

Project 1.3

The Future of Roads: The Role of Road Building in Reducing Environmental Pressures and both Mitigating and Adapting to Climate Change



RESEARCH PROGRAM 1: GREENING THE BUILT ENVIRONMENT

Stakeholder Engagement Report – Perth and Brisbane Stakeholder Workshops

Workshop Details

Date:	Wednesday 12 July 2011	Time:	9:30am – 3:30pm
Venue:	Don Aitken Centre, Perth	Facilitators:	C. Hargroves (Curtin), L. Whistler (QUT)
Team:	L. Whistler, A. Farr, D. Sparks, A. Matan, J. Beauson, C. Hargroves, and C. Desha.		

Date:	Friday 09 September 2011	Time:	9:30am – 3:30pm
Venue:	Main Roads Spring Hill Office Complex, Brisbane	Facilitators:	L. Whistler (QUT), C. Desha
Team:	L. Whistler, C. Desha, A. Farr, A. Matan, O. El-Baghdadi, G. Field, A. Reeve.		

Workshop Context

As part of the Sustainable Built Environment National Research Centre (SBEnc) a research team from Curtin University and Queensland University of Technology (QUT) held a series of stakeholder and experts' workshops in Perth, Western Australia and Brisbane, Queensland. Topics investigated in the three workshops included: the post-occupancy assessment of the performance of green commercial/office buildings; an investigation into the role that roads will play in supporting Australia's response to climate change and other associated challenges; and a consideration of the application of E. O. Wilson's concept of 'Biophilia' to urban planning to enhance Australian cities.

Along with a project focused on sustainable infrastructure procurement based at Swinburne University and QUT and led by Professor Russell Kenley, the projects make up the first round of projects as part of the SBEnc '*Greening the Built Environment*' program led by Professor Peter Newman, Curtin University. The program is investigating important aspects of greening the built environment that will assist Australia to respond to growing environmental, social and economic issues related to climate change and other environmental pressures. The projects are designed as industry collaborations and involve a number of government and industry partners.

Interested parties, stakeholders, SBEnc partners, and experts in the field were invited to join each of the three workshops to contribute to informing the direction of the first stage of each of the projects, which will be completed in September 2012. Based on the learnings of the first stage, the second stage of each project will be developed in close consultation with

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stakeholders and partners, beginning October 2012. The workshops were aimed at learning from the experiences of participants, identifying a range of challenges the research team must consider, and gaining a strong understanding of how the research can directly support and enhance industry and government practices and policies. Hence, the workshops were a valuable opportunity for the research teams to engage with the project partners and experts in the field to ensure that the projects are well informed and guided towards tangible outcomes.

Overview of Project

In the coming decades the design, construction and maintenance of roads will face a range of new challenges - that in many ways will bear little resemblance to the challenges previously faced - and as such will require a number of new approaches. Such challenges will result from a growing number of interconnected environmental, social and economic factors, which are set to apply significant pressure on the future of roads. For instance, environmental pressures will include the impacts of climate change on rainfall patterns and temperature profiles; economic pressure will be affected by shifting global economic balances and flows, and will include materials and resources shortages, along with predicted increases in energy and resource prices globally, and social pressures will include potential shifts to lighter vehicles, reduced use of cars due to higher fuel costs, and political pressure to respond to climate change.

When considering the impact on the world's economies of such pressures it is sobering to consider that the distance covered by roads around the world is more than 34 million kilometres, nearly 90 times the distance from the Earth to the Moon. 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 environmental impacts, economic risks, and social trends associated with roads will have a significant impact on the long term associated costs and impacts. With this in mind a number of Australian state governments are investigating the likely influences on the future of roads and considering how a strategic response can be informed – the impetus for this project.

It is also important to consider the direct environmental impact of roads because of their role in our society and the scale of the infrastructure we have built to date. It is also important, but more challenging, to consider the indirect environmental impact of roads through their end-use as transportation corridors, and how this might be addressed through strategic directions in road building. For example, roads support an automobile industry that employs millions of people and sells a copy of its product every 1.5 seconds.¹ Road infrastructure also supports vehicles that combust 310,000 barrels of oil every day in Australia and emit 17 percent of

¹ Worldmeters.info (n.d.) 'Cars produced in the world International Organization of Motor Vehicle Manufacturers (OICA)', www.worldmeters.info/cars, accessed 20 July 2011.

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Australia's greenhouse gases in turn threatening global climatic stability, local ecology and agriculture industries. The SBEnc 'Future of Roads' project is a collaboration between academia, government and industry to combine world class research with both operational understanding and policy experience to inform the consideration of the increasing pressures that will face roads in the future.

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Workshop Summary

The Perth workshop was hosted by Main Roads Western Australia. The SBEnc Research Team wishes to thank Menno Henneveld and his project leadership team led by Leo Coci, Rob Giles, Ed Nieman and Louis Bettini for their support and commitment to the research project. The Brisbane workshop was hosted by Transport and Main Roads Queensland. The SBEnc wishes to thank Ross Guppy and his project leadership team, Jon Oxford, John Spathonis and Cameron Alexander. The workshops aimed to engage with partners and stakeholders to provide direct input into the research directions of the project. Participants were asked to provide feedback on the progress of the research team to date through a facilitated process and to then co-create the framework considerations going forward. The first part of both workshops focused on participants reviewing key suggested topics related to reducing the environmental pressures from road building. Stakeholders were then asked to identify critical indicators for roads in the future based on a discussion of potential future considerations, risks and pressures. The afternoon session identified scenarios for the future of roads and then discussed how these scenarios might be developed to deliver tangible benefit to stakeholders.



Figure 1 – Brisbane Workshop Participants

A typical workshop run sheet can be found in Appendix A.

Key Workshop Goals:

1. Define, discuss and prioritise the existing environmental pressures with industry stakeholders,
2. Determine the key indicators that will impact on future road construction projects, and
3. Obtain ideas key aspects of the scenarios that will be of use to stakeholders.

The workshop also aimed to identify a number of other sub-items, including;

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- identify existing barriers to implementation of innovations,
- hierarchy of roads, road governance and management influence,
- identify any industry 'hot buttons',
- identify the innovation heroes emerging from the gathered stakeholders.

The Future of Roads workshop in Perth was attended by fifteen participants in addition to a number of members of the research team. The majority of participants were from the Main Roads Western Australia. Other workshop participants were from Alcoa World Alumina (red sand by-product) Queensland University of Technology, Curtin University Sustainability Policy Institute, and industry practitioners. In Brisbane, the workshop attracted thirty participants with a broad cross section of professions ranging from public servants to consultants, contractors, industry associations and academia. A list of participants is given in Appendix B.

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Workshop Facilitation Process

The Future of Roads workshops were facilitated by Luke Whistler, Charlie Hargroves and Cheryl Desha. The workshop followed a semi-structured style and incorporated three main stages:

1. Overview of 'Future of Roads - Part 1' (FoR1)- an outline of research indicators of the environmental pressures related to road construction;

The purpose of this stage of the workshop was to provide an introduction to the research project and allow stakeholders to review the proposed table of contents. Participants were asked to provide feedback on the project structure, highlight relevant areas and identify any perceived gaps.

2. Overview of 'Future of Roads – Part 2' (FoR2)- Discussion of potential future global changes, positive and negative;

The purpose of this stage of the workshop was to seek expert insight into possible future indicators for successful road projects. Workshop participants were divided into industry expert groups to discuss the potential for measurable indicators for new road projects.

3. Overview of 'Future of Roads – Part 3' (For3) - Identification of potential scenarios and the key deliverables from a scenario analysis that would be of use to stakeholders;

The purpose of this stage of the workshop was to seek stakeholder input regarding potential outcomes from the development of scenarios. Participants were asked to both describe probable future scenarios and nominate considerations for the development of scenarios that would increase their relevance and suitability for use.

Participants were clustered into table groups of 3 to 5 participants based on a work breakdown structure (environment, drainage, pavements, operation/maintenance and construction). The discussions and activities used several techniques to provide discussion and capture information, including:

- a) Gap Analysis and Critique: *This technique was used for workshop session 1 (Introduction to FoR 1). The purpose of using this technique was to: a) analyse gaps in the research and, b) capture individual feedback on the proposed table of contents to provide assurance of the project direction.*
- b) Whole of workshop brainstorming and discussions, with ideas and findings documents on a whiteboard: *This technique was used for workshop session 2 (possible future pressures). The purpose of using this technique was to: a) provoke group discussion regarding potential global changes and the resulting pressures for road, b) capture a diversity of ideas and c) prioritises the most relevant and important issues for the stakeholders.*
- c) Rotating control group. Based on Main Roads standard specification categories sub-group discussions were carried out with reporting on butchers paper. Each group rotates and

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- provides written cautions and comments on other group proposals with a presentation of records at the end: *This technique was used for workshop session 2 (possible future pressures and key indicators for assessment). The purpose of using this technique was to: a) provoke group discussion regarding the key indicators required to mitigate the risk of future pressures; b) use rotating groups to expand on proposal and provide alternative perspectives to strengthen/doubt the indicators listed.*
- d) Whole of workshop brainstorming and discussions, with ideas and findings documents on a whiteboard: *This technique was used for workshop at the afternoon session on FoR 3 to investigate what is important for analysing possible scenarios. The purpose of using this technique was to: a) quickly determine any emerging consensus; b) capture the findings of this discussion to provide steering for the investigation focus for this topic.*
- e) In Brisbane the workshop also involved a clustering exercise to determine the most probable scenarios. Participants were asked to individually brainstorm scenarios onto sticky notes and then group them with other participant's ideas to construct a clustered pin-up (see Figure 2) which quickly showed the critical scenarios as identified by the group.



Figure 2 – Results of the Scenario Identification Activity

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Workshop Discussion and Key Outcomes

Session 1: Introduction – Reducing the environmental pressures of current road construction

The purpose of this session was to analyse gaps in the research and capture individual feedback on the proposed table of contents to provide assurance of the project direction. The participants notes highlight the focus areas they see the project needing to address (based on a gap analysis and critique of the proposed FoR1 Table on Contents) is listed in Appendix C.

The aim of the first session (FoR1) was to define, discuss and prioritise the existing environmental pressures with industry stakeholders. The findings assured the research team that the research focus was on the right path and with only minor gaps identified. The data collected reveals that priority topics for each state are as follows:

Perth

The results from the first activity revealed the important trends in the current research. A basic data analysis showed that aggregates are a key concern for the road industry in Perth with the identification of aggregate alternatives ranking highly as a research direction. The process of aggregate replacement (for example by in situ stabilization or through the use of geopolymers) garnered the most attention with the category of aggregate alternatives. Another significant research item was asphalt with most interest directed towards innovative processes such as warm or cold mix designs.

A significant gap was identified by workshop participants as the classification of water as a resource, and indeed as a particularly critical resource. This has been noted by the research team and will be incorporated into future research documentation.

Brisbane

The Brisbane data analysis revealed similar trends as in Perth. Aggregates remain a key priority area, with the identification of aggregate replacement materials of most significant concern. Some focus was also directed towards the road material construction process, specifically the transportation and placement of aggregates.

The environmental impact of bitumen and asphalt attracted reasonable interest from the workshop attendants, with most priority given to innovative processes such as warm mix technologies and bitumen alternatives considering the vulnerability of fossil fuels. Less significant was the level of interest surrounding concrete, with the most mentioned topic being cement alternatives such as geopolymers.

Watersheds and biodiversity garnered little attention, and while this in no way detracts from the importance of these elements in sustainable road construction, it does highlight the limited scope that these areas present for reducing the environmental impacts of road construction.

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Overall, the results of the first exercise in Brisbane again confirmed the initial research directions, and identified some important gaps in the current contents of research, namely recycled asphalt pavement, bitumen alternatives, pavement design, the capacity for research and testing, and noise constraints. As a result of the workshops, these elements will be integrated into the continuing research.

Session 2: Discussion of potential future global changes, positive and negative

Session 2 began with a group brainstorm to identify future global changes (not road-specific), listed in table 1. Participants were asked to name both positive and negative changes in order to conceptually develop a picture of the future global environment for the road construction industry. Distinct trends emerged in the form of overarching themes. The themes common to both workshops were climate change, the rising price of oil, water scarcity and the increased importance of the community as a key stakeholder. Participants of the Brisbane workshop identified population growth and the changing influence of the governments as particularly important, which generally reflects specific pressures that exist in Queensland. Interestingly, only the Perth workshop participants identified research shortages as a key global change - Brisbane participants listed the shortage of resources as an accessibility issue rather than a decreasing supply. This may reflect on WA's long history of resource shortages and changing outlooks within the road construction industry on the long term viability of resource use in Western Australia.

Table 1: *A brainstorm of increasing global pressures, as identified by workshop participants in Perth and Brisbane*

Pressures Common Across Brisbane and Perth	Pressures identified only at Perth Workshop	Pressures identified only at Brisbane Workshop
<ul style="list-style-type: none"> • Climate Change* • Rising Price of Oil* • Water Scarcity* • Increased Community Action* • Decreasing access to resources* • A price on Carbon • Technology Innovation • Rapid Urbanization and Densification • Increased use of social networking • Increased use of smart phones and applications 	<ul style="list-style-type: none"> • Resource Shortages* • Global Financial Crisis* • Biodiversity Collapse • Loss of Agricultural Land • Increased Automation • Waste Reduction and Harnessing • Growing middle class • Peaking of Food Production 	<ul style="list-style-type: none"> • Population Growth* • Government* • Increased Freight* • Maintenance* • Increased community expectations of transport network* • Employment and Skill shortages* • Alternative fuel source • Changing world powers • Intergenerational Responsibility • The influence of the

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<ul style="list-style-type: none"> • Modal Shifts • Frequency and Intensity of Extreme Weather Events • Growing environmental awareness and cooperation 		<p>government</p> <ul style="list-style-type: none"> • Decentralisation • Congestion • Globalised tourism • Health costs and Impacts • Changing lifestyles affecting mobility • New transport paradigms • Short Political Cycles • Skill shortages • Energy Generation
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Note: Information, recommendations and opinions expressed herein 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.

** Denotes the perceived most influential increasing pressures on the future of roads.*

Source: SBEnrc Stakeholder Workshop, Hosted by Western Australian Main Roads, Facilitated by Curtin University and QUT, 12 July 2011, Perth.

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This second part of this session formed sub-groups based on Main Roads standard specification categories. There were:

- A. Drainage
- B. Pavement/Surfacing
- C. Environment
- D. Construction/ Delivery/ Cost
- E. Maintenance/ Operations.

As part of the provocation to consider the increasing pressures on the future of roads the participants were provided with a list of the preliminary themes from the Australian Green Infrastructure Council Rating Tool that is currently under development, shown in Table 2.

Table 2: Australian Green Infrastructure Council Rating Tool (Preliminary Themes)

<ul style="list-style-type: none">- Purchasing & Procurement,- Reporting & Responsibilities,- Making Decisions,- Climate Change Adaptation,- Knowledge Sharing & Capacity Building,- Value For Money,- Economic Life,- Energy Use,- Water,- Materials Selection & Use,- Greenhouse Gas Management,- Discharges to Air, Land & Water,	<ul style="list-style-type: none">- Land Management,- Waste Management,- Functioning Ecosystems,- Enhanced Biodiversity,- Participatory Processes,- Positive Legacy,- Urban & Landscape Design,- Knowledge Sharing,- Capacity Building,- Increased Knowledge and Applied Sustainability, and- Equity.
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Note: Four sub-categories are yet to be decided and are currently under review.

Source: Australian Green Infrastructure Council.

The workshop resulted in a list of the metric indicators required to identify project risk items and also mitigate the risk of future pressures. The significant records captured from the workshop have been analysed and collated to provide the list presented in Appendix D.

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Session 3: Identification of possible future scenarios for roads in Australia

In Perth the likely scenarios revolved around shortages of resources, specifically the shortage of materials needed for the construction of roads, pavements and water shortages. In addition, the scenario discussion at the Perth workshop revolved around water issues, both increases of flood events and shortages of water as a material. The scenario discussion and development at the Perth workshop was limited due to time constraints resulting from a greater focus on session 2, but provides a platform into further scenario development. The scenarios discussed are presented in Appendix E and F.

In Brisbane the workshop involved a clustering exercise to determine the most probable scenarios. Participants were asked to individually brainstorm scenarios onto sticky notes and then group them with other participant's ideas to construct a clustered pin-up which quickly showed the critical scenarios as identified by the group. The results of this exercise are given in Figure 2 with raw data available in Appendix F.

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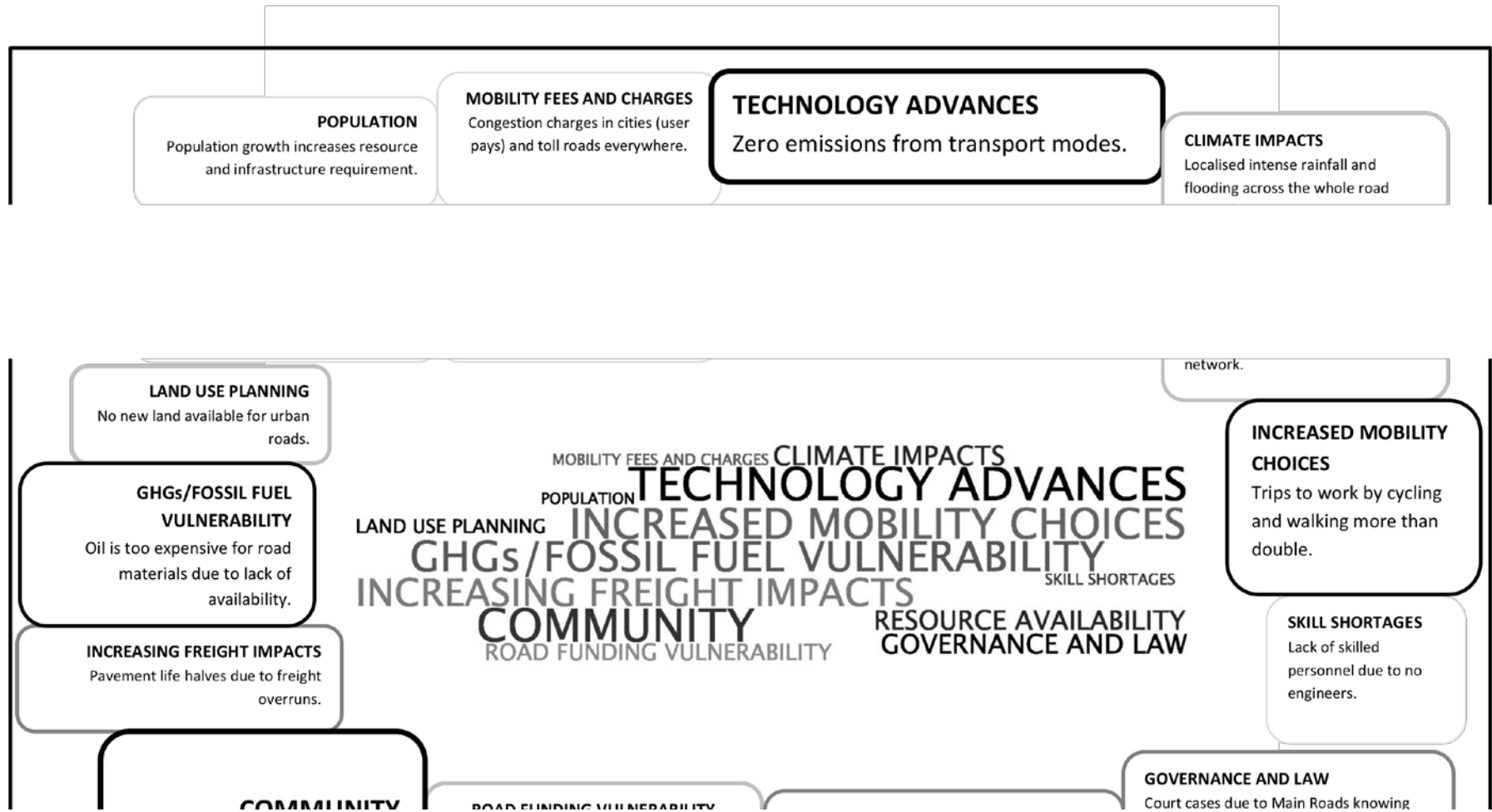


Figure 3 Scenarios Brisbane workshop

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Participants were asked to identify the key outputs of a scenario planning methodology. The following list was provided as a provocation for the kinds of outputs that might be provided by this planning tool:

1. The likelihood of any given scenario.
2. The risks to industry that the scenario creates.
3. The trends that will be experienced leading to a particular scenario.
4. The required governance and policy strategies.
5. The economic issues that will arise from the scenario.

Participants at the Perth Workshop identified the following important scenario deliverables (a full list has been given in Appendix E:

- Identify capacity building and job creation opportunities
- Identify options for positive legacy
- Educate government that there are new scenarios that we are not prepared for
- Show wider use/ function of roads
- Inform risk identification/management
- Likelihood of scenario – indicative timeline
- What does it look like – response needed?
- Demonstrate the need for progressive leadership/governance
- Economics
- Inform efforts to build/increase resilience of system

The scenario discussion conducted by participants at the Brisbane workshop followed a different format (as discussed above) from the Perth workshop, with participants focusing on potential scenario inputs or trends rather than primarily on scenario deliverables. The Brisbane workshop scenarios are presented in Figure 2 and Appendix E. From these identified scenarios, the participants of the Brisbane workshop determined that the best outcomes from the scenarios (the 'game changers') would be that the complexity of the whole transport system from road construction through to road use was appreciated. This includes having the best possible interfaces between all transport modes and having a whole of transport system approach rather than competing objectives between the modes which enabling mapping of people and their travel needs to travel modes.

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Project/Scope Recommendations

A key aim of the workshop was to allow the workshop findings to guide the scope and structure of the SBEnc project, ensuring that the project would deliver strategic benefits to stakeholders and partners. Listed below are key findings and considerations drawn from this process of reflection.

Session 1 - FoR1 Reduce the environmental pressures of current road construction

The aim of the first session (FoR1) was to define, discuss and prioritise the existing environmental pressures with industry stakeholders. The findings assured the research team that the research focus was on the right path and no significant gaps existed. The data collected reveals that priority topics are as follows:

Perth

The key concern in Perth is resource availability, particularly aggregates and water. Significant interest was shown in further research into aggregate replacement (in-situ stabilization and red sand). The availability of water is a key concern and will be further investigated by the research team. Another significant research item was asphalt with most interest directed towards innovative processes such as warm or cold mix designs.

Brisbane

The Brisbane data analysis revealed similar trends as in Perth. Aggregates remain a key priority area, with the identification of aggregate replacement materials of most significant concern. Some focus was also directed towards the road material construction process, specifically the transportation and placement of aggregates.

The environmental impact of bitumen and asphalt attracted reasonable interest from the workshop attendants, with most priority given to innovative processes such as warm mix technologies and bitumen alternatives considering the vulnerability of fossil fuels. Less significant was the level of interest surrounding concrete, with the most mentioned topic being cement alternatives such as geopolymers.

Further research specific to these focus areas will be continued to explore best practices and global initiatives to address key concerns.

Session 2 - FoR2 Evaluate the future pressures for roads (producing an environmental, economic and social framework)

The goal of the second session (FoR2) was to determine the key indicators that will assess future road construction projects. In this process the stakeholders were asked to identify future global changes to inform the development of indicators.

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The full list of potential key indicators is vast (see Appendix D) and will be used in greater detail as the project proceeds with the Sustainability Assessment Framework for Road Infrastructure (SAFRI). The workshop focused on measurable indicators and the list provides a comprehensive review set to compare to the literature review. When analysed the indicators established in the workshop began to follow certain themes and notably align closely with the existing AGIC categories. The indicator themes established by the workshop are;

- Energy/Emissions
- Materials
- Water
- Community
- Environment
- Economics
- Legacy
- Innovation
- Maintenance

Session 3 - FoR3 Build strategies for implementing the roads of the future (utilizing scenario planning strategies)

The goal of session 3 (FoR3) was to determine the key trends to consider when developing scenarios on the roads of the future and to determine the key deliverables essential for stakeholders. These deliverables and key trends will be used to guide the project in developing an 'Innovative Scenarios for Sustainable Road Infrastructure' (ISSRI) scenario planning methodology. The potential key trends identified by the workshops were climate change and resource shortages (including labour and skill shortages along with resources such as oil and water). Underlying themes started to evolve and warrant further exploration in partnership with the respective stakeholders. These include but are not limited to freight impacts on network and safety, modal shifts, maintenance cost burdens and funding models like user pays systems.

The workshops also identified key considerations for the development of future scenarios for roads and considered aspects that would be critical for analysing the scenarios. Of particular interest to the stakeholders was that the scenarios enable them to be able to deal with surprise (environmentally and financially), to determine the appropriate response, enable them to develop relationships (collaboration) across stakeholders and disciplines, inspiration, enabling political frameworks to be respond to events beyond political timeframes, inform risk identification/management and also illustrate a wider use and function of roads than is currently considered within road agencies.