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# A Bright Future for Roads and Sustainability

## Emerging Issues for Road Construction and Maintenance – A Futuristic View

In the coming decades the design, delivery, and maintenance of roads will be increasingly influenced by issues related to sustainability (See Table 1), presenting a range of opportunities for new and improved approaches. An example of this is the impact of climate change and associated extreme weather events, such as the extensive flooding in January 2011 in Queensland, Australia. Other examples include diminishing access to road construction supplies (such as aggregate), water scarcity, and the potential for increases in oil and electricity prices. Many of these considerations have not had a noticeable influence on roads in the past and will require new thinking and strategies.

Given that roads typically have a design life of 20 to 40 years, with bridges being designed for up to 100 years, the level of consideration of future trends related to environmental and carbon impacts, economic risks, and social movements associated with roads will have a significant impact on their long-term associated costs and future.

**Table 1:** Potential increasing pressures on the future of roads [1,2]

| | |
|---|---|
| ↘ Climate change | ↘ Employment and skill shortages |
| ↘ Rising price of oil | ↘ Water scarcity |
| ↘ Increased community action | ↘ A price on carbon |
| ↘ Decreasing access to resources | ↘ Rapid urbanisation and densification |
| ↘ Population growth | ↘ Increased frequency and intensity of extreme weather events |
| ↘ Increased road freight | |
| ↘ Maintenance costs | |

In Australia, such new strategies will need to take into account the variety of needs resulting from the country's geographical and population diversity, expansive road networks, road freight requirements and relatively small population base. For instance, in Australia there is some 814 000 kilometres[3] of road network that spans a wide range of geographic areas. There are also significant economic considerations, considering that the cost of road construction in Australia is estimated to be in the order of $17.5 billion per year, and maintenance costs in the order of $5 billion per year and rising.[4]

The good news is that there is a bright future for roads. Road building is inherently an efficient practice that seeks to minimise costs related to construction and maintenance, with a range of practices that can be called upon for the basis of strategies to address current and future environmental issues. Such practices include:

- ↘ Balancing earthworks to optimise cut and fill
- ↘ Utilising local sources to minimise the import of materials
- ↘ Stabilising additives to adapt local marginal materials
- ↘ Ensuring impacts on the local environment and biodiversity are appropriately managed and revegetated
- ↘ Road water runoff capture and treatment
- ↘ Optimising pavement thickness for anticipated conditions and loads
- ↘ Effective scheduling of associated capital expenditure and rapid delivery.

These practices have enhanced Australia's extensive road infrastructure over the last two decades and will be a key part of road building in the coming decades as part of the response to a changing climate. There are also a number of emerging innovations that are promising significant reductions in environmental pressures, such as:

- ↘ Technological advances in the asphalt process to create a "warm mix"[5] reducing emissions and toxic fumes
- ↘ In-situ stabilisation reducing raw aggregate and energy requirements (foamed bitumen trial - Qld DTMR),[6] and bauxite and alkali activation technology[7,8]
- ↘ Recycling of aggregates and concrete[9] specifications such as the "Queensland Main Roads Specification MRS35 – Recycled Materials for Pavements"[10]
- ↘ The use of residues from the production of bauxite as a road base material in Western Australia[11]
- ↘ Innovations that sequester carbon are emerging with prototype solutions for concrete and aggregates
- ↘ The use of waste plastic and glass in road construction, supported by the Packaging Stewardship Forum and NSW's Transport Road and Maritime Authority[12]

To date innovations in sustainable road construction practices have been given little incentive, with technology focused on engineering design for speed and safety of roads. Internationally, road networks are entering a new chapter in formation and function – the next "wave of innovation" – including for example natural rubber being used to bind marginal (local) material, plant based bitumen alternatives, pavements that generate energy, and roads that incorporate recycled plastic bags.

Alongside such innovation, the coming decade will see a change in focus from "environmental management" that minimises footprint and ecological disturbance, to a second generation of environmental reporting requiring a focus on issues regarding availability (alternative sources) and transport of resources required (reducing greenhouse gas emissions), to construct and maintain roads. Such a shift in focus is imperative and urgent to give road authorities time to create road networks that are resilient to significant environmental and resource related challenges in the future.

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1 *Note: Information, recommendations and opinions expressed are not intended to address the specific circumstances of any particular individual or entity. This table has been produced for general information only and does not represent a statement of the policy of the participants of the stakeholder workshop, the SBEnrc, or the SBEnrc partner organisations.*

2 *Source: Drawing on the findings of SBEnrc Stakeholder Workshops, Hosted by Western Australian Main Roads in Perth on 12 July 2011, and QLD Department of Transport and Main Roads in Brisbane on 09 September 2011, facilitated by Curtin University and QUT.*

3 *Bureau of Infrastructure, Transport and Regional Economics (2009) Transport Statistics Yearbook, Australian Government, Department of Infrastructure and Transport, Canberra.*

4 *BIS Shrapnel (n.d.) 'Infrastructure and Mining', Road Maintenance in Australia 2010-2025, www.bis.com.au/reports/rma_r.html, accessed 5 April 2011.*

5 *Renegar, G. (2007) 'Warm Mix Asphalt: Innovation to Implementation', in proceedings of the Australian Asphalt Pavements Association 2007 Pavements Industry Conference, Sydney.*

6 *Kendall, M., Baker, B., Evans, P., and Ramanujam, J. (1999) 'Foamed Bitumen Stabilisation', in proceedings of the Foamed Bitumen Stabilisation – Southern Region Symposium, Brisbane, Queensland, pp1–18.*

7 *Glasby, T. (n.d.) 'EFC (Earth Friendly Concrete): Developing and commercialising geopolymer concrete in the QLD market', Wagners presentation to AGIC, www.agic.net.au/wagners_efc_-_earth_friendly_concrete.pdf, accessed 20 July 2011.*

8 *Earthco Projects (n.d.) 'PolyCom Stabilising Aid For Road Maintenance and Construction', www.earthcoprojects.com.au/, accessed 20 July 2011.*

9 *Alex Fraser Group (n.d.) '$45 million Western Metropolitan Recycling Facility, owned and operated by the Alex Fraser Group', media release, www.alexfraser.com.au/laverton-site-information.html, accessed 20 July 2011.*

10 *QLD Department of Main Roads (2011) 'MRS35 Recycled Materials for Pavements', www.tmr.qld.gov.au/~/media/93a924b3-6256-4c06-ba8f-c392598da288/mrs35.pdf, accessed 20 July 2011.*

11 *Centre for Sustainable Resource Processing (n.d.) 'ReSand® Production to Specification (3B4)', Project Summary, www.asdi.curtin.edu.au/csrp/projects/3b4.html, accessed 20 July 2011.*

12 *Australian Food and Grocery Council (2010) 'Recycled Glass a Sustainable Alternative in Road Construction', 2 July 2010, www.afgc.org.au/media-releases/286-recycled-glass-a-sustainable-alternative-in-road-construction.html, accessed 20 July 2011.*