Research Plans

- A Business Case - articulating the value of investing in applied research to enable investigation of the current capacity of parts of the road network to carry more and heavier freight vehicles is being prepared.

This research is intended to:

- Inform TMR's priority freight strategies and its network access management business decisions over the next 20 years
- Provide the knowledge and information necessary for more confident prediction of road performance and deterioration to ensure best economic returns from on-going and appropriate investment across the road network.
- Provide understanding of the real capacity of pavements and structures and their potential to deliver freight productivity gains to share with asset owners via user-payment principles; and,
- Provide knowledge and rehabilitation options for appropriate - intervention at identified locations and at the right time to optimise whole of life costs across the road network

Editorial note:
A proposal to address some of these issues through a shared CRC between Queensland and Western Australia has stalled.

ARRB in Queensland is developing a TMR Pavements Research plan "Asset Research: Improving the Productivity and Performance of Queensland's Roads"

The project scope allows for the inclusion of many of the issues identified in this Newsletter and includes aspects and projects within the Strategic Alliance Business Plan.

Edited by: Ross Guppy, Rob Vos, Jenny McMillan, Jason Jones
Layout/Design by: Rob Vos & Ian Reeves
Issued by: Strategic Alliance Managers, 903c Toowong Tower, 9 Sherwood Rd, Toowong, Queensland 4066
Available at: *www.aapaqtmr.org*

Queensland Government

Strategic Alliance
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Developing superior flexible pavements

AAPA

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Sweating our pavements!

Ian Reeves

From the SARG meeting in May 2010

Nationally there is a growing need for increased road freight productivity supported through COAG and the ATC. The COAG Road Reform Plan (CRRP) has objectives of:

- ***'promoting the more efficient, productive and sustainable provision and use of freight infrastructure'*** *and*
- ***'a critical direction is ensuring that national heavy vehicle road prices promote the efficient, safe and sustainable use of infrastructure, vehicles and transport modes'****.*

Climate change & planning

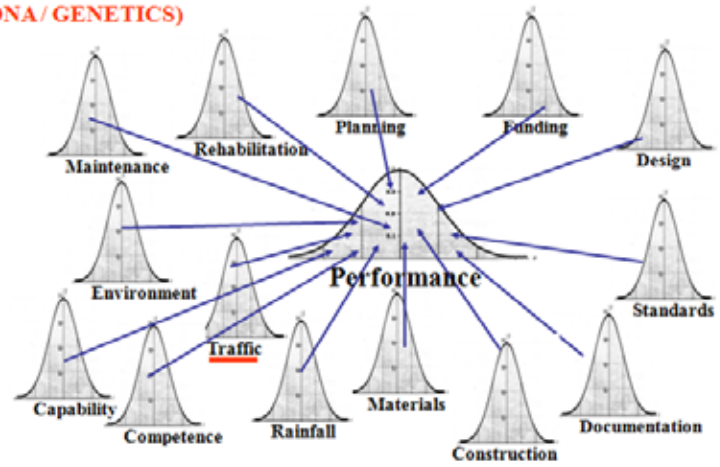
Recent focus on climate change and global reforms and the recent global financial crisis, has reinforced the need for roads (as government's single largest asset) to become more financially and environmentally sustainable. To achieve this, government needs to invest in new sustainable road planning, design, delivery and operational practices.

Current pavement design and management knowledge is not sufficiently developed to provide a sound basis on which appropriate heavy vehicle access management strategies may be established to enable the CRRP objectives to be achieved. In particular, there is limited knowledge of the impacts of anticipated increased road freight mass limits and new vehicle combinations on structures and unbound granular pavements (which represent about 94% of the Queensland network). A substantial body of research is required to address the knowledge gaps.

Road & Bridge loadings up

The ongoing real growth in road pavement and bridge loading, the continuing freight productivity / efficiency demands and the lack of evidence-based infrastructure performance models suited to the proposed vehicle loadings and configurations make defensible decision making increasingly challenging for road authorities.

1 **Road Pavement Performance (DNA / GENETICS)**



Performance experience

The Queensland road network is quite diverse and exhibits a range of physical and performance characteristics, not just age and service levels. It is not fully developed in the sense of being a mature and durable network. Its creation and evolutionary development to date has been based on a philosophy of adequacy, as opposed to aspirational and low cost.

Arguably the Queensland road network is one of the most susceptible to damage from higher mass limits in Australia. It's vulnerability is also regularly tested by cyclonic and flooding events when real damage does occur and road closures followed by periods of load limiting become necessary to allow pavements to regain strength as they dry out.

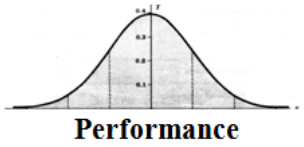
Across Queensland's approximate 33,500 km network we experience variable performance from road pavements.

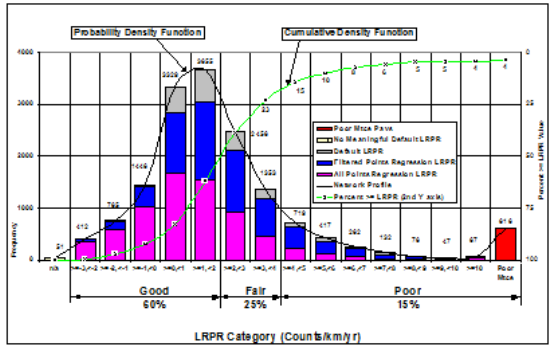
All these variables (and more) (*Figure 1)* continually interact and dictate road performance to the vehicles using roads.

Not just future bigger vehicles

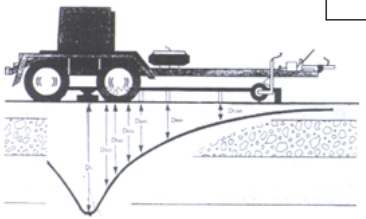
We are not just talking about the future - bigger vehicles are here now and are challenging our roads and bridges. If they are just too heavy then performance will deteriorate rapidly. Even one pass of an overloaded vehicle can cause significant damage. The challenge is for our asset managers to analyse performance across the network and to argue for appropriate funding for maintenance and rehabilitation and to also make recommendations about where to invest in order to deliver optimal

6 **Road Pavement Performance (DNA / GENETICS)**





Linear Roughness Progression Rate (surrogate)



Deflection (direct)

You'll note from *Figure 7* that this was not very safe for the operators.

Traffic Speed Deflectometer

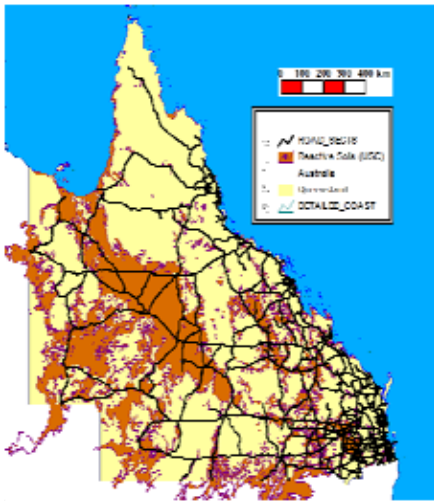
It's this feature, amongst others, that has been eliminated with the new Danish Traffic Speed Deflectometer.

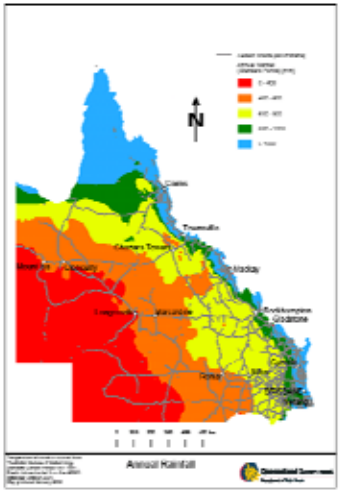
It's a new technology relying on lasers and therefore does not rely on instruments contacting the road surface

Research Challenges

- Role of roads is to serve the needs of the users but they do wear out
- Worn out bridges are effectively the 'fuses' in the road system but worn out pavements can seriously impede the free flow of vehicles
- Solutions are needed - defensive positioning is increasingly becoming unacceptable
- How do we predict future performance?
- Can we take greater risks with 'better performing' existing pavements and structures?
- How do we get a better understanding of commercial pressures and commercial opportunities for the transport industry?
- How do we help them realise those opportunities?
- What climate change scenarios should we begin to respond to?
- How do we confidently influence investment and funding to deliver adaptable and sustainable roads?

5





Variable subgrades that respond to changes in moisture – shrink in the dry and swell in the wet - and variable rainfall too!

However, deflection is a more direct measurement of pavement strength and performance. The maximum deflection and shape of the deflection trace tells pavement engineers a lot about the structure and its capacity to carry current and future loads. It also allows them to design rehabilitation treatments that extend the life of a existing piece of road. Queensland's road assets were last valued at $53.9 billion – more than doubling in the last decade. Yet TMR's investment in R&D to improve its pavement knowledge and design and maintenance practices has declined from $4.7 million per annum in 2002 to $1.3 million in 2009.

Research investments

Urgent investment is therefore needed in researching:

- road asset structural capacity (pavements, bridges and culverts), redundancy and risk
- freight industry needs e.g. loads, number, frequency and access expectations
- sustainable design, maintenance and network operations practices – e.g. recycling, reuse of demolition materials, new products and processes.

Deflection Testing

Benkleman Beam (1950's technology) used manually read dial gauges to measure pavement deflections under a standard axle loading. These were replaced with displacement transducers in the late 70's giving far more data and more meaningful information about the total pavement structure. This meant many cables and rudimentary field based computers.

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performance with the investment funds that are made available.

Risks & accelerated damage

While the risks of accelerated damage by increased loading are real, the potential for accommodating some increase on some parts of the network also exists. Currently however, the Queensland Department of Transport and Main Roads (TMR) has imperfect knowledge of the medium to long term performance of these roads, in their actual environments under the likely increased loading.

Research to establish whether the state-controlled road network contains some level of redundant capacity (to accommodate higher loads) and the performance risks (cost) will be key to confident and cost-effective roll-out of CRRP freight efficiency initiatives.

There is also limited knowledge of industry demand (specific to Queensland routes) and in particular the value to industry of arrangements that would enable them to run high productivity road freight vehicles, which may include higher axle loads.

The challenge is far more complex than solving an access issue in remote areas.

We have aged and worn out assets across the state, designed and built to outdated standards when there were far fewer heavy vehicles carrying

4

much lighter loads than current and continually emerging heavy vehicles

Predicting performance

Using surrogate measures like Linear Roughness Progression Rates can provide insight into pavement performance. Phil Hunt's 2002 analysis of some 16,000 kms of the rural road network suggested 60% was performing well, 25% fair and some 15% poorly.