decision was made to send materials from the two local quarries offshore to be tested. The product met and exceeded the design criteria and a joint decision to proceed was made.

The choice of FBS pavement allowed a thinner overlay thickness which significantly reduced the amount of gravels and select fills required.

FKG Group shared its knowledge with the Department of Transport and Main Roads which enabled the department to refine its own FBS designs.

The Hughenden Airport project has demonstrated an environmentally sustainable solution involving scarce local resources. The treatments applied in the project have allowed local materials to be used whilst also meeting the elevated design specifications required for higher axel loading applications.

# HIGHLY COMMENDED: MATTHEW KOVESS

Downer nominated Matthew Kovess as Young Stabiliser of the Year in the AustStab Awards of Excellence 2015. Matthew received a Highly Commended Award.

Matthew holds a Bachelor of Engineering (Civil & Infrastructure, RMIT), Certificate IV Project Management, and achieves an Advanced Development for Managers at the Melbourne School of Business. His career began with Goulburn-Murray Water (G-MW) in 2006 based in Tatura, rural Victoria as project engineer.

Matthew joined Downer in 2009, initially working with the High Pressure Water Retexturing and Microsurfacing businesses delivering projects across Victoria and Australia.

In 2011 he transitioned into the Victorian Stabilisation business; initially as the project engineer, then taking over as manager in early 2012. Matthew's team of eight has delivered over 300 individual projects for small civil contractors, tier one contractors, local governments and road authorities, all of which he carries with pride and authority.

Matthew has been a Downer representative for AustStab and has been heavily involved in leading project management of Foamed Bitumen Trials in Victoria in conjunction with Austroads and the VicRoads authority. He participated in the IPWEA Regional Network series in 2013 "Doing more with less" on behalf of AustStab.

Matthew has also been involved with the Victorian AustStab working group and is an active member of AustStab. He has been part of the training and promotions group for AustStab, carrying out presentations to the Swinburne University as part of the Australian University Guest Lecture Programme on behalf of AustStab.

He also contributes articles on behalf of AustStab for inclusion in print media.

Matthew Kovess is a young ambitious and dynamic engineer. He is technically knowledgeable in road stabilisation whilst being personable and able to interact with clients, striving to deliver value-for-money outcomes. Matthew has a keen interest in early contractor involvement with councils to ensure the best value solution is delivered.

He is married and surrounded by a large extended family on both sides; he enjoys being active and social, playing various sports with and against friends. He has a keen interest in AFL (Essendon supporter) and enjoys being hands-on, rebuilding an old Holden and renovating his bathroom, with mixed results.

# YOUNG STABILISER OF THE YEAR : DAMIAN VOLKER

Since joining TMR in 2005, Damian has provided technical assistance to many stabilisation projects and continues to provide valuable input into all aspects of stabilising projects, including design, construction, research and development of TMR specifications.

Damian has demonstrated his ability through providing analysis and solutions that effectively address problems and challenges frequently encountered during pavement stabilisation on multiple projects.

Those projects included foamed bitumen stabilised sections on the Gore Highway and Warrego Hihgway, as well as subgrade stabilisation on the Flinders Highway and Waterford-Tamborine Road projects.

Throughout his work in this area, Damian's expert advice and innovative approach has contributed to significant improvements in production, quality and efficiency on a wide variety of stabilisation projects.

He has adopted learnings from these projects into his own presentation, which outlines issues that stabilisation projects are likely to encounter, and how these can be avoided by proactive measures.

As well as contributing these suggestions to projects, Damian has made a major contribution to enhancing the recent reviews of TMR specifications for lime, cement and foam bitumen stabilisation respectively.

The process adopted for these specification reviews was to involve our stabilisation industry partners, AustStab, and key regional staff in a number of workshops.

The workshops went through the specifications in great detail and resulted in many changes which are advantageous for TMR and the

industry. During these workshops, Damian was able to contribute significant expert advice based on his extensive field experience and gained wide respect for his contributions.

Damian has assisted his Director of Pavements Rehabilitation (Jothi Ramanujam) by ensuring that where a particular type of stabilisation is recommended, the technical support and expert advice is such that the project will have an excellent prospect of success.

For example; the Gentle Annie project south of Rockhampton, near Raglan, has just been successfully stabilised with triple blend (lime, cement and flyash) to improve the sub base.

It is notable that this approach did not require any additional subbase material. This was followed by additional paving material and bitumen stabilising the base. This maximised the use of existing materials and resulted in enhanced sustainability.

Damian's innovative contribution to this project was the incorporation into the pavement of old highly cemented and heavily cracked bases, which would previously have been removed and replaced.

He achieved this by an innovative process which involved working with the stabilising contractor to pulverise the profiled material and then carefully blend it with limited imported granular crushed rock material. This approach resulted in a cost saving of over 10 per cent for the project.

Damian has played an important role in AustStab training courses in stabilisation practices throughout Queensland and brings his valuable experience and approach to these courses.

He always displays a friendly and helpful attitude in giving his advice and goes out of his way to illustrate complex issues in a simple way that the audience can readily understand. He adopts a similar open and collaborative approach in his dealings with contractors at pre-close of tender and prestart meetings, and Mr Ramanujam often receives feedback on how helpful participants found his advice.

Damian's approach to his work has been recognised within the Department, and led to him winning the Chief Engineer's award on two occasions in 2012 and 2013 and 2014 'Unleash Potential" TMR Cubie nomination.

# **HIGHLY COMMENDED:** CHRISTOPHER CLEATON – STABILISED PAVEMENTS OF AUSTRALIA

A graduate of The University of Wollongong, Christopher (Chris) Cleaton has achieved much in the field of road stabilisation and pavement recycling.

Entering the role of Area Manager (for Southern NSW) for Stabilised Pavements in 2012, Chris quickly came to terms with the technical, people management and project management demands of his new role in the private sector.

If it is possible to have rounded experience as reflected in one's career achievements, Chris has achieved this in a very short space of time.

## Technical skills

Chris has excelled in his ability to consider the challenges facing a range of clients to develop and submit designed and fully costed rehabilitation options. He has achieved this through a balance of using his own initiative and harnessing the experience of those around him.

Some design and construct solutions that Chris has successfully promoted and delivered to metropolitan clients range from surface cement stabilisation treatments, two-layer subgrade and upper pavement treatments, foamed bitumen stabilisation, and combinations of the above using polymer modified seals and asphalt surface finishes.

## Communication skills

Chris has proven capable of communicating well and building relationships of trust and respect with clients. Throughout the design and construction phases of projects he has been able to provide sound, best-value full service stabilisation solutions for his various metropolitan and rural clients.

Chris has been instrumental in developing initiatives to facilitate communication between employees involved with administration and procurement, and in the field.

He has also taken it upon himself to create and administer the Stabilised Pavements of Australia Facebook page, which has included project photographs and stories that have proved informative to subscribed clients and motivational to staff involved in the projects.

## Commitment to advancement of stabilisation

Despite his relatively short time in the stabilising industry, Chris has established himself as a knowledgeable and valuable member of stabilising projects. He has recently secured large works programs with metropolitan councils which were previously unaware of the full benefits of stabilisation. The works have been successfully completed ahead of program and with minimal public disruption or complaints.

## Project specific experience

Chris was successful in winning a major full service works package let by the Roads and Maritime Services for the rehabilitation of the Barton Highway.

The treatment employed by the RMS and successfully delivered by SPA was for the 275mm deep foamed bitumen stabilisation of the existing roadways surface, finishing with a 10mm primer seal prior to a final RMS supplied wearing course. All works were performed under a night time Road Occupancy Licence.

## Conclusion

Chris is a leading role model for young engineers who are not only interested in beginning a career in stabilisation, but are seeking to break into any industry. His achievements in the field of stabilisation as applied to road rehabilitation and, as an employee of Stabilised Pavements of Australia, speak for themselves. His management team was delighted to nominate him for the AustStab Awards of Excellence Young Stabiliser of the Year 2015. He received a Highly Commended Award.

# METRO LED LIGHTING TOWERS

In the last few years Australia has seen an influx of imported lighting towers and units that often seem appealing at first glance.

Australian work sites, however, need products that meet Australia's tough conditions. JLG's new Metro LED Lighting Tower is purpose-built using ISO9001 standards in Australia, with features designed to suit local conditions.

Results of recent surveys highlight what is important to light tower owners: proven reliability, prompt supply of parts and service - especially into remote locations, and transportability over long distances.

The JLG Metro LED will also help users save on fuel. Extra low voltage, high-output LED lights, in combination with fuel-efficient engines and start/stop controllers, greatly reduce fuel consumption.

According to Arron Cooper, Product Manager at JLG Industries, electricians are no longer needed for "tag and test" because the towers have a 48-volt DC extra low voltage system. A quick-disconnect light head makes short work of disassembly.

Operators will find it easier to comply with noise regulations thanks to the new exhaust system, sound-proofing and quieter running engines on the JLG Metro LED.

Mr Cooper said the Metro LED Lighting Towers were designed for side-by-side loading on trucks, allowing seven units to be transported on a standard semi-trailer or 11 units at a time on a B-Double.

This, he said, would produce significant savings for rental companies, contractors and their customers.

Whilst the list of standard features on the JLG Metro LED is impressive, the lighting towers can also be customised to almost any application with additional options and accessories, many of which are available in kits.

All JLG products are backed by its industry-leading Ground Support network. Factory-trained technicians are available at JLG workshops across the country or they can reach most jobsites with an extensive fleet of field service vehicles, which are equipped with IVT and spare parts.

**To learn more about the Australian designed and developed Metro LED Lighting Tower, visit www.jlg.com.au or call JLG Australia on 131 554 or JLG New Zealand on 64 9276 1278.**


## AN EFFICIENT WAY TO EXTEND PRODUCTIVE HOURS.

Whether you need to get on the job before the sun comes up or work into the evening to stay on schedule, the new JLG® Metro-LED Lighting Tower lights the way. With 130L capacity fuel tanks, the Metro-LED combines extra-low voltage, high-output LED lights with efficient engines, allowing units to run longer between refueling. Other features include quieter running engines and new exhaust systems for reduced noise levels on-site.

**Learn more at www.jlg.com.au/lighting-towers-7** **131 JLG**

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# New bridge for Fortescue River crossing

A contract has been awarded for the replacement of the single lane bridge over the Fortescue River near Roy Hill Station in Western Australia's Pilbara region.

The current bridge was built in 1929 and the replacement project will reduce disruptions being experienced during the wet season – disruptions which have resulted in road closures due to flooding.

Construction of the two lane bridge was due to start in August. The BMD MACA Joint Venture was selected to build the bridge and seal two kilometres of Marble Bar Road near Roy Hill Station.

Marble Bar Road is used by heavy and light vehicles servicing mine sites and local communities between Newman, Nullagine and Marble Bar, and is a key transport and service link in the Pilbara.

WA Regional Development Minister, Terry Redman, said the State Government's Royalties for Regions program was investing $12.66 million in the project over two years.

"Royalties for Regions is about strengthening and growing our regions and helping regional communities realise their economic potential through the delivery of key economic infrastructure."

The project is due for completion in April 2016.

# New bridge part of Pacific Highway upgrade at Macksville

Work has started on construction of a new bridge over the Nambucca River at Macksville, part of the $830 million Warrell Creek to Nambucca Heads upgrade along the Pacific Highway.

The new Nambucca River Bridge is being built approximately 1.2 kilometres east of the existing bridge – at 850 metres long, it will span the northern floodplain to minimise flood impacts on Macksville and nearby properties.

Navigation restrictions will be imposed on the Nambucca River during construction of the new bridge. A navigable channel will be maintained through the building site, although short closures will be necessary for the safety of boat users and workers.

A reduced speed limit of four knots and "no towing" restrictions will be in place.

The bridge will open to traffic in 2017, weather permitting.

The Warrell Creek to Nambucca Heads upgrade bypasses Macksville and will reduce the number of heavy vehicles passing through the town. It is one of five major upgrades under construction between Port Macquarie and Coffs Harbour.

Construction is being jointly funded by the Federal and New South Wales Governments, with each providing $415 million.

The Federal Government has committed $5.64 billion towards completing the Pacific Highway upgrade by the end of the decade.

# Building bridges across Australia

Local governments around Australia had until the end of August to submit applications under the second round of the Federal Government's $300 million Bridges Renewal program.

The program is designed to improve access for communities and deliver greater productivity for the nation.

The second round of the program will provide $100 million funding, which will be available only for local government projects, including works submitted by the ACT Government.

The Federal Government will cover up to 50 per cent of the costs to renew and replace bridges – successful projects will be selected through a competitive, merit-based process.

Round One of the program has seen more than $100 million in projects approved, with many projects already under construction.

## New bridge for Yellow Gin Creek near Ayr

Construction will commence in late September on the Yellow Gin Creek Upgrade project south of Ayr – a project that will make the Bruce Highway more flood-resistant.

Seymour Whyte Constructions has been awarded the contract for the $45 million bridge upgrade, about 90 kilometres south of Townsville, which will improve the creek crossing and make the highway safer and more dependable for industry, tourists and local residents.

More than 3,000 vehicles which use the section of highway each day will benefit from the project – nearly a quarter of them heavy vehicles carrying regional and interstate freight.

The project will involve replacing the existing low-level floodway crossing over Yellow Gin Creek with a new raised bridge, plus upgrades to the highway on the approaches to the bridge.

A side track will be built alongside the existing highway to ensure traffic disruptions are minimised during the works, which will improve a 1.6 kilometre stretch of the highway, making it safer and more reliable.

"Around 100 direct jobs will be supported over the life of the project.

Construction of the bridge upgrade is expected to be completed in late 2016, weather permitting.

The Yellow Gin Creek Upgrade is part of the Federal and Queensland Governments' $8.5 billion commitment over the next decade to fix the Bruce Highway.

The Federal Government is providing $36 million towards construction, with the Queensland Government providing the remaining $9 million.

# VicRoads leads the way with Reverse Smart radar safety technology

Hot on the heels of the recent Australian launch of the state-of-the-art Reverse Smart AEB (Automatic Emergency Braking) system, VicRoads has announced that it will install radar-based reverse braking technology to its road maintenance fleet after a successful trial.

The automated system is the first of its kind to be trialled in Australia and VicRoads is the first heavy fleet operator to install the technology.

"Safety in the workplace is of the upmost importance and this technology will significantly improve safe working conditions for VicRoads employees. The safety of our people and members of the public is paramount and the autonomous braking system will make a difference," VicRoads Chief Executive, John Merritt, said.

According to WorkSafe Australia, between 2003 and 2012, 18 workers were killed in the workplace by incidents involving reversing trucks. Fatalities included 6 workers killed while undertaking loading activities, 5 while undertaking traffic control activities and 3 workers were simply moving around construction sites when they were hit by a truck.

The Reverse Smart AEB system has been specifically designed to reduce the incidents of large vehicles or mobile plant impacting workers or objects while reversing. The Reverse Smart AEB detects objects or people behind the vehicle, warns the driver / operator and, unless the driver confirms the nature of the object and specifically triggers the 'sleep' mode (which is used when intentionally reversing up to a solid object), applies the vehicle's brakes.

VicRoads recently completed a six month trial of the Reverse Smart radar-based AEB technology. The trial, which commenced in mid-February this year, involved a full in-service evaluation of two Reverse Smart AEB units.

The first unit was installed on a SprayLine Cover Truck located at a regional depot, while the second was installed on a Road Services Patrol Truck at a Melbourne metropolitan depot.

The trial has been extremely successful in terms of both the units' performance and operator acceptance of the system. Indeed, drivers have been very supportive of the technology and agree that it benefits their daily work activities and has even helped to increase their awareness and care while reversing.

VicRoads will now progressively install the technology on to its fleet.

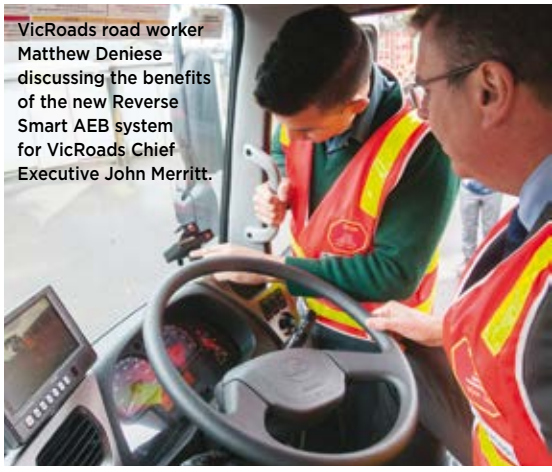
Even though Automatic Emergency Braking systems are becoming commonplace in passenger vehicles on Australian roads (AEB is now a standard inclusion in many new cars built in Europe, Japan and the United States) the VicRoads trial is pioneering because the radar-based Reverse Smart AEB system is being retro fitted to VicRoads' existing fleet of road maintenance vehicles.

"The technology works alongside other safe systems already in operation and complements our suite of work place procedures," Mr Merritt said.

"We believe this technology will significantly reduce worksite risks and we hope it will become standard across the industry."

"Our dedication to workplace safety never ends and VicRoads will continue to consider any new technology which may save lives," Mr Merritt added.

VicRoads will share the trial data with transport groups and fleet managers and hopes the technology will be widely used within the construction industry.



VicRoads road worker Matthew Deniese discussing the benefits of the new Reverse Smart AEB system for VicRoads Chief Executive John Merritt.


Object detected while reversing

Vehicle continues to reverse towards object


VicRoads Chief Executive John Merritt (on left) and Davin Hamnett, Business Development Manager with Reverse Smart (on right) with 'Worker Wal' at the recent VicRoads Reverse Smart demonstration day in Melbourne

## Reverse Smart: State-of-the-art radar technology

Available exclusively throughout Australia from safety, traffic control and line marking equipment specialists A1 Roadlines, the state-of-the-art Reverse Smart system has been at the forefront of AEB reversing system technology for a number of years throughout Europe and the UK, with many hundreds of successful installations on heavy vehicles, large plant and other mobile equipment.

The key to the success of the Reverse Smart system lies within its purpose-designed radar, which not only allows for an accurately focussed detection area, but also overcomes many of the limitations that can be experienced by traditional ultrasonic detection.

Davin Hamnett, Business Development Manager with Reverse Smart explained:

"Unlike ultrasonic reversing detection - which is a common feature on many passenger vehicles – the Reverse Smart radar system is not affected by vibration or frequency clashes which can result in 'ghosting' and false proximity alarms."

"In addition, the fact that the radar unit is a purpose-built, heavy duty, fully-sealed unit, means that it is unaffected by dust and dirt and is suitable for use in even the harshest operating environments," he said.

"It's extremely robust, and maintenance free," he added. "The driver or operator doesn't have to change the way they operate the equipment and there are no additional steps required to operate or calibrate the Reverse Smart system once it has been installed."

"The only driver interaction with the system is when they are intentionally reversing up close to a solid object, in which instance they can press a button to 'sleep' the braking function while still maintaining the proximity detection alert," Davin Hamnett added.

**For further information, or to arrange a demonstration, please visit:**
**www.reversesmart.com.au**
**or contact: Davin Hamnett, Reverse Smart, Ph: 0419 177 199 or A1 Roadlines Pty Ltd, Ph:1300 217 623 (1300 A1ROAD)**

## Large equipment can be easy to miss!

On most worksites, there is usually a myriad of equipment operating, most of which has flashing lights, beacons, cameras and reversing buzzers or other audible warnings. In short, there is usually a lot going on and there's too much external stimulus to pay attention to all of it – especially when you're trying to concentrate on the job at hand.

While from the outside looking in, it may seem almost impossible to miss a large piece of equipment moving towards you, in reality, if you're wearing hearing protection and concentrating on a job where the approaching vehicle is not in direct line of sight, it's easy to miss even the largest equipment approaching.

Impact accidents occur with alarming regularity – and this often results in serious injuries or even fatalities. By providing an additional level of protection, including an engineering control that can stop the vehicle, the Reverse Smart AEB system can significantly reduce the risk of impacts and injuries.


Reverse Smart AEB system automatically applies the brakes and stops the vehicle

# Transforming NSW public transport and road network

**The New South Wales budget – delivered on 23 June – provided the biggest investment boost in transport infrastructure the state had ever seen, according to Minister for Transport and Infrastructure, Andrew Constance, and Minister for Roads, Maritime and Freight, Duncan Gay.**

Mr Constance and Mr Gay said the budget included $16.5 billion that would be invested in the next 12 months to transform the state's public transport and road network.

"The 2015-16 Budget reinforces the government's ongoing commitment to unclog crippling congestion."

Mr Gay said $7.5 billion had been identified to support the huge infrastructure program currently underway to build and upgrade critical road, maritime and freight networks – a $2 billion increase in annual funding compared to last year's investment.

The budget included $4.1 billion for Regional NSW including $1.9 billion to continue fast tracking major upgrades of key regional highways such as the Pacific, Princes, Great Western, Newell, New England, Oxley, Mitchell, Kings, Central Coast, Silver City and Cobb.

It also incorporated $1.7 billion to build the world class WestConnex motorway and $180 million towards easing city congestion.

"Not only are we well advanced in delivering the biggest infrastructure program in the state's history, we're also investing record levels – $1.5 billion this financial year alone – to repair and maintain existing road and maritime assets," Mr Gay said.

Grants to local government would total $326 million in 2015-16, meaning councils could get on with the job of building and maintaining their local and regional road networks.

## Budget highlights for roads and maritime for urban NSW

- $275 million (including $51 million for enabling road works and land acquisitions) in state and federal funding towards construction of the NorthConnex Motorway, with twin tunnels under Pennant Hills Road to connect the M1 Pacific Motorway at Wahroonga to the M2 Hills Motorway at West Pennant Hills.
- $180 million towards easing Sydney's congestion, including delivering additional clear ways and fixing notorious traffic pinch points and planning to develop the next package of works ($62 million), continued planning for the Smart Motorways program ($15 million) and delivering real time travel information for motorists ($9 million).
- $167 million for continued road upgrades to support population and economic growth in Western Sydney, including completing the final section of Camden Valley Way ($16 million) and ongoing upgrades of Schofields ($44 million), Richmond ($30 million) and Old Wallgrove ($30 million) roads.
- $164 million in joint funding with the Federal Government to upgrade roads to help support Sydney's second airport at Badgerys Creek, including continuing construction on Bringelly Road between Camden Valley Way, Leppington and Kings Street, Rossmore ($50 million) and on the Werrington Arterial Road between the M4 Motorway and the Great Western Highway ($30 million).
- $57 million for cycling and pedestrian infrastructure, including towards the Nepean River Green Bridge near Penrith ($14 million) and Arncliffe Pedestrian Tunnel ($12 million).
- $42 million to start delivering major road upgrades to support the new Northern Beaches Hospital at Frenchs Forest.
- $36 million to progress planning and identification for future links on the Sydney motorway network including: Western Harbour Tunnel; Gateway to the South – M1 (Princes Motorway) Extension (includes the F6 corridor study); Outer Sydney Orbital; Bells Line of Road – Castlereagh Connection.
- $32 million to continue upgrading commuter wharves, including at Rhodes and Cabarita.
- $17 million to complete planning and commence construction of major road upgrades in the Sydney Airport precinct to reduce congestion and complement the operation of the future WestConnex Motorway.

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## Budget highlights for roads and maritime for regional NSW

- $1.4 billion in joint funding with the Federal Government to continue fast tracking the duplication of the Pacific Highway to a four lane, divided road between Hexham and the Queensland border; including construction of the final section of the upgrade between Woolgoolga and Ballina.
- $182 million to continue major upgrades on the Princes Highway, including construction of the Foxground and Berry bypass ($140 million), completing the Gerringong upgrade ($12 million) and realignment of the highway at Termeil Creek near Ulladulla ($12 million).
- $87 million to continue upgrading the Great Western Highway, including finishing the upgrade at Bullaburra ($3 million) to complete a four-lane highway between Emu Plains and Katoomba, major safety improvement works from Katoomba to Mount Victoria and Forty Bends and Hartley Valley ($53 million in state and federal funding) and $27 million for upgrades at Kelso.
- $69 million for upgrades to Central Coast roads, including completing the upgrade of the intersection of Central Coast Highway with Brisbane Water Drive and Manns Road at West Gosford ($7 million), completing the upgrade of the intersection of Terrigal Drive and Charles Kay at Terrigal ($6 million), continued upgrade of the intersection of Wyong Road and Enterprise Drive at Chittaway Bay ($10 million), commencing construction of the Pacific Highway upgrade between Lisarow and Ourimbah ($10 million) and planning for upgrades of the Pacific Highway at Narara and Lisarow ($5.5 million).
- $50 million for upgrades to Hunter roads, including widening Cormorant Road between Industrial Drive to Stockton Bridge ($10 million in state and federal funding), ongoing upgrades to roundabouts on the New England Highway at Maitland ($19.5 million), continued planning for the Newcastle Inner City Bypass ($4 million), and planning for the extension of the Pacific Motorway to Raymond Terrace ($3 million).
- $35 million for a series of key upgrades on the Newell Highway, including completing the final section of the Moree Town Bypass ($3.9 million in joint state and federal funding), realignment of the highway at Grong Grong (east of Narrandera) and Trewilga (south of Peak Hill - $12 million) and additional overtaking lanes along the length of the highway ($5.5 million).
- $23 million to continue the Bells Line of Road Corridor Improvement Program, including extra overtaking lanes at Kurrajong Heights and Bilpin.
- $12 million for upgrades on the Oxley Highway, including completing construction of a new bridge across Tangaratta Creek near Tamworth ($1.5 million) and improvement works at the intersection of the highway and Wrights Road, Port Macquarie ($6.7 million).
- $9.8 million to continue sealing the Cobb and Silver City Highways, $9 million towards construction of the Queanbeyan Ring Road (Ellerton Drive Extension), $6 million to realign the Kings Highway at River Forest Road, $5 million for safety works on the Riverina Highway and $5 million to start major work to realign the Mitchell Highway at Guanna Hill.

## Budget highlights for urban and regional freight

- $209 million for the upgrade and maintenance of Country Rail Network assets, including replacement of old timber sleepers with modern long-life steel sleepers, resurfacing track and replacement of bridges and culverts (includes $56 million for grain rail lines).
- $124 million (state and federal funding) for the Northern Sydney Freight Corridor to improve freight rail access through the Sydney-Newcastle rail corridor between Strathfield and Broadmeadow.
- $76 million to continue the Bridges for the Bush program to replace or upgrade weight-restricted bridges on key regional freight routes, including completing construction of a new 'road over rail' bridge on the Olympic Highway at Kapooka ($24 million in joint state and federal funding), continue planning for a new Gunnedah Bridge on the Oxley Highway ($3 million), completing construction of the Tulladunna Bridge over the Namoi River near Wee Waa ($3.7 million) and finishing the widening of the Bemboka River Bridge at Morans Crossing on the Snowy Mountains Highway ($3.7 million).
- As part of a $20 million initiative to deliver upgrades on key sections of the Country Rail Network, $5 million will be invested to expand on the existing program to deliver rail siding extensions to improve train loading rates for grain.
- $15 million to progress upgrading Gocup Road to support increasing numbers of heavy vehicles carrying timber and general cargo to and from the forest products mills in the Tumut Valley.


**"Travel reliability and passenger experience is also at the forefront of the Budget with $92 million allocated for new and replacement buses and $12 million for brand new ferries for Sydney Harbour."**

- As part of the overall $50 million for Hunter roads, $2 million has been allocated for planning bypasses of Singleton and Muswellbrook on the New England Highway, $1 million for planning a grade separation of the intersection of the New England and Golden highways at Belford, and $500,000 to plan the widening of the railway underpass at the Gowrie Gates near Singleton.
- $5 million for the NSW Cargo Movement Coordination Centre, which will improve efficiency and reliability of freight rail operations throughout NSW and increase rail mode share.
- $4.25 million to upgrade Kidman Way south of Cobar.

Mr Constance said $977 million would be invested towards delivering the $8.3 billion Sydney Metro Northwest which would boost passenger capacity across the entire rail network.

"Hundreds of buses will be removed from the crowded CBD every day following the completion of Light Rail and more than $120 million is allocated to keep progressing this vital work.

"Travel reliability and passenger experience is also at the forefront of the Budget with $92 million allocated for new and replacement buses and $12 million for brand new ferries for Sydney Harbour."

Other key projects include:

- $103 million to progress construction on light rail in Newcastle to completely revitalise the CBD and reconnect it with its waterfront.
- $94 million to continue procurement of the next-generation intercity train fleet.
- $7.5 million to start planning for a new fleet to replace the ageing XPTs.
- $1.2 billion on rail maintenance and $74 million towards a world-class rail operations centre to manage delays.
- $37 million to commence planning for the major upgrades on the T1 Western Line to increase train reliability and capacity, and $43 million to overhaul Wynyard Station.
- $2 million towards four new Parramatta River ferry vessels to improve travel experience and reliability.

# 'Big' transport infrastructure budget for Queensland

More than $18.8 billion will be invested in Queensland's transport infrastructure in the next four years under the Queensland Transport and Road Investment Program (QTRIP) - the state's program of planned works.

QTRIP outlines planned spending on roads, rail, marine, public transport and active transport infrastructure, and will sustain almost 15,000 jobs over the four-year time frame.

Minister for Transport, Jackie Trad, said the 2015-16 Budget outlined a plan to improve transport infrastructure and invest in Queensland's future.

"The government is investing in the roads and public transport network to reduce congestion and improve safety, services and infrastructure for all Queenslanders," Ms Trad said.

Minister for Main Roads and Road Safety, Mark Bailey, said investment in the roads, road safety and maritime component of QTRIP totalled $14.9 billion.

"In a vast state like Queensland, motorists rely on a safe and reliable road network, particularly in regional areas where roads are the lifeblood of many communities," he said.

"We have significantly increased the 50:50 state/local government Transport Infrastructure Development Scheme funding by $60 million over two years and brought it forward by a year to provide much needed support for local infrastructure and jobs."

Road project highlights for the Budget delivered under QTRIP include:

- $175.9 million in joint funding to widen the Gateway Motorway North to six lanes all the way between Nudgee and Bracken Ridge for a total cost of $1.2 billion;
- $172.1 million in joint funding towards the Toowoomba Second Range Crossing – a bypass route to the north of the city from the Warrego Highway at Helidon to the Gore Highway for a total cost of $1.6 billion;
- $113.1 million in joint funding towards the duplication of the Bruce Highway from Cooroy to Curra from the Cooroy Southern Interchange to Sankey's Road (Section A) for a total cost of $490 million;
- $40 million in state funds over two years to deliver the Western Roads Upgrade Program, comprising 14 regional priority road projects across western Queensland;
- $33.4 million in joint funding to continue building a new elevated crossing on the Bruce Highway across the Yeppen Floodplain, south of Rockhampton, for a total cost of $170 million; and
- $12.9 million in joint funding towards the replacement of timber bridges on the Peak Downs Highway, between Nebo and Mackay for a total cost of around $70 million.

Public transport project highlights under QTRIP include:

- $568.4 million to continue rail network improvements, including building a third track between Lawnton and Petrie stations, commencing the duplication of the Gold Coast line between Coomera and Helensvale station;
- $304.6 million for 75 new trains, including new maintenance and stabling facilities by December 2018; and
- $136.8 million in 2015-16 to complete the construction of the Moreton Bay Rail Link, at a total cost of $988 million.

Further significant programs to be delivered under QTRIP include:

- $635 million in joint funding over five years to upgrade of the Warrego Highway between Toowoomba and Miles;
- more than $500 million in joint funding over two years for targeted road safety projects across Queensland;
- $260.5 million in joint funding over five years for the Cape York Region Package, to upgrade key roads and other infrastructure to better connect communities in the Cape;
- $160.7 million in state funding over three years for the Gold Coast package of road works, in the lead up to the Commonwealth Games.

"The government recognises the importance of a safe and reliable road network and our planned investment will deliver on our election promises, and ensure that safety continues to be maintained on the state's roads," Mr Bailey said

# Multi-million dollar package for Gold Coast roads

A program of major road upgrades on the Gold Coast in the lead-up to the 2018 Commonwealth Games will cost an estimated $160 million.

The Queensland Government is working with the Gold Coast City Council and the Gold Coast 2018 Commonwealth Games Corporation on a package of road improvements to target traffic trouble spots on the region's road network.

Proposed upgrades include:

- six-laning the Southport-Burleigh Road, from Southport to Broadbeach Waters, including major intersection upgrades;
- traffic signals for the intersection of Labrador-Carrara Road at Ross Street and Ashmore Road;
- extending the six lanes of Olsen Avenue to the Southport-Nerang Road, with intersection upgrades;
- boosting traffic capacity along Nerang-Broadbeach Road at the Gooding Drive roundabout; and
- improving the intersection of Smith Street Motorway and Kumbari Avenue.

Main Roads and Road Safety Minister, Mark Bailey, said the Gold Coast was Queensland's fastest-growing city, and population growth and increasing tourism numbers were testing the road network.

"It's forecast that six million extra journeys will be made across the Gold Coast during the 2018 Commonwealth Games.

"We want to ensure residents and visitors to the games have the road infrastructure they need for safe, smooth and seamless travel on the Gold Coast."

Deputy Premier, Jackie Trad, said the funding would deliver a safe and reliable road network and create hundreds of jobs for workers in road construction and related industries.

"Importantly, our investment in pedestrian, cycling, public transport and road improvements will leave a lasting legacy for residents and visitors, not only when the international spotlight is on the Gold Coast, but for years to come."

Ms Trad said in the lead-up to the Commonwealth Games it was imperative the Federal Government committed vital funding to stage two of the Gold Coast Light Rail.

"Mr Abbott's reluctance to commit any money to critical public transport infrastructure is the major road block to extending the Gold Coast's light rail project in time for the games."

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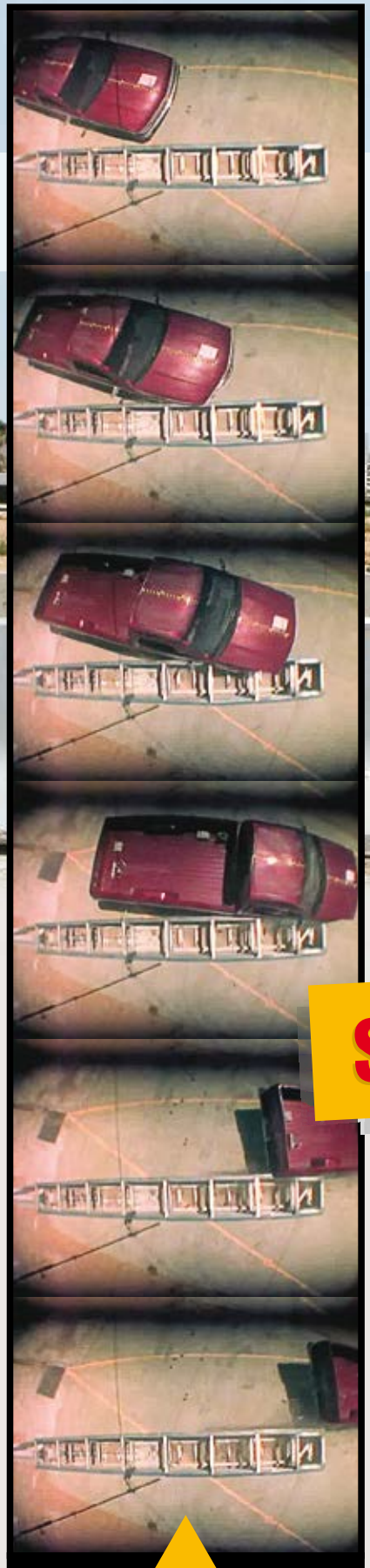

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