



# CRC for Construction Innovation

**ANNUAL REPORT 2007-08**

*Established and supported under the Australian Government's  
Cooperative Research Centres Program*



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## 1.0 Executive Summary

### 1.1 Achievements and Activities of the CRC in relation to research, commercialisation/utilisation and education outcomes for the reporting period

This year saw the commencement of an additional five projects under the Extension Program planned for the two years from 1 July 2007 to 30 June 2009. This overlaps with the now extended life of one year for our CRC to 30 June 2009. This Extension Program has been highly supported by our Participants and has encouraged the engagement of six additional Participants — Leighton Contractors, Mirvac, Nexus Point Solutions, Sydney Opera House, Transfield Services Australia and Thiess. Having been unsuccessful in the 2006 CRC Program Selection Round, we believe this level of engagement clearly demonstrates the recognition our CRC has received in the property, planning, design, property, construction and facility management industries in which we are the key facilitator of research and implementation nationally. Our public and private industry Participants value our CRC's collaborative efforts as in many cases their own research areas have been consolidated into our Centre's activities. Having been in existence now for seven years, the strength of our Participants' collaboration has reached a mature level, the *storming* and *norming* of group formation has occurred and the group is at that point where the *whole* is providing more than *the sum of the individual* efforts. On-going investment in this unique national collaboration is a priority for our industry's future.

Our Extension Program, the focus of our research for 2007–08 and 2008–09, is across three areas with Industry Taskforces established to oversee the work to ensure that industry is intimately engaged in the strategic oversight and dissemination of the research. Firstly, the Integrated Digital Modelling Program Taskforce is chaired by Andrew Gutteridge of the Australian Institute of Architects. This program is contributing to international standards for the digital modelling of roads, site works, underground services and landscaping; producing a National Guideline for digital building models that will allow sharing of data between the design, construct and facility management sectors of the industry; and documenting suitable information technology platforms that allow for on-line collaboration between design and construct project team members.

The Construction Safety Program continues our previous highly successful work in safety with a focussed project in developing safety effectiveness indicators. The third area has a Taskforce chaired by Tony Barry, Chief Operating Officer, Connell Wagner on behalf of the Built Environment Design Professionals overseeing the Procurement and Dispute Resolution Program which is analysing the costs to the community resulting from contractual disputes in construction and improving systems for more effectively avoiding and resolving disputes.

Other key outcomes from continuing research projects concluding this year include the following. The completion of the *Your Building* web portal to help owners, developers, designers, builders, tenants and facility managers create and manage more sustainable commercial buildings. This is delivered, for example, by providing case studies and practical advice about energy-saving design and technologies, recycling and water efficiency, reducing greenhouse gas emissions and other sustainability initiatives incorporating environmental, business and social outcomes. Negotiations are being finalised to transfer *Your Building* to the Property Council of Australia (PCA). This tangible industry support to continue this initiative acknowledges the importance of this leading research outcome for industry. The PCA will add to the content and improve access by various media paths including video streaming, on-line courses and blogs.

The publications, *Wayfinding design guidelines* and *Wayfinding system audit* resulting from research identifying wayfinding systems, technologies and devices appropriate for people with sensory impairment was supported by Disability Services, Queensland. These publications assist designers and property managers adhere to the *Disability Services Act 2006* to ensure that the

conditions of everyday life for people with a disability are the same as, or as close as possible, to the conditions enjoyed by the general community.

The construction industry has been identified as a priority industry for safety improvement under the *National OHS Strategy 2002–2010*. A *Practical Guide to Safety Leadership* developed with the support of the Office of the Federal Safety Commissioner provides practical guidance for small-to-medium size companies to implement the *Construction Safety Competency Framework* developed previously by our CRC.

With two Participants, Curtin University of Technology and WA Department of Housing and Works joining our CRC in January 2006 as the first WA-headquartered Participants, projects based in Western Australia are now being completed and implemented by the WA Government in the area of procurement — recommendations for social policies that impact on costs of building procurement, knowledge capture from outsourced activities and a toolkit to assist government clients in the selection of the most appropriate procurement method for projects.

The *LCADesign* licence agreement with a small Australian software company has led to industry trials in the Netherlands, Germany, USA and Australia. Landmark buildings like the Sydney Opera House are using the tool on proposed refurbishment work. In his opening address to over 2,000 attendees at the SB08 World Sustainable Building Conference in Melbourne on the 22 September 2008, the Honourable Peter Garrett AM, MP, Minister for the Environment, Heritage and the Arts launched *LCADesign* — our environmental impact ‘calculator’ for commercial properties, describing it as the world-first software that ‘will provide industry with the information necessary to design buildings that are ecologically and economically sustainable’.

Closer linkages with buildingSMART and the International Council for Research and Innovation in Building and Construction (CIB) have provided us with valuable international relationships to ensure our work is recognised globally and ensures rigorous peer review of our research outputs. buildingSMART has reviewed much of our Building Information Model (BIM) work in the Extension Program and with the commercialisation work of *LCADesign* and *Automated Estimator*. CIB has provided us with international audiences for much of the dissemination of our project outputs through refereed conferences and with the opportunity to engage specifically through a number of TaskForces, such as TG58 — Clients and Construction Innovation.

Our Third International Conference — *Clients Driving Innovation: Benefiting from Innovation* — held at the Surfers Paradise Marriott Resort from 12–14 March 2008 was an overwhelming success. Over 200 delegates representing 11 countries attended presentations delivered by more than 75 industry, government and research representatives from around the globe. These were across the key themes — sustainable construction for the future, meeting client needs, industry development, procurement and risk management, facility management, ICTs improving efficiencies, and occupational health and safety. The program featured an equal contribution of presentations from industry/government and research. Almost 70 per cent of attendees were from industry and government exemplifying the strong interest in our CRC’s research and implementation initiatives, and highlighting the strengthening support from Australian and international research users.

This year has seen the introduction of a comprehensive Education and Skills Development Program. It followed a ‘testing of the market’ in November 2007. The 5 two-day and 12 half-day workshops attracted approximately 400 attendees during the course of the Program. Given the positive feedback from these workshops, we are developing further targeted industry skills-development programs for the future.

## **1.2 Risks, opportunities and responses to the above**

The development of the Extension Program consisting of new projects followed the notification that our CRC had been unsuccessful in the 2006 CRC Program Selection Round. The rationale for the Extension Program was to continue active engagement of existing Participants. It has also allowed

new Participants that expressed interest in our 2006 bid to join giving them the opportunity to become familiar with the CRC environment. This has allowed us to jointly prepare for the 2008/09 CRC Program Selection Round.

Our challenge is maintaining the momentum of this key group when the industry is so buoyant and there is uncertainty in the selection guidelines and timelines around the next CRC funding round. Our response has been to continue to plan a new centre effective from 1 July 2009 and to undertake preliminary work in the January — June 2009 period for the program activities being developed for the successor to the CRC for Construction Innovation – the Sustainable Built Environment Centre.

### **1.3 Impediments to achievement of the CRC's objectives experienced during the year and strategies adopted to address these**

The increasing volume of construction work happening across Australia makes it a challenge to engage industry at the level required by industry Project Leaders. We have addressed this by employing full or part-time support staff to assist with project management, administration and coordination. The Industry Taskforce approach worked very successfully on two projects previously. Therefore, we have introduced that approach for the three Programs within the new research Extension Program. As the Taskforce members are senior executive representatives from industry and professional associations and their time is provided as a service to industry, CRC headquarter personnel oversee the operation of the Taskforces.

### **1.4 Awards, special commendations, CRC highlights**

#### **Awards, special commendations**

*Project of the Year, 2007 Association of Consulting Engineers Australia (ACEA) Awards for Excellence.* Awarded to Sydney Opera House Facility Management Exemplar project, in conjunction with our CRC Participant, Arup (30 November 2007)

*IFAWPCA Atsumi Award, 2007 International Federation of Asian and Western Pacific Contractors' Associations (IFAWPCA) International Awards.* Awarded to Dean Cipolla, John Holland Group for his leadership of CRC Project *Construction Site Safety Culture* (10 November 2007)

*Excellence Award (R&D), 2007 Australian Institute of Building National Professional Awards.* Awarded to *Construction Site Safety Culture: A Safety Management Competency System for the Construction Industry* (21 September 2007)

*Judges' High Commendation, 2007 Australian Institute of Project Management Achievement Awards.* Awarded to *Construction Site Safety Culture: A Safety Management Competency System for the Construction Industry* (30 August 2007)

*Queensland Government 2007 Disability Action Week Award, Building and Accessible Environments Category.* Awarded to *Wayfinding in the Built Environment* (17 July 2007)

#### **CRC highlights**

Below are some of the highlights of our CRC for 2007–08.

Our CRC's safety initiatives have achieved significant impact and acclaim. *Guide to Best Practice for Safer Construction* was launched by former Federal Employment and Workplace Relations Minister, the Honourable Joe Hockey, at an industry-wide event at Parliament House in Canberra on 12 September 2007.

The former Minister for Workplace Relations Kevin Andrews in Melbourne on 22 September 2006 launched our CRC's *Construction Safety Competency Framework*, and in Canberra on 24 June 2008 the Federal Safety Commissioner launched our *A Practical Guide to Safety Leadership*, sponsored by the Office of the Federal Commissioner. *This Guide* provides assistance to implement the competency framework developed in the publication — *A Construction Safety Competency Framework: Improving OH&S performance by creating and maintaining a safety culture*.

The *Your Building* web portal for sustainable commercial buildings was launched on Friday 28 September 2007 at Stockland's offices in Castlereagh Street, Sydney. The *Your Building* initiative is a \$1.5 million internet portal which builds industry capacity to create green and profitable commercial buildings. It is anticipated before the end of the 2008 calendar year the website will be relocated to the PCA to ensure continuity of the site's industry engagement and development. Feedback from our private sector partners indicates the industry is highly supportive of this move as it gives the site further credibility and additional resources for its development.

The extension of our CRC for an eighth year in 2008–09 was agreed in the Commonwealth Agreement Variation dated 2 January 2008. This extension has allowed an additional five research projects in the Extension Program to be conducted with a value of over \$800,000 fully funded by Participants. It has also seen the addition of six new industry Participants - Leighton Contractors, Mirvac, Nexus Point Solutions, Sydney Opera House, Transfield Services Australia and Thiess.

Our Third International Conference — *Clients Driving Innovation: Benefiting from Innovation* — held at the Surfers Paradise Marriott Resort from 12–14 March 2008 was an overwhelming success. Over 200 delegates representing 11 countries attended presentations delivered by more than 75 industry, government and research representatives from around the globe. These were across the key themes sustainable construction for the future, meeting client needs, industry development, procurement and risk management, facility management, ICTs improving efficiencies and occupational health and safety. The program featured an equal contribution of presentations from industry/government and research.

The value of industry and research collaboration record was emphasised throughout the Conference, and it was pleasing to see how the blend of technological, management and process innovations offered our industry a fresh and exciting future. Once again, the contribution of global leaders from industry professionals and researchers underpinned the success of the Conference. Our eight keynote presenters were Prof Martin Fischer of Stanford University (USA); Dr Mike Williams, PB International (USA); Prof Peter Brandon, University of Salford (UK); Brendan Crotty, former CEO and Managing Director of Australand (Australia); Dr Ben Schwegler of Walt Disney Imagineering (USA); Dr Calvin Kam of Optima and formerly US General Services Administration (USA); Dr Dennis Shelden of Gehry Technologies (USA) and Dr Keith Futcher of ISS Facility Services (Hong Kong). Five of these keynote presenters were new to our CRC conference history and extended the international reach of our centre.

Our CRC also received very positive feedback from delegates regarding the *Future Leaders Forum* — *The Future of Australia's Building and Infrastructure Industry* a special session during our Third International Conference. The Forum played an important role in highlighting the need to address the career goals of our future leaders and the importance of industry practitioners, government policy analysts and clients, and researchers collaborating for a more promising joint future. The Forum was expertly facilitated by Mike Wilke, former Chief Operating Officer and President, PB Americas (USA).

During his address, Tim Mackey, Deputy Secretary, Department of Innovation, Industry, Science and Research highlighted the new Federal Government's recognition of the value of Australia's construction industry and our CRC for *Construction Innovation's* acknowledged successes. During the formal dinner address, Angelo Conte, General Manager, Major Projects, Specialist Businesses, John Holland consolidated the message to government of the need for industry R&D support and applauded our CRC's successes for firms and industry as a whole.

The conference provided an ideal forum for the hosting of national and international groups, including a meeting of our CRC's Research Committee with CRC scholars and meetings of CIB Working Commissions and Task Groups.

*Construction Innovation* also capitalised on the attendance of international leaders to provide additional value for our partners. For example, Prof Martin Fischer, Dr Ben Schwegler and Dr Calvin Kam undertook a series of meetings in the three days preceding the conference with senior public and private sector leaders. During the week following the conference, Calvin Kam also presented on our behalf at networking forums in Melbourne and Sydney aimed at accelerating the uptake of sustainable building principles and practices in the commercial property sector. These forums were special lead-up events to the World Sustainable Building Conference SB08 held in Melbourne in September 2008. Additionally, public administrators from The Netherlands and a senior researcher from CSTB, France undertook a series of discussions with our public, private and research partners in their evaluation of *Construction Innovation* as an international model of a driver for national industry development. Opportunities such as these continue to add national and international value for our partners.

The book *Clients Driving Construction Innovation: Benefiting from Innovation* published the key papers from our Third International Conference. It was the third in the series aligned to our international conferences which focused on the role of clients in the innovation process in the construction industry. This third book builds on key frameworks, concepts and case studies presented in the earlier two volumes, *Mapping the Terrain* and *Moving Ideas into Practice*, and is a key deliverable for our CRC's leadership of the CIB Task Force 58 – Clients and Construction Innovation.

March 2008 saw the commencement of our Education and Skills Development Program throughout Australia with courses in safety, relationship management and sustainability delivered to approximately 400 people throughout Brisbane, Sydney, Melbourne and Perth.

In April 2008, *Construction Innovation* made a submission to the National Innovation System Review highlighting the value of CRC outputs to industry. Other public policy submissions include *Submission to the Senate Education, Employment and Workplace Relations Committee — Inquiry into the Effects of Climate Change on Training and Employment Needs* on 5 September 2008; and *Improving sustainable housing in Queensland* to Queensland Department of Infrastructure and Planning on 12 September 2008.

Our international industry and research collaboration was been recognised through our Chair, Mr John McCarthy's elevation to the Executive of the Board of CIB, the global network for international exchange and cooperation in research and innovation in building and construction. Mr McCarthy's role on this core leadership team is one of four office bearers leading this international association, comprising over 400 member organisations originating in some 70 countries. CIB members include most of the major national laboratories and leading universities around the world in building and construction.

## 1.5 Context and major developments during the year

*Construction Innovation* has continued in building its influential role across industry nationally, with invitations to serve on excellence judging panels across state and national awards, together with Board presentations to industry associations and firms.

|  |   |
|--|---|
| <p>A brief outline of the industry context in which the CRC operates (e.g. has there been a change in market conditions; have these changes impacted on the ability of the CRC to meet its</p> | <p>With <i>The Australian</i> reporting on 28 August 2008, 'building firms are still winning new construction projects faster than they can complete the ones on their books' with a backlog of building work in the pipeline standing at \$51.3 billion - \$10.6 billion or 26 per cent more than a year ago. Access Economics analysis shows there are investment projects worth \$162 billion under construction with commitments made for</p> |
|--|---|



|   |  |
|---|--|
| <p>objectives?).</p>  | <p>projects totalling a further \$80.1 billion. The ABS survey of building and construction shows the big engineering firms completed \$13.8 billion of work in the June quarter, 8.2 per cent more than in the same period last year and 42.5 per cent higher than the level of three years ago. This rate of growth has placed real constraints on the industry across all levels of staff to meet this demand.</p> <p>Another significant challenge emerging for the industry is the necessity to respond to climate change in an industry which is responsible for a significant amount of contributing factors. 'Climate change and the need to reduce GHG emissions, in particular CO<sub>2</sub>, is probably the most important and urgent issue facing mankind. Because buildings contribute about 40% of total emissions they should be at the frontline of the fight against global warming.' (The Dollars and Sense of Green Buildings 2008, AGBC) Given the construction of new building and infrastructure is extremely costly in environmental terms there is an increasing focus on five and six green star rating. The other dimension to this is the option to re-life existing buildings. This is potentially less costly in terms of greenhouse gases. A stronger focus on 'green infrastructure' is emerging as a key industry driver and on this CRC is rising to address.</p> <p>These changes in the industry context have placed demands on the ability of the end-users to be engaged in our CRC projects due to the level of activity within the industry. However, this deterrent has been overshadowed by the need to be engaged to meet the industry challenges.</p>                           |
| <p>An explanation of any major developments or initiatives including:</p> <p>Actions undertaken in relation to internal and/or external reviews, recommendations resulting from these reviews, strategies for implementing these recommendations and any resulting difficulties for the CRC anticipated by the Board; and</p> <p>Key events and changes of a substantial nature including key Staff appointments and/or changes and purchases of major equipment.</p> | <p>In October 2007, a review panel lead by the CEO, Property Council of Australia undertook a comprehensive review of our CRC focusing on our performance across all centre activities and providing advice on our positioning for future renewal funding. The other members of the panel were Prof Peter Robinson, University of Wollongong, Prof Peter Newton, Swinburne University and Mr Robin Fardoulis, National Chair, Australian Institute of Building. The panel's twelve recommendations focused entirely on the development and the business model for a new centre. The key recommendations highlighted the need for a strategic plan with clearly defined outcomes, an 'investment philosophy' approach to research funding, ensuring an industry mandate for research undertaken and establishment of a performance evaluation system. The recommendations provided have been adopted as we move to define the business model for our new centre.</p> <p>One of the strengths our participants value is the continuity of the senior management headquarter team. Program Directors (research based) and Deputy Program Directors (industry based) were appointed to each of the three original research programs. With projects starting to wind down and no additional projects commencing other than the Extension Projects, it was decided not to fill vacant Program and Deputy Program Director positions and to discontinue the positions for the 2008-09 year. The Extension Program oversight is being undertaken by the Chief Operating Officer, Research and Commercialisation with the assistance of special taskforces drawn from senior industry representation including AIA, ACA and BEDP.</p> |

## 2.0 National Research Priorities

### 2.1 National research priority goal highlights

#### ***An Environmentally Sustainable Australia***

*Your Building* is a key online resource at [www.yourbuilding.org](http://www.yourbuilding.org). The *Your Building* web portal is helping owners, tenants, developers, builders, designers and facility managers create more sustainable commercial buildings by providing case studies and practical advice about energy-saving design and technologies, recycling and water efficiency, reducing greenhouse gas (GHG) emissions and other sustainability topics incorporating environmental, business and social outcomes.

Not only does *Your Building* provide up to-date and reliable information that is comprehensive and relevant, it has a user-friendly and interactive, wiki-style interface.

High construction costs and the increasing emphasis on sustainability are directing the attention of building owners towards alternative re-Living solutions rather than demolition and new build.

“Re-Living”, featured on the *Your Building* website, outlines how to improve the serviceability of buildings and apply the principles of ecologically sustainable development. This includes decision-making processes and critical steps in the areas of project management, floor space optimisation and structural capacity, recycling and waste management, residual service life, and sustainability and building efficiency, thus contributing to the management of climate change impacts.

*Your Building* is playing a vital role in informing the industry, given that in Australia 10 per cent of national GHG emissions are produced by commercial buildings.

#### ***Promoting and Maintaining Good Health***

*Construction Innovation* has created an unprecedented alliance of industry, government and researchers committed to saving lives and preventing injuries on Australia’s construction sites. It has committed to improving safety on construction sites by providing a consistent, national approach to implementing safety leadership in large and small organisations.

#### **Striving for safer construction**

The industry-endorsed *Guide to Best Practice for Safer Construction* was the first of two key outcomes in response to the recognised need to reduce accidents and deaths in construction processes. The guide provides a framework to improve safety performance on construction projects and covers all stages of a project: planning, design, construction and post-construction.

#### **Improving safety culture**

*A Construction Safety Competency Framework* is the second key outcome focusing on safety. It is designed for safety managers and senior managers to create a positive safety culture by ensuring that key staff such as project managers, supervisors, OHS advisors and engineers can effectively execute tasks needed to better manage OHS.

This step-by-step guide instructs users on how to implement the award-winning *Construction Safety Competency Framework*. It explains the safety critical positions and safety management tasks that companies should implement to achieve a positive safety culture. In addition to industry case studies from small and large organisations which have implemented the competency framework, the guide’s value is enhanced through its concise and hands-on approach.

In response to the industry’s demand for improved consistency in the regulatory environment driven, a *Construction Innovation* report has examined and evaluated four attempts to promote consistency of OHS across Australia. It concludes that while there is a high level of information sharing between jurisdictions, particularly from the National Occupational Health and Safety Commission standards, a fragmented OHS policy framework remains in place across Australia. The Office of the Federal Safety Commissioner refers to this report for policy development on the nation harmonisation of safety legislation.

## **Technologies for Building and Transforming Australian Industries**

### **Smart information use**

**eContracting and eTendering — advancing eBusiness** - By providing recommendations on the appropriate legal requirements for information technology security structures for eContracting and eTendering and hence how to minimise and avoid risk, this research enables construction firms and their clients to operate more confidently in an electronic environment.

**Procurement toolkit — optimising strategies** - Choosing the appropriate procurement system for construction projects is a complex and challenging task for clients, particularly when professional advice has not been sought. To assist the decision-making process, a range of best-practice aligned procurement selection techniques has been consolidated into the Procurement Method Toolkit.

**Knowledge management checklist** - This checklist system will enable managers to identify knowledge management issues encountered when handling a variety of external contracts. Improving such processes will be of particular value when these contracts build upon knowledge not residing with the organisation. The system operates by mapping knowledge boundaries of government agencies and how they interface with the knowledge requirements for different contracts.

**Multi-outcome construction policies** – By examining information contained in the details of construction procurement contracts implementing government policy to support training in the construction industry, this project is providing valuable feedback to government regarding the limitations of the policies in an area, training, which is currently in extremely urgent need of being addressed.

**Building Information Model (BIM) national guidelines** - These National Guidelines for BIM will be based on experience, industry consultation and practical examples that promote consistency in the implementation of digital models for building and infrastructure projects. The guidelines will support stakeholders in achieving interoperability throughout the lifecycle of the facility and will be based on internationally accepted standards. By highlighting open and consistent processes, they will allow any practitioner to work with any other practitioner in developing shared “virtual buildings and infrastructure” projects.

### **Promoting an innovation culture and economy**

The BRITE (Building, Research, Innovation, Technology and Environment) project has been fostering innovation in Australian small business through case studies demonstrating the benefits of innovation, a national database of innovative contractors and a step-by-step guide to becoming a more innovative business.

The BRITE website of resources (refer [www.construction-innovation.info](http://www.construction-innovation.info) homepage) is helping to promote more widespread adoption of best practice. BRITE's success has been demonstrated by external reviews and industry feedback, both showing a strong trend of increased innovation awareness and activity.

**Table 1: National Research Priorities and CRC Research**

| <b>NATIONAL RESEARCH PRIORITIES</b>   | <b>CRC RESEARCH (%)</b> |
|---|-------------------------|
| <b>AN ENVIRONMENTALLY SUSTAINABLE AUSTRALIA</b> – <i>Transforming the way we use our land, water, mineral and energy resources through a better understanding of environmental systems and using new technologies</i> |                         |
| Water – a critical resource   | 10%                     |
| Transforming existing industries  | 10%                     |
| Responding to climate change and variability  | 10%                     |

| NATIONAL RESEARCH PRIORITIES   | CRC RESEARCH (%) |
|--|------------------|
| <b>PROMOTING AND MAINTAINING GOOD HEALTH</b> – <i>Promoting good health and preventing disease, particularly among young and older Australians</i>   |                  |
| Strengthening Australia's social and economic fabric   | 32%              |
| <b>FRONTIER TECHNOLOGIES FOR BUILDING AND TRANSFORMING AUSTRALIAN INDUSTRIES</b> – <i>Stimulating the growth of world-class Australian industries using innovative technologies developed from cutting-edge research</i> |                  |
| Smart information use  | 10%              |
| Promoting an innovation culture and economy  | 23%              |

### 3.0 Governance and Management

#### CEO, Governing Board Members and Committee Members

| Name  | Position/<br>Organisation   | CRC Position / Role  |
|---|---|--|
| Josh Baker<br>Key skills: <ul style="list-style-type: none"> <li>• Organisational management</li> <li>• Financial management</li> <li>• Risk management</li> <li>• Member AICD</li> </ul>   | General Manager -<br>Operational Services<br>Leighton Contractors       | Member, Board  |
| Professor Neil Furlong<br>Key skills: <ul style="list-style-type: none"> <li>• Research</li> <li>• Research management</li> <li>• IP management</li> </ul>  | Pro Vice-Chancellor<br>(Research and<br>Innovation)<br>RMIT             | Member, Board  |
| David Golightly<br>Key skills: <ul style="list-style-type: none"> <li>• Multi-discipline Construction Pre-contracts skills</li> <li>• Risk &amp; Commercial Management</li> <li>• International construction exposure &amp; experience</li> </ul> | General Manager -<br>Engineering & Estimating<br>John Holland Group     | Member, Board  |
| Ross Guppy<br>Key skills: <ul style="list-style-type: none"> <li>• Industry knowledge</li> <li>• Management experience</li> <li>• Infrastructure procurement</li> <li>• Registered Practising Engineer</li> </ul>                                 | Executive Director (Road<br>and Delivery<br>Performance)<br>QDMR        | Member, Board  |
| Andrew Johnson<br>Key skills: <ul style="list-style-type: none"> <li>• Research management experience</li> <li>• Research development</li> <li>• Member AICD</li> </ul>   | Associate Director<br>Research Division<br>(Business Development)<br>UN | Member, Board<br>Member, Audit & Compliance Committee<br>Member, Board Performance Committee |

| <b>Name</b>  | <b>Position/<br/>Organisation</b>  | <b>CRC Position / Role</b>   |
|--|--|--|
| <p>Allen Kearns</p> <p>Key skills:</p> <ul style="list-style-type: none"> <li>• Research – environmental and social assessment of urban and industrial developments</li> <li>• Research management</li> <li>• Organisational development</li> </ul>  | <p>Deputy Chief<br/>Sustainable Ecosystems<br/>CSIRO</p>                 | <p>Member, Board</p>   |
| <p>John McCarthy</p> <p>Key skills:</p> <ul style="list-style-type: none"> <li>• Highly experienced chair having chaired many national groups, including currently – AEH Property Pty Ltd and Chairman of CentreCare (NSW) Property Committee.</li> <li>• Board member of CIB – International Council for Research and Innovation in Building and Construction – and Chair of CIB's Marketing and Communication Committee and Chair of the International Organising Committee of SBO8 – the world sustainable buildings conference scheduled for Melbourne in September 2008.</li> </ul> | <p>Chair<br/>AEH Property Pty Ltd</p>                                    | <p>Chair, Board<br/>Chair, Remuneration Committee</p>  |
| <p>John Oliver</p> <p>Key skills:</p> <ul style="list-style-type: none"> <li>• Organisational management</li> <li>• Financial management</li> <li>• Industry experience</li> <li>• Experience in contractual and cost planning matters</li> </ul>  | <p>Senior Consultant<br/>Rider Levett Bucknall</p>                       | <p>Member, Board<br/>Chair, Audit &amp; Compliance Committee<br/>Chair, Board Performance Committee<br/>Member, Remuneration Committee<br/>Chair, Research Committee</p> |
| <p>Max Smith</p> <p>Key skills:</p> <ul style="list-style-type: none"> <li>• Organisational management</li> <li>• Financial management</li> <li>• Public sector procurement requirements</li> <li>• Fellow of IE Aust.</li> <li>• Fellow of AICD</li> <li>• Fellow of AIB</li> </ul>   | <p>Deputy Director-General<br/>QDPW</p>                                  | <p>Member, Board<br/>Member, Remuneration Committee</p>  |
| <p>Tony Tate</p> <p>Key skills:</p> <ul style="list-style-type: none"> <li>• Organisational management</li> <li>• Financial management</li> <li>• Research management</li> </ul>   | <p>Director<br/>Research and Development<br/>Curtin</p>                  | <p>Member, Board<br/>Member, Board Performance Committee</p>   |
| <p>Ian Wade</p> <p>Key skills:</p> <ul style="list-style-type: none"> <li>• Organisational management</li> <li>• Financial management</li> <li>• Industry experience</li> </ul>  | <p>Executive General Manager<br/>Thiess Business Services<br/>Thiess</p> | <p>Member, Board<br/>Member, Research Committee</p>  |

| Name   | Position/<br>Organisation   | CRC Position / Role  |
|--|---|--|
| Rod Wissler<br>Key skills: <ul style="list-style-type: none"> <li>• Research policy and management</li> <li>• IP management and knowledge transfer</li> <li>• Doctoral education</li> <li>• Graduate AICD</li> </ul>                                     | Dean of Research and Research Training<br>QUT                                 | Member, Board<br>Member, Audit & Compliance Committee<br>Member, Remuneration Committee  |
| Dennis Wogan<br>Key skills: <ul style="list-style-type: none"> <li>• Industry experience in planning, design, construction and management of road networks</li> <li>• Knowledge transfer experience</li> <li>• Registered Practising Engineer</li> </ul> | Executive Director (Special Projects - Road and Delivery Performance)<br>QDMR | Member, Board<br>Member, Audit & Compliance Committee  |
| Keith Hampson, CEO   | CRC CI  | Invitee, Board<br>Ex officio Member, Research Committee  |
| Carole Green<br><i>Graduate Diploma in Company Secretarial Practice. GAICD</i>   | CRC CI  | Secretary, Board<br>Secretary, Audit and Compliance Committee<br>Secretary, Board Performance Committee<br>Ex officio Member, Research Committee |
| Paul Akhurst   | SOH   | Member, Research Committee   |
| Brian Ashe   | ABCB  | Member, Research Committee   |
| Mick Davis (Jan- Jun 08)   | QBSA  | Member, Research Committee   |
| Andy Dong  | US  | Member, Research Committee   |
| Robin Drogemuller  | QUT   | Member, Research Committee   |
| Greg Foliente  | CSIRO   | Member, Research Committee   |
| Tom Fussell  | QDPW  | Member, Research Committee   |
| Richard Hough  | Arup  | Member, Research Committee   |
| Kerry London   | UN  | Member, Research Committee   |
| Peter Love   | Curtin  | Member, Research Committee   |
| David Marchant   | Woods Bagot   | Member, Research Committee   |
| Dean Morse   | BCC   | Member, Research Committee   |
| Peter Nassau   | BC  | Member, Research Committee   |
| Michael Pearson  | WADHW   | Member, Research Committee   |
| Richard Rizzalli   | Mirvac  | Member, Research Committee   |
| Peter Scuderi  | CRC CI  | Secretary, Research Committee  |
| Jason Smith ( Jul – Dec 07)  | QBSA  | Member, Research Committee   |
| John Spathonis   | QDMR  | Member, Research Committee   |
| Claudelle Taylor   | Nexus Point   | Member, Research Committee   |
| Lambert Van der Heide  | Leighton Contractors  | Member, Research Committee   |
| Ron Wakefield  | RMIT  | Member, Research Committee   |
| Phil Warren  | Transfield Services   | Member, Research Committee   |

## Program Leaders

| Name                        | Organisation | CRC Position / Role          |
|-----------------------------|--------------|------------------------------|
| Professor Robin Drogemuller | QUT          | ICT Platform Director        |
| Professor Ron Wakefield     | RMIT         | Program C – Program Director |

For the Extension Program, the projects are being overseen by the Chief Operating Officer, Research and Commercialisation together with specific Industry Taskforces brought together for this purpose. The members of the Industry Taskforces are executive level, highly respected industry personnel. For example, our Dispute Avoidance and Resolution project operates with a Industry Taskforce consisting of the former Royal Commissioner into the Building and Construction Industry Justice Terrence Cole AO, chaired by Connell Wagner's Chief Operating Officer, Tony Barry and representatives from the Civil Contractors Federation, Queensland and Western Australia Departments of Main Roads, Built Environment Design Professionals, Australian Constructors Association, and the Australian Procurement and Construction Council.

The above approach has worked successfully in 2006-07 for our two previous projects Safer Construction and Your Building in bringing broader industry engagement beyond our partner group and also provides credible champions in the market place.

Members of the Integrated Digital Modelling Taskforce is chaired by Andrew Gutteridge, representing Australian Institute of Architects and members includes representatives from Association of Consulting Engineers Australia, Australian Institute of Building, buildingSMART, Queensland Department of Public Works, Engineers Australia, Built Environment Design Professionals, Australian Institute of Project Management, Nexus Point Solutions and the Australian Procurement and Construction Council.

## Governing Board

The Governing Board retains responsibility for strategic and policy matters relating to the activities of the CRC and ensures these are carried out in accordance with the provisions of the Commonwealth and Centre Agreements. The Board has continued to meet bi-monthly at capital city venues across Australia based on participant location. With the addition of new participants this year, the Board has increased slightly from nine plus the independent Chair, Mr John McCarthy, to consist of 12 plus Mr McCarthy continuing as Chair. Of the 12 Board members, 4 were private sector and 3 government agencies, thus giving the majority of Board positions to research end-users as required by the Commonwealth Agreement.

## Research Committee

The Research Committee's role has changed at this stage of our CRC to focus more on the outputs of the projects rather than the development and on-going monitoring of projects which was its main focus previously. This change in focus has reduced the need to meet regularly and in 2007-08 has met three times. Its membership consists of representatives from each participant with a total of 7 private sector members. John Oliver, Rider Levett Bucknall, a private sector member of the Governing Board chairs the Committee.

## Audit and Compliance Committee

The Audit and Compliance Committee assists the Board in fulfilling its responsibilities relating to accounting and reporting practices; improving the credibility and objectivity of *Construction Innovation's* financial and other reports; and strengthen the systems of internal controls, risk management and compliance with the Centre Agreement, and applicable laws and regulations. Members of the Audit and Compliance Committee are John Oliver, Rider Levett Bucknall (Chair); Rod Wissler, QUT; Dennis Wogan, Queensland Department of Main Roads; and Carole Green, Chief Operating Officer - Business, *Construction Innovation*. The committee met five times during 2007-08.

## Board Performance Committee

The Board Performance Committee reviews the performance of the Board. John Oliver, Rider Levett Bucknall replaced Don Allan, Queensland Department of Public Works as Chair; Tony Tate, Curtin University and Andrew Johnson, University of Newcastle joined the Committee; and Carole Green, Chief Operating Officer – Business, *Construction Innovation*.

## Remuneration Committee

The Remuneration Committee meets in conjunction with the Board meetings and provides advice regarding employment conditions for the Senior Management Team. The Committee members are John McCarthy (Chair); Allen Kearns, CSIRO; John Oliver, Rider Levett Bucknall; David Golightly, John Holland Group; and Rod Wissler, Queensland University of Technology. Three of the five members are from the private sector.

## Changes to Participants

| Participants Name                                  | Commonwealth Approval (✓, Y (Yes) N (No)) |
|--|---|
| Leighton Contractors – joined 1 July 2007          | Yes                                       |
| Mirvac – joined 1 July 2007                        | Yes                                       |
| Nexus Point Solutions – joined 1 July 2007         | Yes                                       |
| Thiess – joined 1 July 2007                        | Yes                                       |
| Transfield Services Australia – joined 1 July 2007 | Yes                                       |

## 4.0 Research Programs

### 4.1 Research activities and achievements

A list of refereed publications is provided as Appendix 1.

#### 4.1.1 Key research achievements

In addition to the achievements identified previously in Section 2.1 National research priority goal highlights the following has been achieved.

*Electronic Contract Administration – Legal and Security Issues* project, in addition to providing the publically available publication, *eContracting – Security and legal Issues* the project also provided QDPW, BCC and JHG a list of recommendations for their own specific systems covering critical legal and security issues in electronic contract administration of construction projects.

*Building Research Innovation Technology and Environment (BRITE)* project's aim was to improve the incidence and quality of innovation in the Australian property and construction industry. The project operated from 2003 and the lead partners were QUT, CSIRO, QDPW and QDMR. In its five years of operation, the BRITE team has aimed at improving the capability of firms to successfully innovate, particularly small firms, which generate two-thirds of value-added and three-quarters of employment in this critical Australian industry. Highlights of the project include 12 major case studies; assisted the Australian Bureau of Statistics to undertake the first national innovation survey of the industry; developed a national database of innovative contractors; conducted an interview program covering 20 of Australia's most innovative contractors and had media coverage in 200 industry magazine articles. These highlights were in addition to the series of BRITE publications that have widespread interest from across industry.



*Construction Industry Business Environment (CIBE)* project has delivered a large volume of work, including reports, conference papers, journal articles and submissions to government inquiries around the theme of increasing the regulation between various jurisdictions. This extensive approach to examining policy harmonisation in the construction industry has not been done before in Australia. The case studies selected are specifically relevant to the Australian industry. The project has produced an introduction to public policy for people not familiar with this industry. It has also developed a hierarchy of harmonisation mechanisms based on the literature. The outcomes of this project will inform policy makers and the industry to create a more unified policy environment - reducing inefficiencies in government and the industry.

#### **4.1.2 Nature of major consultancies and their contribution to the CRC**

There have been no consultancies.

#### **4.1.3 Nature of any grants and how they contribute to the CRC**

Office of the Federal Safety Commissioner (OFSC) supported our previous project Construction Site Safety Culture which produced A Construction Safety Competency Framework: Improving OH&S performance by creating and maintaining a safety culture presents a clear way forward for the construction industry by promoting a consistent national standard to improve OH&S competency for key safety positions. In 2007-08, the OFSC continued support for this activity by providing a further \$60,000 to develop A Practical Guide to Safety Leadership. This is a follow-up resource to A Construction Safety Competency Framework to help industry readily apply the principles of safety culture within their organisations. The endorsement of the OFSC has helped the promotion of this safety approach within industry as it provides a level of approval and credibility to the Competency Framework. Organisations, including the Sydney Water Board, require tenders to confirm that have these safety competency. Queensland Department of Main Roads has contracted Learning Dimensions, a company our CRC works with to delivery training based on our safety work through 2008-09.

#### **4.1.4 Any changes to future research directions**

The Commonwealth Agreement Deed of Variation dated 2 January 2008 outlines the addition of three new Research Programs – Integrated Digital Modelling; Construction Safety; and Procurement and Dispute Resolution. These programs commenced in 2007-08 and are scheduled to be completed in 2008-09.

### ***Research activities and achievements outputs and milestones***

#### **Research Programme A: Business and Industry Development**

| <b>Output / Milestone Number</b> | <b>Description</b>   | <b>Contracted Achievement Date</b> | <b>Achieved (Yes or No)</b>   | <b>Reasons why not achieved (if applicable)</b> | <b>Strategies to achieve unmet milestones</b> |
|----------------------------------|--|------------------------------------|---|---|---|
| <b>Outcome 6</b>                 | Recognition of the Australian property and construction industry as an international leader through more effective industry training and business innovation | 30/06/2008                         | Yes<br><br>Acceptance of our skills development program over 400 attending courses.<br><br>Uptake by industry of our research – safety, |   |   |

| Output / Milestone Number | Description  | Contracted Achievement Date | Achieved (Yes or No)   | Reasons why not achieved (if applicable) | Strategies to achieve unmet milestones |
|---------------------------|--|-----------------------------|--|--|--|
|                           |  |                             | sustainability , BIM   |  |  |
| <b>Outcome 7</b>          | CRC CI accepted as a positive influence on government policy | 30/06/2008                  | Yes<br>Procurement Method toolkit and multi outcome policy being implemented by WA government.<br>Uptake of submissions to public policy development<br>.<br>eTendering and eContracting implementation within Qld Government. |  |  |

### Research Programme B: Sustainable Built Assets

| Output / Milestone Number | Description  | Contracted Achievement Date | Achieved (Yes or No)   | Reasons why not achieved (if applicable)   | Strategies to achieve unmet milestones   |
|---------------------------|--|-----------------------------|--|--|--|
| Outcome 1                 | <i>Informing policy – 50% increase in water recycling and re-use in Greenfield subdivisions</i> <ul style="list-style-type: none"> <li>Health and safety resolved</li> </ul> | 30/06/08                    | Yes<br>Sustainable Subdivision reports provided policy input to BCC and developers like Delfin Lend Lease – SEQ reduction in water use |  |  |
| Outcome 3                 | Improved human and environmental health – legionella eliminated as a public health risk  | 30/06/08                    | No   | Research Committee reviewed the milestone in light of issues such as liability and lack of critical equipment. | Internationally peer reviewed studies in indoor air quality and productivity undertaken and provided to industry through YB website.<br><br>An automated indoor air quality assessment |

| Output Milestone Number / | Description | Contracted Achievement Date | Achieved (Yes or No) | Reasons why not achieved (if applicable) | Strategies to achieve unmet milestones   |
|---------------------------|-------------|-----------------------------|----------------------|--|--|
|                           |             |                             |                      |  | prototype tool has been developed and is raising interested in Australia and NZ. |

### Research Programme C: Delivery and Management of Built Assets

| Output Milestone Number /   | Description  | Contracted Achievement Date | Achieved (Yes or No)   | Reasons why not achieved (if applicable) | Strategies to achieve unmet milestones |
|---|--|-----------------------------|--|--|--|
| Use of CRC CI research outcomes improves performance over business as usual | Procurement method toolkit development for government clients enabling appropriate procurement methods to be used.   | 30/06/2008                  | Yes<br><br>WA Government using guide in its procurement processes.                                     |  |  |
|   | Study undertaken to highlight business drivers for the use of BIM to achieve better project outcomes in terms of time quality and cost of procuring buildings. | 30/06/2008                  | Yes<br><br>Integral part of National AIA conference - joint leadership with key industry associations. |  |  |

### Research Programme – Extension Program 1 Integrated Digital Modelling

| Output / Milestone Number               | Description  | Contracted Achievement Date | Achieved (Yes or No) | Reasons why not achieved (if applicable) | Strategies to achieve unmet milestones |
|---|--|-----------------------------|----------------------|--|--|
| 1.1 Interoperable Standards Development | Research report - International review of similar research worldwide [Interoperable Standards]   | 30/09/2007                  | Yes                  |  |  |
| 1.2 Interoperable Standards Development | Research report – clear information specification which details what objects and their associated information are required for IFC-based information models in the area of site works, | 26/10/2007                  | Yes                  |  |  |

| Output / Milestone Number               | Description   | Contracted Achievement Date | Achieved (Yes or No) | Reasons why not achieved (if applicable) | Strategies to achieve unmet milestones |
|---|---|-----------------------------|----------------------|--|--|
|   | roads, underground services and landscaping for projects conducted by QDPW and QDMR.  |                             |                      |  |  |
| 1.3 Interoperable Standards Development | Development of a prototype IFC model and spreadsheet documentation to meet these information requirements. The spreadsheet will detail the new objects, their properties and valid range of values for properties.  | 28/03/2008                  | Yes                  |  |  |
| 1.4 Interoperable Standards Development | Documentation (for incorporation in the 2007-002-EP National Manual & Case Studies project) of the processes to be adopted in developing integrated digital models for roads, site works, underground services and landscaping, specific to their project roles and the project requirements. | 25/04/2008                  | Yes                  |  |  |
| 2.1 National Manual and Case Studies    | An industry workshop to re-scope the project's research methodology following the development of a working definition for the National Manual and description of its scope and application.   | 30/06/2007                  | Yes                  |  |  |
| 2.2 National                            | A National Manual which includes:   | Spec Draft 1 & 2 x Case-    | Yes                  |  |  |

| Output / Milestone Number            | Description  | Contracted Achievement Date   | Achieved (Yes or No) | Reasons why not achieved (if applicable) | Strategies to achieve unmet milestones |
|--------------------------------------|--|---|----------------------|--|--|
| Manual and Case Studies              | <ol style="list-style-type: none"> <li>1. Guidelines for well-structured IFC compliant digital models that will allow the sharing of data between disciplines</li> <li>2. IT standards used for off site fabrication and manufacture in Australia and facilitate the use of numerical control equipment in the industry.</li> <li>3. Standard processes providing the right data filters for the disciplines specified by Project Partners and achievable within an 18-month timeframe.</li> <li>4. Outputs of the RAIA Integrated Practice taskforce included where appropriate.</li> </ol> | <p>studies – 30/11/2007</p> <p>Spec Draft 2 &amp; 2 x additional case-studies – 30/06/2008</p> <p>National Manual Draft 1: 30/06/2008</p> |                      |  |  |
| 2.3 National Manual and Case Studies | A development and implementation guide derived from the lessons learnt from organisations and projects that have implemented integrated digital modelling  | Draft 1: 30/06/2008   | Yes                  |  |  |
| 3.1 Collaboration Platform           | A desktop audit of capability and future development of the EDM, Active Facility, Eurostep and Oracle model servers.   | 31/08/2007  | Yes                  |  |  |
| 3.2                                  | Two (2) pilot-study reports  | 13/06/2008  | No                   | Only one case study                      | While one tool was case                |

| Output / Milestone Number  | Description   | Contracted Achievement Date | Achieved (Yes or No) | Reasons why not achieved (if applicable)  | Strategies to achieve unmet milestones            |
|----------------------------|---|-----------------------------|----------------------|---|---|
| Collaboration Platform     | documenting the capabilities of each model server tools, identified information gaps and recommendations for improvement.   |                             |                      | developed. There was only one collaboration tool that was available for the project team. | studied, the report will be generic in nature.    |
| 3.3 Collaboration Platform | An industry report specifying collaboration scenarios and "view" definitions as well a "reachability" diagram that links the model server work with the case-studies in Project 2007-002-EP | Interim Report: 13/06/2008  | No                   | Delayed due to availability of suitable case study project.                               | Expected completion will be end of December 2008. |

### Research Programme – Extension Program 2 Construction Safety

| Output / Milestone Number         | Description   | Contracted Achievement Date | Achieved (Yes or No) | Reasons why not achieved (if applicable) | Strategies to achieve unmet milestones |
|-----------------------------------|---|-----------------------------|----------------------|--|--|
| 1 Safety Effectiveness Indicators | Literature review of existing Positive Performance Indicators, safety effectiveness indicators and behaviours   | 30/09/2007                  | Yes                  |  |  |
| 2 Safety Effectiveness Indicators | Develop a small number of Safety Effectiveness Indicators against 13 of the of the 39 Safety Management Tasks relating to safety competencies that were developed during Project 2003-050-A Construction Site Safety Culture [Cipolla, JHG] | 31/12/2007                  | Yes                  |  |  |
| 2 Safety Effectiveness Indicators | Undertake a series of Pilot projects within three to four construction companies.   | 31/03/2008                  | Yes                  |  |  |

## Research Programme – Extension Program 3 Procurement and Dispute Resolution

| Output / Milestone Number                 | Description  | Contracted Achievement Date | Achieved (Yes or No) | Reasons why not achieved (if applicable) | Strategies to achieve unmet milestones |
|---|--|-----------------------------|----------------------|--|--|
| 1<br>Procurement<br>Dispute<br>Resolution | The position paper and the research agenda developed as described in Stage 1 of the research process | 14/12/2007                  | Yes                  |  |  |

### 4.2 Research collaborations

This year saw the start of an additional five projects under what we have called an Extension Program planned for the two years from 1 July 2007 to 30 June 2009. This coincides with the now extended life of one year for our CRC to 30 June 2009. This Extension Program has been highly supported by our Participants and has encouraged the engagement of six additional Participants – Leighton Contractors, Mirvac, Nexus Point Solutions, Sydney Opera House, Transfield Services Australia and Thiess. Having been unsuccessful in the 2006 CRC Program Selection Round, we feel this level of engagement clearly demonstrates the recognition our CRC has received in the planning, design, property, construction and facility management industries in which we work as being a key facilitator of research and development across the industry where previously this collaboration has not existed. The Extension Program has provided a focus for the engagement of the new Participants and on-going renewed enthusiasm from existing Participants with only four previous Participants choosing not to continue in 2008-09.

Our Extension Program, the focus of our research for 2007-08 and 2008-09, consisting of five projects with an average of eight participants involved in each, is across three areas each with an Industry Taskforce established to oversee the work to ensure that industry is providing peer review of our work and to engage with the dissemination of the work. The Integrated Digital Modelling Program Taskforce is chaired by Andrew Gutteridge of the Australian Institute of Architects. This program is developing international standards for the digital modelling of roads, site works, underground services and landscaping; producing a National Manual of guidelines for well-structured international standard compliant digital models for buildings that will allow sharing of data between the design, construct and facility management sectors of the industry; and, documenting for industry's reference suitable information technology platforms that allow for on-line collaboration between design and construct project team members.

The Construction Safety Program continues our previous highly successful work in the safety by identifying lead measures for Safety Effectiveness Indicators of the Safety Management Tasks relating to safety competencies previously identified. The third Taskforce chaired by Tony Barry, Chief Operating Officer, Connell Wagner and representing the Built Environment Design Professionals oversees the Procurement and Dispute Resolution Program which is analysing the costs to community resulting from contractual disputes in construction and the systems for effectively resolving disputes.

The engagement of the Industry Taskforce members provides a level of collaboration with industry that gives industry credibility to our work. It also assists in the dissemination of the research to both industry organisations and the professional organisations which support our industry.

Two of the five Extension Program projects include external parties as project participants providing further collaboration with another three key industry contacts for our CRC – 12D, a software development company, and two other construction companies – Davis Langdon and Laing O'Rourke.

In addition, a further 14 projects have continued through 2007-08, the majority of which have completed their research activities or will complete by the end of calendar year 2008. These projects have seen on-going commitment from our original Participants.

Our international industry and research collaboration has achieved significant recognition. Construction Innovation's Chair, John McCarthy, continues to sit on the Board of CIB, a global network for international exchange and cooperation in research and innovation in building and construction. Mr McCarthy Board position has been elevated to be one of four core leadership team. He is also Chair of the CIB Marketing and Communication Committee.

*Construction Innovation's* CEO Keith Hampson leads the international CIB Task Group 58 – Clients and Construction Innovation.

*Construction Innovation* collaboration continues to strengthen with buildingSMART International Alliance for Interoperability (IAI), the organisation which established the international open standard IFC for object-based software in construction and facilities management. *Construction Innovation's* Chief Operating Officer, Research and Commercialisation, Peter Scuderi, is a member of buildingSMART Board and holds the position of International Education Coordinator and is a member of the buildingSMART International Council. Mr Scuderi attended International Council meetings in London and showcased the significant research outcomes of Construction Innovation's Sydney Opera House FM Exemplar Project.

Mr Scuderi has also been actively engaged in the development of the AGIC which will develop Australia's first sustainability rating tool for infrastructure projects.

One of the key strategies our CRC has invested in for a number of years is to work with relevant industry associations as a way to inform industry of our research outputs. These relationships have continued to strengthen through 2007-08. For example, the following associations are supporting our next Education and Skills Development Program of 27 workshops in various ways including the provision of venues and the advertising of the Program – Australian Institute of Project Management, Australian Sustainable Built Environment Council, Australian Institute of Building, Civil Contractors Federation, Australian Institute of Quantity Surveyors, Australian Institute of Architects, Association of Consulting Engineers of Australia, Facility Management Association of Australia, buildingSMART, Engineering Education Australia and Built Environment Australia.

Construction Innovation collaborates closely with the Australian Construction Industry Forum (ACIF) and its member organisations, and is an active member of the Australian Sustainable Built Environment Council (ASBEC), Urban Development Institute of Australia (UDIA) and a founding member of Australian Green Infrastructure Council (AGIC). Our industry-focused collaborative research has been recognised by winning five prominent industry association awards, as noted in the Executive Summary.

## **5.0 Commercialisation and Utilisation**

### **5.1 Commercialisation and utilisation strategies and activities**

Construction Innovation's Commercialisation/Technology Transfer Program is designed to enhance the transfer of research outputs into commercial or industry outcomes of economic, environmental or social benefit to Australia. The three guiding principles in achieving this are:

- to ensure Intellectual Property (IP) management and strategies for commercialisation are targeted to potential commercial opportunities
- to transfer public good research outcomes to Construction Innovation participants, the construction industry and the broader Australian community



- to ensure that smart and streamlined systems are utilised to effectively manage research activities in a focused and targeted manner, allowing easy identification and exploitation of commercialisation opportunities.

*Construction Innovation's* project agreements address a process for commercialisation and/or utilisation of the outputs at the commencement of a project. Each six-monthly project review considers the commercialisation and/or utilisation opportunities with, where appropriate, a more focused strategy being developed six to nine months from the completion of the research. Education and communication activities are considered for the project and legal and technology development professionals are engaged, as required, to develop appropriate licence agreements. Market analysis and economic impact reports are sourced externally.

To facilitate the management of Intellectual Property and strategies for commercialisation, *Construction Innovation* also educates and trains key personnel.

Trials of project outputs allow participants to become familiar with tools or processes developed at a project level. Often, the learnings from projects influence processes within participant organisations. For example, two of our government agency participants are reviewing the requirements of their electronic procedures for tenders and contract administration to allow appropriate electronic signatures to be used, electronic contract formations, electronic contract administration, issues of IP, evidentiary and archive issues. The BRITE project also encouraged innovation in government agencies and allowed suppliers and contractors to share risk and develop procurement contracts which give suppliers and contractors more scope for innovation in their delivery approach.

Our first preference for commercialisation partners are our *Construction Innovation* participants. In all projects it is a requirement that at least two research-users participate in the project. Therefore, potential initial adopters of the technology are likely to be the industry participants involved early in the specific project.

*LCADesign* is an eco-profiling software tool that can electronically calculate and chart the environmental impact of construction materials and building products. *LCADesign* analyses all elements in a Building Information Model (BIM) using data from its comprehensive Life Cycle Inventory (LCI) database of building products and operations. The software delivers an eco-preferred result at the push of a button, enabling practitioners to produce superior eco-profiles in hours or days compared with weeks of work. *LCADesign* has been trialled in the USA, The Netherlands, Germany and in several of Australia's leading design firms to optimise the environmental impact of buildings at the design stage, reducing greenhouse emissions, air and water pollution, and saving energy.

*Construction Innovation* has licenced this technology to an Australian company Ecquate Pty Ltd to further develop and distribute this technology. This technology has the potential to provide important benefits to the construction industry as it struggles to reduce its greenhouse gas emissions.

*Construction Innovation* has concentrated on undertaking collaborative research among its participants and has not been involved in any contract research activities. In an industry where a research culture is still developing, our participants have gained considerably through their involvement in the research process and in incorporating the learnings as projects progress into their daily activities. The utilisation of research results has been a real success for this CRC. The primary examples during 2007/08 has been:

- the uptake of *Your Building* with more than 12,000 unique visits per week and growing rapidly. The portal has now been taken over by the Property Council of Australia for ongoing management and operation of the site for upgraded industry use.
- implementation of *Safer Construction* by companies and industry associations. The best practice guidelines are being used by the ACEA in their continuing professional development courses delivered through the University of Sydney and clients like Sydney

Water are implementing the principles into their desalination plant project and QDMR into its road construction and management activities.

- implementation of Construction Safety Competency Framework with the development of *A Practical Guide to Safety Leadership* which is being converted into half day training sessions which will be delivered in Brisbane, Sydney, Melbourne, and Perth in the second half of 2008. The framework has been implemented in construction large and medium construction companies such as John Holland, Bovis Lend Lease, Joss Group, and Laing O'Rourke.
- positive impact of BRITE (Building, Research, Innovation, Technology and Environment) Project in fostering innovation in Australian small construction companies is reflected in the Australian Bureau of Statistics data showing that the number of construction firms innovating rose 4 per cent between 2002 and 2004. It is very likely that BRITE and other CRC projects have contributed to this increase. BRITE ran from early 2002 to December 2007 and in that time had significant industry through the impact of its published findings of how companies within the construction industry innovate. Over 200 articles have been published in 50 different industry publications, including magazines produced by our participants, QUT, Main Roads and Public Works. Seven refereed journal articles have been published in academic journals (and from an RQF perspective, two of these are in the top journal in the field). 18 refereed conference papers were also presented.

There have been no spin off companies established by Construction Innovation. No patents, including provisional patents, have been lodged in Australia or overseas.

### **Commercialisation and Utilisation Outputs and/or Milestones**

| <b>Output / Milestone Number</b> | <b>Description</b>                                    | <b>Contracted Achievement Date</b> | <b>Achieved (Yes or No)</b> | <b>Reasons why not achieved (if applicable)</b> | <b>Strategies to achieve unmet milestones</b> |
|----------------------------------|---|------------------------------------|-----------------------------|---|---|
| Output 1                         | IP register and IP valuation                          | 30 June 2008                       | Yes                         |   |   |
| Output 2                         | Commercialisation strategies – review and development | 30 June 2008                       | Yes                         |   |   |
| Output 3                         | Partner/student development on commercialisation      | 30 June 2008                       | Yes                         |   |   |
| Output 4                         | Industry workshops                                    | 30 June 2008                       | Yes                         |   |   |

## **5.2 Intellectual property management**

Construction Innovation's project agreements address a process for commercialisation and/or utilisation of the outputs at the commencement of a project. Each six-monthly project review considers the commercialisation opportunities. Legal and technology development professionals are engaged, as required, to develop appropriate licence agreements. Market analysis and economic impact reports are sourced externally.

Intellectual Property is managed according to the terms and conditions of the Centre Agreement and in the specific agreements at the project level. These processes are reviewed annually to ensure continued adherence to the National Principles of IP Management. To facilitate the day-to-day management of Intellectual Property and strategies for commercialisation, Construction Innovation also educates and trains key personnel.

To ensure IP arrangements will accrue maximum national benefits to Australia, our first preference for commercialisation partners are our Construction Innovation participants. In all projects it is a requirement that there are at least two research-users. Therefore, potential initial adopters of the

technology are likely to be the industry participants involved early in the specific project. Of the 18 projects active during 2007-08, 14 projects had more than the mandatory two research-users. This greatly assists the dissemination of project outputs as the majority of those projects have significant knowledge generated of immediate use to the participants.

The following publications have been made available free of charge, if downloaded from our website. Alternatively, printed versions are available for sale and many have been distributed free of charge at CRC events or CRC sponsored events:

Apelt,R., Crawford,J., Hogan,D., (2007), *Wayfinding design guidelines*, CRC for Construction Innovation (Sale Price: \$27.50)

Apelt,R., Crawford,J., Hogan,D., (2007), *Wayfinding system audit*, CRC for Construction Innovation (Sale Price: \$16.50)

Blismas,N., (2007), *Off-site manufacture in Australia: Current state and future directions* (Sale Price: \$27.50)

Diaper,C., Tjandraatmadja,G., Kenway,S., (2007), *Sustainable subdivisions: Review of technologies for integrated water services*, CRC for Construction Innovation (Sale Price: \$19.25)

Fleming,T., Lingard,H., Wakefield,R., (2007), *Guide to Best Practice for Safer Construction: Implementation kit*, CRC for Construction Innovation (Sale Price: \$66.00)

Thomas, P., Moller, S., (2007), *HVAC system size: Getting it right Right-sizing HVAC systems in commercial buildings*, CRC for Construction Innovation

*eContracting – Security and legal Issues*, (2008), CRC for Construction Innovation (Sale Price: \$27.50)

Biggs,H.C., Dingsdag, D.P., Roos,C.R., (2008), *A Practical Guide to Safety Leadership*, CRC for Construction Innovation (Sale Price: \$66.00)

One development and commercialisation agreement has been executed on 22 November 2007 which gives Server.Sys Pty Ltd, an Australian company, a licence to further develop the LCADesign software produced by our CRC and then to commercialise in accordance with the terms of the agreement. A subsequent variation to the agreement transfers the agreement to Equate Pty Ltd, a company formed by Server.Sys to commercialise this software. This software will be on sale and promoted at the upcoming World Sustainable Building (SB08) Conference in Melbourne in September 2008. SB08 brings together the peak industry and research bodies in the sustainable building movement worldwide with over 60 invited speakers and more than 500 peer-reviewed scientific papers, and participation from over 60 countries, SB08 is the peak international gathering of the building industry in 2008 with over 2,000 attending this key event, chaired by Construction Innovation's Governing Board Chair, John McCarthy. The Honourable Peter Garrett, Federal Minister for the Environment, Heritage and the Arts officially launched *Construction Innovation's* LCADesign software during his opening keynote address at SB08 on 22 September.

Another agreement is being finalised with the Property Council of Australia (PCA) to assign *Your Building* to the PCA for their continued development and on-going provision to Australian industry.

### **5.3 Communication strategy**

Construction Innovation is highly focused and successful in disseminating key outcomes of our research activities. Construction Innovation's communication strategy seeks to advise and inform our participants and private and public industry stakeholders and the community of the beneficial outcomes deriving from our applied research. We undertake a range of communication activities

which include both internal and external communication and include our intranet site, corporate and project websites, industry-directed publications and brochures, monthly eNewsletter, media and publicity, launches, workshops, and international conference and event sponsorships.

In addition to the publications listed in Section 5.2, other project brochures have been produced. Executive Report Cards were again produced customised to the interests and needs of each of our participants. The report cards provide a snapshot of the value to the participant of their investment in Construction Innovation. This is an annual process, following the data collection for the Annual Report. Participant feedback during the subsequent face-to-face consultations continues to reinforce the value of the Executive Report Card process.

Media releases issued in 2007-08 included:

- New guide provides tools for industry to adopt best practice safety leadership [Jun08]
- Councils cooperate to slash development application red tape [Mar08]
- Sustainability crucial to \$82 billion infrastructure plan [Feb08]
- Sydney Opera House digital modelling receives Project of the Year award [Dec07]
- YourBuilding Profiting From Sustainability launched [Sep07]
- Guide to Best Practice for Safer Construction launched [Sep07]
- Project Team Wins Disability Award [Jul07]
- New international role for John McCarthy [Jul07]

Our focus has continued to aim at publication in industry professional journals and other trade journals. This in some cases targets organisations and in many cases individuals as many associations require individual registration. This also assists in dissemination to SMEs. In 2007-08, articles have appeared in publications including *The Australian*, *National Building News*, *Construction Contractor* and *Anthill*.

#### **5.4 End-user involvement and CRC impact on end-users**

It is a requirement for all our projects that at least two of our end-user participants are actively engaged in each project. This gives the partners early opportunity to implement the findings of the research projects. Beyond our immediate participant group we work actively to ensure others in the industry can also benefit from our research. This is achieved by actively working with professional associations including ACIF, ASBEC, AIB, MBA, FMA, PCA, EA and ACA to provide articles for their publications, to present at their conferences both as keynotes and from project output perspectives and to provide sponsorship to allow the brand of our CRC to become familiar in these markets.

In the 2007–08 period, Construction Innovation provided sponsorship to:

- ABCB, Building Australia's Future 2007 5<sup>th</sup> National Conference, 23–26 September 2007
- Master Builders Australia National Conference, 7-10 November 2007
- International Alliance for Interoperability – buildingSMART Conference, 14 November 2007
- Australian Institute of Building, Construct 2008 Conference, 21-23 February 2008
- Australian Institute of Architects National Conference: Critical Visions, 10–12 April 2008
- Facility Management of Australia Conference – ideaction 2008, 7-9 May 2008

## End-user Involvement in CRC Activities

| End-user name   | Relationship with CRC<br>(e.g. Industry, Participant, International) | Type of activity and end-user location                | Nature / scale of benefits to end-user<br>(e.g. exports increase, productivity, employment)  | Actual or expected benefit to end-user<br>(\$ terms)  |
|---|--|---|--|---|
| Queensland Government Department of Infrastructure and Planning | Government agency (end-user)   | Utilisation of research findings<br>(Queensland)      | Findings from CIBE project published in the Government News Volume 28, Issue 3, April 2008 assessed the benefits to ordinary home owners, developers and councils of the new ICT-enhanced development application process found the eGovernment 'Planning and Development Online' and 'Local Government Toolbox' projects had slashed redtape and increased speed of processing for many types of development applications." | This assists the government to measure the success of one of the Government's aims:<br><i>eGovernment (streamlining development applications and local government processes).</i> |
| Bovis Lend Lease  | Industry   | Utilisation of research findings<br>(International)   | Implementing a two-year training program based on 'A Construction Safety Competency Framework' developed by our CRC.   | Personal, community and economic savings by improving OH&S performance by creating and maintaining a safety culture throughout the organisation.                                  |
| Education and Culture – Leonardo da Vinci                       | Education and training organisation                                  | Utilisation of research findings<br>(Norway, Romania) | Course/workshop Management Principles for Outsourced Production was developed based on the report, Industry Culture: A Need for Change. Report 2001-008-C-05.  | Delivered twice, once in Norway and once in Romania.  |
| 12D   | Project Participant  | Utilisation of research findings<br>(International)   | Currently incorporating information gained from project involvement into   | Proof of concept for their further development of an IFC compatible version of 12D  |

|   |                              |  |   |  |
|---|------------------------------|--|---|--|
|   |                              |  | their software for trialling a partial IFC interface to the 12D software  | software. This will increase their market to other non-road focused clients.   |
| PCA - Relifing  | Diffusion Collaborator       | Utilisation of research findings (National)      | Helped shape, endorsed and now promotes the industry publication  | Provides research rigour to the knowledge base available to the PCA members  |
| Active Facility   | Project participant          | Utilisation of research findings (International) | Currently re-designing capability of software tool from project involvement and gained out of the development of technical requirements   | Provides Active Facility with an opportunity to respond specifically to industry need and increase marketability from asset management tool to a design and construction collaboration tool. |
| WADHW – Procurement method toolkit                          | Government Agency (End user) | Utilisation of research findings (WA)            | After piloting the Procurement Method toolkit on projects, it is now forming part of the department's approach to identifying the appropriate procurement system for a given project. | More appropriate procurement system used for government projects.  |
| WADHW/WAMR Managing Knowledge in an Outsourcing Environment | Government Agency (End user) | Utilisation of research findings (WA)            | Provided the department with a process to capture knowledge in an outsourcing environment   | Implementing a strategy to capture knowledge and increase productivity.  |
| WADH Multi Outcomes Procurement Policies                    | Government Agency (End user) | Utilisation of research findings (WA)            | Providing the department with a cost benefit analysis methodology to enable better policy development.  | Development of Social Policies that do not adversely effect building procurement.  |
| QDPW - Wayfinding   | Government Agency (End user) | Utilisation of research findings (Qld)           | Implementing a design guide and checklist for embedding wayfinding principles into the design and construction of commercial buildings  | Provides a socially acceptable design solution for wayfinding to commercial buildings.   |

## **6.0 Education and Training**

One of the successful initiatives of our scholars program has been the 2-3 day workshops conducted twice a year. The final workshop was planned in conjunction with our International Conference held 12-14 March 2008. With fewer numbers of scholars moving into 2008-09, it was decided the benefits of workshops were being eroded and appropriate to discontinue.

An exciting new initiative for our 2008-09 year are four scholarships of \$5,000 offered to four of our partners - PB, Arup, Woods Bagot and RMIT – enabled six of their employees to attend Stanford University's Virtual Design and Construction (VDC) course to be held over three days, 10-12 September 2008 at Stanford University, California. In addition, industry visits were arranged to the American offices of PB, Arup and Swinerton Inc (Construction Contractor) to hear first-hand the developments in digital modeling and its application in the design and construction process. All attendees agreed the Summer Program and the industry visits were a valuable experience which should be repeated annually.

### **6.1 Extent to which the CRC is on target in terms of recruiting and supervising PhD and masters students**

As part of the winding down of the final year of this CRC, transfer arrangements were implemented to move the financial oversight of the remaining scholars' stipends and expense allowances back to their respective universities at the end of this reporting period. A total of six scholars' financials were transferred. While the financial and educational aspects have been transferred, the ongoing progress of the scholars research and their industry supervisor arrangements will continue to be overseen by the CRC's Education and Training Officer.

### **6.2 Involvement of industry in research supervision**

All scholars for this reporting period have an allocated, active and relevant industry supervisor. See table in Section 6.3 for details.

### **6.3 Graduate destinations**

One scholar, Dr Tim Rose, graduated for this reporting period. An update of scholar's current activities is provided in the table below.

## Construction Innovation continuing scholars 2007-08

| Student                           | University | Research Topic Title   | Academic Supervisor (Associate Supervisor) | Industry Supervisor         | Expected Completion Date | Update on Scholar's Progress   |
|-----------------------------------|------------|--|--|-----------------------------|--------------------------|--|
| Tim Rose                          | QUT        | Optimising the Impact of Financial Incentive Mechanisms in Australian Commercial Building Projects   | Karen Manley (Keith Hampson)               | Don Allan, QDPW             | 29-Dec-07                | Tim's has completed his PhD - awarded in Aug 08 - and now works full time as a senior policy officer for the Qld Dept of Public Works  |
| Judy Kraatz                       | QUT        | Value-Mapping for Major Economic Infrastructure Projects for the Australian Public Sector<br><b>Benefit to Industry:</b> Improved ability to better identify and align project outcomes and impacts with stated corporate objectives as well as assist in managing risks and minimise possible ecological and social harm. | Prof Stephen Kajewski (Dr Karen Manley)    | Scott Stewart BCC           | 22-May-09                | Judy presented her PhD paper entitled "Value Mapping for Major Economic Infrastructure Projects for the Australian Public Sector" to the Mar 08 CRC 3rd International Conference on the Gold Coast. Her PhD is progressing well with good support from her industry and academic supervisors. Presenting a paper "Aligning Project Outcomes with BCCs Corporate Themes" coauthored by Judy, Stephen Kajewski & Karen Manley QUT at Subtropical Cities Conference 3-6 Sep 08.   |
| Soon Kam Lim                      | QUT        | Decision Making Processes for Sustainable Infrastructure Projects<br><b>Benefit to Industry:</b> Improved understanding among stakeholders and better sustainability reporting mechanisms.   | Prof Jay Yang                              | Derek Skinner QDMR          | 01-Oct-09                | Soon Kam presented his PhD to the CRCs 3rd International Conference Mar 08 entitled "Developing Framework and Processes of Enhancing Sustainability Deliverables in Infrastructure Projects". Presenting a paper "Developing Framework & Processes of enhancing Sustainability Deliverables in Infrastructure Projects" at International conf on Infrastructure Development, Kuala Lumpur 7-9 May 08 - coauthored by Soon Kam and Jay Yang.  |
| Agustin Chevez Bernaldo de Quiros | RMIT       | Evolution of Workplace Architecture as a Consequence of Technology Development<br><b>Benefit to Industry:</b> Identification of holistic approaches to the design of and to strategically manage new and redeveloped office environments   | Dr Guillermo Aranda-Mena                   | James Calder Woods Bagot    | 18-Sep-09                | Agustin presented his PhD paper entitled "Reaching Singularity Point in Architecture" to the Mar 08 CRC 3rd International Conference at the Gold Coast. Agustin has also been accepted as part of the CIFE/Stanford/CRC scholarship to attend the Virtual Design Construction Summer Program on 10-11 Sept 08. Agustin has enrolled into eGrad School's Knowledge Transfer & Research Commercialisation Grad Certificate.  |
| Abdulkader Sharabah               | RMIT       | A Reliability Based Predictive Model for Building Asset Management<br><b>Benefit to Industry:</b> Development of tools to support decisions on maintenance priority in relation to all building elements.  | A/Prof Sujeeva Setunge                     | Axl Driml QDPW              | 18-Sep-09                | Abdul presented his PhD paper for the CRC's 3rd International Conference Mar 08 entitled "Effective Condition Monitoring and Assessment for More Sophisticated Asset Management Systems". Abdul is currently developing an algorithm for Matlab or similar software and hopes to develop this into a user friendly CPD module for practicing Engineers.  |
| Robert Lopez                      | Curtin     | Design Management: Error Reduction and Containment Strategies in Projects<br><b>Benefit to Industry:</b> Highlight how fewer design errors can result in less waste, less rework and improved project performance in terms of schedule and budget.   | Prof Peter Love (A/Prof Peter Davis)       | Peter Tilley WADHW          | 01-Apr-10                | Robert co-authored and presented a paper for the Mar 08 CRC 3rd International Conference based on insights from his involvement in the CRCs Procurement Method Toolkit project. Curtin has approved application for candidacy in late Nov 07 subject to Level A ethics clearance. Remaining section of thesis work has begun and literature review is being updated. As a result, some changes have been made to the methodology. Robert will attend and present a paper at the ARCOM conference in Cardiff in Sep 08. Robert is also providing research for the CRCs 2006-034-C Procurement Method Toolkit project. |
| Joanne Jakovich                   | US         | A Model of Adaptive Soundspace Installation<br><b>Benefit to industry:</b> Potential for interaction beyond traditional computer interfaces with the next generation of 'smart' buildings and environment.   | Dr Kirsty Beilharz                         | David Marchant, Woods Bagot | 11-Jan-08                | Joanne's CRC scholarship period concluded in Jan 08 though she continues her studies and expects to finish approximately September 2008. Joanne has also been offered a lecturing position at UTS in the Design, Architecture and Building Faculty and begins that position later in 2008.   |
| Craig Furneaux                    | QUT        | Policy Networks: Demonstrating their Presence, Structure & Network   | Prof Kerry Brown (Amanda Gudmundsson)      |                             | 30-May-08                | Craig has recently accepted and begun a full time scholarship with CIEAM and no longer holds a Construction Innovation scholarship. He continues to work as a researcher on Construction Innovation's CIBE Project.  |
| Adrian Cupitt                     | QUT        | Microclimatic Impacts on the Built Environment - Extension of Day Lighting Theory to Produce Algorithms for Light Technical Parameters for any Location  | Stephen Coyne                              | Ron Apelt QDPW              | 30-Dec-07                | Although Adrian's scholarship period has concluded, he continues to work full time at QUT's Photometric Lab, where they calibrate light and UV meters, and test light distribution, transmission, reflection and colour of lamps and materials: such as brake lights, indicators, headlights, street lights, traffic signal lights, floodlights, emergency exit signs, shadecloth, etc. With the new setup, the lab is able to test light distribution in 50   |
| Colleen Yuile                     | QUT        | Attention to CSR by Australian Corporations: Trends Over Time and the Relationship with Financial Performance  | Boris Kabanoff & Amanda Gudmundsson        | N/A                         | 02-Feb-09                | Colleen has recently articulated from a PhD to a Masters by Research.  |
| Marcello Tonelli                  | QUT        | Exploring Corporate Real Estate Decision-Making in the Italian Consulting Industry   | Stephane Tywoniak & Boris Kabanoff         | Teng Hee Tan Qld Health     | 28-Dec-07                | Marcello has completed his scholarship period with CRC CI and continues to progress his studies on his PhD. Marcello operates his own consultancy business. Submission of thesis to panel is for 18 Dec 08 with final presentation scheduled for 23 Jan 09. Marcello is enrolled in eGrad School's Research Commercialisation & Knowledge Transfer Grad Certificate and has completed 2 units.   |
| Colin Greville                    | UWS        | Psychology of Sustainable Development  | Alan Jeary (Graham Miller)                 | John Oliver, Rider Hunt     | 26-Dec-07                | Col has completed his scholarship period with the CRC and in 2007 took a leave of absence from his studies. Although due to return to his studies in Mar 08, Col has indicated that he intends to withdraw from study because of personal reasons and his current workload. He would however, like to return to his PhD in the future. Col is a self employed builder and building inspector in the Wide Bay/ Central Qld area and is currently gaining his certifier's licence.   |



## 6.4 Nature of end-user involvement in developing undergraduate courses

| Curriculum Content  | Who                                    | Number of students | Project/Publication Reference                      |
|---|--|--------------------|--|
| Honours Thesis  | QUT – Angela McCabe                    | 1                  | Multi Outcomes Construction Policies               |
| First Year Economics 100 (1234)                               | Curtin – Siobhan Austen                | 1000               | Multi Outcomes Construction Policies               |
| 2 <sup>nd</sup> year BUSM3108 Project Management Fundamentals | RMIT – Nick Blismas                    | 196                | Offsite Manufacture in Australia (case study used) |
| MBA program Business Strategy & International Business 660    | Curtin – Peter Galvin                  | 80                 | Managing Knowledge in an Outsourcing Environment   |
| 2 <sup>nd</sup> year - Site Management 241                    | Curtin – Lecturer & JHG Safety Manager | 150                | Safer Construction                                 |

## 6.5 Nature of seminars/workshops/courses run for industry

| Conference/Event                                     | What  | Who   | When      | Number attending |
|--|---|---|-----------|------------------|
| AMCAA Melbourne                                      | BRITE & BIM   | Karen Manley & Peter Scuderi  | 1 Nov 07  | 50               |
| Australian Consulting Engineers Association Brisbane | Safer Construction - Kits and project overview  | Kerry Brown & Lyn Pearson   | 5 Oct 07  | 15               |
| Roadtek Conference Mackay                            | All CRC Safety projects presentation – Safer Construction, CIBE, Safety Competency Framework, Safety Leadership Guide, SEIs | Lyn Pearson   | 16 May 08 | 75               |
| Griffith Uni FM & Safety Managers Brisbane           | BIM, Safety and FM presentation   | Peter Scuderi & Lyn Pearson   | 7 Sep 07  | 18               |
| QUT FM & Safety Managers Brisbane                    | BIM, Safety, Dispute Resolution & FM presentation   | Peter Scuderi   | 20 Nov 07 | 22               |
| Research Symposium Brisbane                          | Safety & Innovation   | Peter Scuderi (CRC), John Dwyer (DBS), Kerry Brown (QUT), Craig Furneaux (CRC Scholar), Dean Cipolla (John Holland), Bert Biggs (QUT) | Jul 07    | 75               |

## 6.6 Contribution to skill development in the industry

In 2007-08 we had a clear strategy to deliver to industry the outputs of our research in the form of paid workshops. In some instances we centrally coordinated the development of the training content and the delivery of the course. In other instances we worked with other training providers to deliver the courses. This has been highly successful and valued by industry as demonstrated by the attendance and the support from the industry professional associations which assisted in the workshops through advertising using their networks and in some instances providing venues and sponsorship. Another series of workshops are currently being planned for the October 2008 – March 2009 period.

| Who                                   | What   | Presenters   | When                         | Number Attending |
|---------------------------------------|--|--|------------------------------|------------------|
| Public courses Bris, Syd, Melb        | ½ day Developing the Business Case for Sustainable Commercial Buildings workshop | Kendra Wasiluk, Peter Szentel, Greg Johnson Stockland, Andrew Borger, Leighton Contractors | 21, 22 & 26 Nov 07           | 80               |
| WADHW, WAMR , WAPTA, WADPI Perth      | 2day Relationship Management Workshop  | Graham Scott   | 25-26 Oct 07                 | 44               |
| Public Workshops Melb, Syd, Bris      | ½ day Developing the Business Case for Sustainable Commercial Buildings workshop | Kendra Wasiluk RMIT Centre for Design  | 3,4 & 7 Apr 08               | 62               |
| Public Workshops Bris & Syd           | ½ day Valuing Sustainable Commercial Buildings workshop                          | Richard Reed Deakin University   | 27 & 28 May 08               | 25               |
| Public Workshops Melb, Bris & Syd     | ½ day Life Cycle Costing for Sustainable Commercial Buildings workshop           | Andrew Carre RMIT Centre for Design  | 13,16 & 26 Jun 08            | 58               |
| Public workshops Bris, Syd & Melb     | ½ day Facility Management for Sustainable Commercial Buildings workshop          | Steve Moller Sustainable Built Environments  | 21,22 & 29 Jul 08            | 52               |
| QDPW Bris                             | 2day Relationship Management Workshop  | Graham Scott   | 22 & 23 Apr 08               | 12               |
| Engineering Education Aust Syd & Melb | 2day Relationship Management Workshop  | Graham Scott   | 29&30 Apr 08<br>14&15 May 08 | 22               |
| Public Workshop Bris                  | 2 day Safety Leadership Foundations Workshop                                     | Louise Quinn - Safety Dimensions   | 30 Apr -1 May 08             | 16               |

### **Education and Training Outputs and/or Milestones**

| Output / Milestone Number                              | Description   | Contracted Achievement Date | Achieved (Yes or No) | Reasons why not achieved (if applicable) | Strategies to achieve unmet milestones |
|--|---|-----------------------------|----------------------|--|--|
| Educational Training packages developed and marketed & | Workshops 08 – Education & Skills Development program including workshops listed above  | 30 Jun 08                   | Yes                  |  |  |
| Educational Training packages delivered to industry    | <ul style="list-style-type: none"> <li>• Sustainability Workshop Series (14)</li> <li>• Relationship Management workshops (4)</li> <li>• Safety Leaders workshop (1)</li> </ul> | 30 Jun 08                   | Yes                  |  |  |

| Output / Milestone Number   | Description  | Contracted Achievement Date | Achieved (Yes or No) | Reasons why not achieved (if applicable) | Strategies to achieve unmet milestones |
|---|--|-----------------------------|----------------------|--|--|
| PhD students – recruit, orientation, commercialisation & training | <ul style="list-style-type: none"> <li>• As part of final year preparations, transfer remaining scholars financial responsibilities back to their universities</li> <li>• Implement scholars' workshop via dedicated 2 day program and <i>Construction Innovation</i> conference networking meetings &amp; final farewell lunch</li> </ul>   | 30 Jun 08                   | Yes                  |  |  |
| Student involvement in conferences and publications               | <p>Articles &amp; Papers authored or co-authored and presented at national and international conferences<br/>Eg:</p> <ul style="list-style-type: none"> <li>▪ CIB SB07 Hong Kong</li> <li>▪ WorkTech07 London</li> <li>▪ Assoc of Architecture Schools of Australasia 2008 Sydney</li> <li>▪ International Journal Article - Public Management &amp; Money 2008</li> <li>▪ AGSE International Entrepreneurship Research Exchange 2007</li> <li>▪ Proceedings International Research Symposium on Public Management XI</li> <li>▪ CIB World Building, Congress 2007 Cape Town</li> <li>▪ 3<sup>rd</sup> International CRC CI Clients Driving Innovation 2008 Gold Coast</li> <li>▪ SubTropical Cities 2008 Brisbane</li> <li>▪ CIB2008 Dubai</li> <li>▪ ARCOM Cardiff Wales 2008</li> </ul> | 30 Jun 08                   | Yes                  |  |  |
| <i>Construction Innovation</i> dissemination strategies           | <ul style="list-style-type: none"> <li>▪ Research Symposium Brisbane July 07</li> <li>▪ Safety Guide Launch</li> </ul>   | 30 Jun 08                   | Yes                  |  |  |
| Industry workshops  | <ul style="list-style-type: none"> <li>▪ Industry workshops conducted in Brisbane, Sydney, Melbourne and Perth as rollouts from research projects</li> </ul>   | 30 Jun 08                   | Yes                  |  |  |

## 7.0 PERFORMANCE MEASURES (2000 Round CRC)

The performance measures and indicators addressed in this Annual Report are those agreed in the January 2004 Commonwealth Agreement Variation. No Objective/Target was specified in the Variation. However, where appropriate, based on our internal planning for the 2007-08 year an objective or target has been included.

### Progress on Performance Measures (2000 Round CRCs)

| PERFORMANCE INDICATOR  | OBJECTIVE / TARGET   | 2006-07 PROGRESS / ACHIEVEMENT  | 2007-08 PROGRESS / ACHIEVEMENT   |
|--|--|---|--|
| <b>Objective of the Centre</b>   |  |   |  |
| 1. To create and commercially exploit tools, technologies and management systems to deliver innovative constructed assets to further the financial, environmental and social benefit to the construction industry and the community. | n/a  | This was not required to be reported against.   | Of the 18 research projects active during 2007-08, 13 projects have either completed or neared completion, all have delivered at least one output of significant benefit to the industry. The most broadly applicable to industry are:<br>Safer Construction - publication<br>Safety Competency Framework - publication<br>Your Building – web portal<br>LCADesign – a software tool<br>Electronic Contract Administration – Legal and Security Issues - publication |
| <b>Quality and Relevance of the Research Program</b>   |  |   |  |
| 1. Satisfaction of partners and users with research quality and value to industry.   | Continuity and expansion of partner engagement particular private sector | Satisfaction was demonstrated by: <ul style="list-style-type: none"> <li>• 4 awards received</li> <li>• Retention of all partners</li> <li>• External review noted our research as validating approaches being developed by industry partners and supporting a culture of change to adopt new technologies and innovation.</li> </ul> | A Commonwealth Agreement Variation dated 2 January 2008 formalised the joining of 8 new participants, 5 of which were private sector. The variation also extended our CRC for 12 months with only 4 of the original partner group deciding not to continue. Overall, there has been a strengthening of the private sector engagement demonstrating the value of this CRC within the industry.  |
| 2. Increase volume of research contribution to CRC.  | Level of cash and in-kind commitment                                     |   | Since the execution of the Variation, an additional \$506,000 cash or 30 per cent has been committed for the 2008-09 financial year by participants and external project parties.  |

| PERFORMANCE INDICATOR   | OBJECTIVE / TARGET | 2006-07 PROGRESS / ACHIEVEMENT  | 2007-08 PROGRESS / ACHIEVEMENT   |
|---|--------------------|---|--|
| <p>3. Adoption of research results/Benefit of result by partners.</p> |                    | <p>Seven partners implemented outcomes from six projects. In some instances, adoption was extended to the organisation's supply chain.</p> <p>Licence agreement for LCADesign and LCI Database under development.</p> | <p>WADH - 2006-034-C Procurement Method Toolkit [Davis, Curtin]</p> <p>Implementing the procurement toolkit to enable better selection of procurement systems for given projects.</p> <p>WADH - 2006-036-A Multi-Outcomes Procurement Policy [Austin, Curtin]</p> <p>Lessons learned and provision and a methodology provided for enhanced social policy development implemented on procurement projects in WA.</p> <p>WAHW/WAMR - 2006-039-A Managing Knowledge in an Outsourcing Environment [Galvin, Curtin]</p> <p>Implementation of strategies for better capturing of knowledge by government agencies in an environment of staff shortages and outsourcing of services.</p> <p>QDPW/QDMR/BSA/BCC – 2004-032-A Construction Industry Business Environment [Brown, QUT]</p> <p>Four government agencies provided with best practice, lessons learned and strategies for coherent policy development and productivity gains for government in the area of sustainability, OH&amp;S, BIM and Sewer Mining.</p> <p>JHG – 2005-027-A Safer Construction [Fleming, JHG]</p> <p>The best practice guide for whole of stakeholder engagement in safety has</p> |

| PERFORMANCE INDICATOR   | OBJECTIVE / TARGET | 2006-07 PROGRESS / ACHIEVEMENT   | 2007-08 PROGRESS / ACHIEVEMENT  |
|---|--------------------|--|---|
|   |                    |  | <p>been implemented in the Sydney Water project.</p> <p>QDPW/Building Commission/ABCB – 2004-028-C Wayfinding in the Built Environment [Hogan, BC]</p> <p>QDPW, Building Commission and ABCB are better equipped to make socially acceptable policy decisions in relation to the design and operation of commercial buildings.</p>                              |
| 4. Increase national and international collaborations.                |                    | <p>Domestic collaborations included:</p> <ul style="list-style-type: none"> <li>. development of Relationship Management course and delivery of 17 courses for industry</li> <li>. development of two-year additional research program with 27 partners</li> <li>. John McCarthy, Chair of CRC appointed Chair of CIB Marketing and Communication Committee as well as member of Board.</li> <li>. Keith Hampson, CEO, member of International Review Panel of PSIBouw (Process and System Innovation in Building and Construction)</li> <li>. Peter Scuderi, COO, Research and Commercialisation is a IAI Board member and International Education Coordinator – Australasia buildingSMART International Alliance for Interoperability</li> </ul> | <p>Commencement of the additional two-year research program with five new partners. An additional two new industry partners involved at the project level.</p> <p>Third International Conference</p> <p>Continued involvement in CIB</p> <p>Continued BuildingSMART involvement</p> <p>BRANZ – NZ contact</p> <p>Engagement with Tasmanian Innovation Award</p> |
| 5. Increase in industry innovations and shifts in the knowledge base. |                    | <p>Industry Taskforce to provide senior strategic input to projects was established for Safer Construction and Your Building.</p> <p>Update of ICT solutions at Sydney Opera House, innovation approaches based on BRITE work.</p>   | <p>Model of Industry Taskforce has been implemented for the three new research streams for the new two-year research program.</p> <p>Increase use of ICT applications that use Building Information Models (BIM) within Sydney Opera House, Queensland</p>  |

| PERFORMANCE INDICATOR  | OBJECTIVE / TARGET | 2006-07 PROGRESS / ACHIEVEMENT  | 2007-08 PROGRESS / ACHIEVEMENT   |
|--|--------------------|---|--|
|  |                    |   | Departments of Public Works and Main Roads, John Holland, Bovis Lend Lease, Leighton Contractors, Mirvac, and other industry partners as their employees become more familiar with the advantages and applications from engagement in CRC projects that demonstrate the next level of potential application which significantly reduces re-work and re-entry of data across the design, tender, construct and facility management cycle. |
| 6. Increased recognition of the CRC's contribution to improved standards of design and construction. |                    | Victorian and Queensland Government agencies using guidelines developed for wayfinding in the built environment.<br>CRC engagement with IAI, the organisation working to establish the international standard for IFC for building design, construct and facility management data.  | Extensive support has been provided by private sector partners in contributing to the new research program which commenced this year. In particular the National Guidelines for BIM which attempts to improve standards at the design stage.   |
| 7. Contribution by CRC participants in developing public policy initiatives.                         |                    | Key submissions were provided to: <ul style="list-style-type: none"> <li>• Performance Benchmarking of Australian Business Regulation (Productivity Commission)</li> <li>• Draft Brisbane Economic Development Plan (Brisbane City Council)</li> <li>• Inquiry into a Sustainability Charter (House of Representatives Standing Committee on Environment and Heritage)</li> </ul> | Key submissions have been provided to: <ul style="list-style-type: none"> <li>• National Innovation System Review highlighting the value of CRC outputs to industry. April 2008</li> <li>• <i>Submission to the Senate Education, Employment and Workplace Relations Committee — Inquiry into the Effects of Climate Change on Training and Employment Needs</i> on 5 September 2008.</li> </ul>   |
| 8. Strength of collaboration achieved in research development between                                |                    | Use of Industry Taskforces to strengthen R&D collaboration proved to be extremely successful with   | The successful start of five new projects at the commencement of the 2007-08 year engaging an  |

| <b>PERFORMANCE INDICATOR</b>   | <b>OBJECTIVE / TARGET</b> | <b>2006-07 PROGRESS / ACHIEVEMENT</b>   | <b>2007-08 PROGRESS / ACHIEVEMENT</b>  |
|--|---------------------------|---|--|
| researchers and industry.  |                           | the Safer Construction and Your Building projects.<br>BRITE project disseminated findings broader across all sectors and sizes of the industry the management practices of Australia's most highly innovative contractors   | additional seven new private sector partners – five at the core participant level and two at the project level demonstrates the strength of collaboration with industry. These projects are all proceeding well with the majority completing their research component in the first part of the 2009 calendar year, allowing time for dissemination of outputs prior to the closure of this CRC in June 2009. |
| 9. External recognition of CRC CI as a leader in collaborative and innovative research in Australia. |                           | External recognition was demonstrated by: <ul style="list-style-type: none"> <li>• Comment from this CRC being sought by Business Review Weekly, Australian Financial Review and ABC radio</li> <li>• Engagement of Minister Kevin Andrews and Parliamentary Secretary Bob Baldwin to launch our CRC projects</li> <li>• Successful development of the two-year extension research program</li> <li>• CRC personnel being sought for keynotes at conferences</li> <li>• Over 250 industry stakeholders attending Construction Site Safety Culture workshops.</li> <li>• Additional project funding from OFSC of \$100,000 cash plus in-kind support.</li> </ul> | External recognition demonstrated by: <ul style="list-style-type: none"> <li>• Requests such as from Master Builders request to print an article which they describe as 'a great article and great resource for the construction industry, as is the overall "Your Building" website'.</li> </ul> In their bi-monthly magazine that goes to around 11 000 members of the construction industry               |
| <b>Strategy for Utilisation and Commercialisation of Research Outputs</b>                            |                           |   |  |
| 1. Diffusion activities undertaken by CRC audience indicated by number of project                    |                           | Summary of activities <ul style="list-style-type: none"> <li>• Two research symposiums attended by over 150 people</li> </ul>   | Summary of activities <ul style="list-style-type: none"> <li>• One research symposium attended by 75</li> </ul>  |



| <b>PERFORMANCE INDICATOR</b>  | <b>OBJECTIVE / TARGET</b>   | <b>2006-07 PROGRESS / ACHIEVEMENT</b>   | <b>2007-08 PROGRESS / ACHIEVEMENT</b>   |
|---|---|---|---|
| initiated seminars and workshops.   |   | <ul style="list-style-type: none"> <li>Four presentations of project research outcomes to over 300 facility management practitioners</li> </ul> | <ul style="list-style-type: none"> <li>14 workshops - Sustainability Series attended by 277 people</li> <li>3 workshops - Relationship Management attended by 78 people</li> <li>One Safety Leaders workshop attended by 16 people</li> </ul> |
| 2. Invitations as keynote speaker to industry conference, seminars, etc.  | Number of presentations   | 6 keynote presentations nationally and 4 keynote presentations internationally  | 4 keynote presentations nationally and 4 keynote presentations internationally  |
| 3. Increase in participation in industry, trade and academic conferences. | Number in which CRC participated  | 16 internationally and 17 state or national events  | 10 internationally and 8 state or national events   |
| 4. Increase in publications for industry users.                           |   | 10 specialist industry publication produced with 4,300 copies being distributed   | 25 publications for industry users  |
| 5. Increase in number of media clippings/appearances.                     |   | 76 articles published in industry and mainstream media  | 60 articles published in industry and mainstream media  |
| 6. Growth in income and industry uptake from commercialisation of IP.     |   | 5 products being trialled with external parties   | One product, LCADesign is the subject of a development and commercialisation licence.   |
| <b>Education and Training</b>   |   |   |   |
| 1. Uptake of CRC CI inputs to curriculum.                                 |   | 8 courses were identified as containing significant amount of curriculum content based on project outputs.                                      | 4 courses were identified as containing significant amount of curriculum content based on project outputs as stated in Section 6.<br>Additional courses use our publications as reference materials.  |
| 2. Co-supervision of students by industry partners.                       | All students have an industry supervisor.   | All students had an industry supervisor.  | All students had an industry supervisor.  |
| 3. Uptake of CRC CI Research Scholarships by quality candidates.          | Candidates meet the requirements of the APAI guidelines.<br>Meet the approval of academic and | All four new scholars meet the requirements set.  | No new scholarships awarded.  |

| <b>PERFORMANCE INDICATOR</b>  | <b>OBJECTIVE / TARGET</b>    | <b>2006-07 PROGRESS / ACHIEVEMENT</b>   | <b>2007-08 PROGRESS / ACHIEVEMENT</b>  |
|---|------------------------------|---|--|
|   | research users participants. |   |  |
| 4. Growth in numbers of industry users involved in research training.   |                              | Four new scholars all were actively supported by industry supervisors and employing organisations.  | No new scholarships awarded. Therefore, no new industry supervisors engaged. However, existing industry supervisors continued their support.   |
| 5. Number of alliances delivering CRC CI research outputs to industry.  |                              | 2 projects had Industry Taskforces overseeing their operations  | The Industry Taskforce model has provided successful and two new taskforces have been developed for the new extension program of research through 2007-09.                           |
| 6. Growth in value of research training sponsorship awarded by government and industry for research and/or study related to CRC projects. |                              | Three scholars received top-up funding from government and industry participants.   | Top-up funding from government and industry participants to three scholars continued.  |
| <b>External Communication</b>   |                              |   |  |
| 1. Press releases raising profile of CRC CI and its partners in the promotion of collaboration and innovation.                            |                              | 11 media releases were issued.  | 9 media releases were issued   |
| 2. Growth in impact of publications recognised as key by industry and academic partners.  |                              | 2 Ministers were prepared to launch publications – Hon Kevin Andrews and Hon Bob Baldwin<br>2 industry publications used as basis for education and training by QUT and AIRAH         | 1 former Minister prepared to launch publication - Hon Joe Hockey<br>1 industry publication used as basis for education by USQ   |
| 3. Number of papers presented to national and international conferences and promotional activities.                                       |                              | 13 referred conference papers to international conferences and 4 international industry presentations<br>10 papers to national conferences and 16 industry and academic presentations | 20 referred conference papers to international conferences and 4 international industry presentations<br>21 papers to national conferences and 5 industry and academic presentations |
| 4. Number of presentations to partners, industry and community groups.  |                              | 7 projects industry seminars and launchers, 3 stakeholder workshops, 2 research symposiums  | 14 projects industry seminars and launchers, 1 stakeholder workshops, 1 research symposiums  |
| <b>Administration</b>   |                              |   |  |
| 1. Satisfaction of participant and Commonwealth   |                              | 19 Executive Report Cards circulated to participants.   | 4 Executive Report Cards circulated to participants.   |

| <b>PERFORMANCE INDICATOR</b>   | <b>OBJECTIVE / TARGET</b> | <b>2006-07 PROGRESS / ACHIEVEMENT</b>  | <b>2007-08 PROGRESS / ACHIEVEMENT</b>  |
|--|---------------------------|--|--|
| with financial and research management systems.  |                           | External survey found a high level of satisfaction with our CRC and identified the main benefits for participants as the CRC's capacity to bring various industry partners together to collaborate and the CRC's support for a culture change to adopt new technologies and innovation in the industry.  | The Board has approved all financial and research management systems and close monitoring of these systems occurs through the Board committees – Audit and Compliance Committee and Research Committee. There have been no issues of concern to the Board regarding the operation of these systems.<br><br>The Commonwealth has accepted all quarterly financial reports and no funding payments have been withheld.   |
| 2. Effective Centre operations across all Commonwealth programs.                                 |                           | All reporting and audit milestones were met.<br>Australian Institute for Commercialisation identified our CRC as one of the top 5 performing CRCs.   | All reporting and audit milestones have been met. The Centre's Governing Board continues to express confidence in the established systems which are regularly monitored through the risk management process overseen by the Audit and Compliance Committee.  |
| 3. Collaborative transactions with industry or government partners, including research projects. |                           | 5 industry conferences were sponsored and conference presentations provided.<br><br>Your Building, was a major collaborative project with AGO and ASBEC and sponsorship provided by 7 parties external to the CRC.   | 6 industry conferences were sponsored and conference presentations provided.   |
| 4. Growth in number of additional collaborations annually, particularly with industry.           |                           | Collaboration with 27 industry, government and research partners to develop the two-year research extension program<br><br>2 Industry Taskforce in operation over 2 projects. Industry Taskforces consist of senior executives from industry established to ensure a keen industry focus for the project and to garner champions for the research outputs. | The two-year extension program commenced successfully bringing on 6 new industry partners whilst retaining all existing partners. It has also attracted the involvement of 3 new industry partners at the project level. The extension program has proved highly successful in meeting its goals of extending our CRC for 12 months to position for the next CRC funding round and engaging existing and new emerging areas of research. It has allowed the 8 newly engaged industry |

| PERFORMANCE INDICATOR  | OBJECTIVE / TARGET | 2006-07 PROGRESS / ACHIEVEMENT   | 2007-08 PROGRESS / ACHIEVEMENT   |
|--|--------------------|--|--|
|  |                    |  | organisations to experience the benefits of the CRC Program as they work with us in developing the new CRC proposal.   |
| 5. Growth in repeat collaborations with partners on projects and related activities. |                    | <p>Collaboration with 27 industry, government and research partners to develop the two-year research extension program</p> <p>OSFC provided funding of \$60,000 to further develop research outcomes from the Construction Site Safety Culture project bringing the total additional funding received from OFSC to \$100K.</p> | In 2007-08, there have been 18 active projects, 13 continuing and the 5 new projects from the extension research program. Across the 18 projects there has been an average of 6 partners engaged on each project. In addition there are 3 new industry partners engaged at the project level across two of the new extension program projects. |

## 8.0 Glossary of Terms

|  |          |
|--|----------|
| American Society of Civil Engineers                          | ASCE     |
| Architecture Engineering and Construction                    | AEC      |
| Association of Consulting Engineers Australia                | ACEA     |
| Association of Researchers in Construction Management        | ARCOM    |
| Australian Building Codes Board                              | ABCB     |
| Australian Construction Industry Forum                       | ACIF     |
| Australian Constructors Association                          | ACA      |
| Australian Council for Infrastructure Development            | AusCID   |
| Australian Greenhouse Office                                 | AGO      |
| Australian Institute of Architects                           | AIA      |
| Australian Institute of Building                             | AIB      |
| Australian Institute of Management                           | AIM      |
| Australian Institute of Project Management                   | AIPM     |
| Australian Performance Based Building Initiative             | AusPeBBu |
| Australian Procurement and Construction Council              | APCC     |
| Australian Sustainable Built Environment Council             | ASBEC    |
| Australian Universities Building Educators Association       | AUBEA    |
| Bill of Quantities   | BoQ      |
| Bovis Lend Lease   | BLL      |
| Brisbane City Council  | BCC      |
| Brisbane Water Enviro Alliance                               | BWEA     |
| Building Code of Australia                                   | BCA      |
| Building Commission (Victoria)                               | BC       |
| Building Industry Redundancy Trust (Queensland)              | BIRT     |
| Building Information Modelling                               | BIM      |
| Building Products Innovation Council                         | BPIC     |
| Building Research Innovation Technology and Environment      | BRITE    |
| Building Services Research and Information Association       | BSRIA    |
| carbon fibre-reinforced polymer                              | CFRP     |
| case-based logic   | CBL      |
| Centre for Integrated Engineering Asset Management           | CIEAM    |
| Civil Contractors Federation                                 | CCF      |
| Commonwealth Scientific and Industrial Research Organisation | CSIRO    |

|  |        |
|--|--------|
| Computer-Assisted Design   | CAD    |
| Contract Planning Workbench  | CPW    |
| Cooperative Research Centre  | CRC    |
| Cooperative Research Centre Association  | CRCA   |
| Construction and Property Services Industry Skills Council                     | CPSISC |
| Continuing Professional Development  | CPD    |
| Corporate Real Estate  | CRE    |
| Corporate Social Responsibility  | CSR    |
| Critical Success Factors   | CSF    |
| Decision-support Systems   | DSS    |
| Engineering database management  | EDM    |
| Environmental Protection Agency  | EPA    |
| Environmentally sustainable development  | ESD    |
| Executive support systems  | ESS    |
| Facilities Management Association Australia                                    | FMAA   |
| Facility management  | FM     |
| Fibre-reinforced composite   | FRC    |
| fibre-reinforced polymer   | FRP    |
| Forest and Wood Products Research and Development Corporation                  | FWPRDC |
| Government Asset Management Arena  | GAMA   |
| Housing Industry Association   | HIA    |
| Heating, ventilation and air-conditioning                                      | HVAC   |
| Human-computer interfaces  | HCI    |
| Industry foundation classes  | IFC    |
| Information and communication technology                                       | ICT    |
| Institution of Engineers Australia   | IEAust |
| Intellectual property  | IP     |
| International Alliance for Interoperability                                    | IAI    |
| International Construction Research Alliance                                   | ICALL  |
| International Council for Research and Innovation in Building and Construction | CIB    |
| Key performance indicators   | KPIs   |
| Life cycle analysis  | LCA    |
| National Occupational Health and Safety Commission                             | NOHSC  |
| Noise-induced hearing threshold shifts   | NITS   |
| Occupational Health and Safety   | OHS    |
| Office of the Australian Safety and Compensation Council                       | OASCC  |
| Off-site manufacture   | OSM    |
| Outcomes performance indicators  | OPI    |
| Property Council of Australia  | PCA    |
| Public-Private Partnership   | PPP    |
| Queensland Department of Main Roads  | QDMR   |
| Queensland Department of Public Works  | QDPW   |
| Queensland Department of State Development and Innovation                      | QDSDI  |
| Queensland University of Technology  | QUT    |
| Research and development   | R&D    |
| Royal Australian Institute of Architects                                       | RAIA   |
| Royal Melbourne Institute of Technology  | RMIT   |
| Small-to-medium size enterprise  | SME    |
| Small office – home office   | SOHO   |
| Smart and Sustainable Built Environment  | SASBE  |
| Soft systems methodology   | SSM    |
| Strategic asset maintenance  | SAM    |
| Technical and Further Education  | TAFE   |
| Vocational education and training  | VET    |
| University of New South Wales  | UNSW   |
| Urban Development Institute of Australia                                       | UDIA   |
| Year of the Built Environment  | YBE    |

## Appendix 1 Refereed Publications

### Refereed Journal Articles

Allan, D., Brown, K. and Furneaux, C., (2008), 'Public Values Embedded in Australian Public Works Procurement: An Institutional Analysis', in Koppenjan, J., Charles M. and Ryan, N (eds), submitted to *Public Management and Money Journal*, Vol 28, No 3, pp 167-172 - first submitted to CRC CI 3.11.07

Aranda-Mena, G., Arlt, M., Stark, J. and Walker, D., (2007), 'Chapter 7: E-Business and Project Procurement', in Walker, D. and Rowlinson, S. *Procurement Systems – A Project Management Perspective*, Taylor & Francis Books (incorporating Spon Press)

Beilharz, K. (2008), 'Embodied music controllers: Cyborg precision for gestural interaction' (in press)

Beilharz, K. (2008), 'Interactive instrumental performance and gesture sonification' (in press)

Beilharz, K. and Jakovich, J. (2007), 'Interaction as a Medium in Architectural Design', in Edmonds, E. (ed) 'Transactions', *Leonardo: Journal of Art, Science and Technology*, MIT Press, pp 368-369

Beilharz, K. and Song, H. (2007), 'Concurrent Auditory Stream Discrimination in Auditory Graphing', in NAUN *International Journal of Computers*, Issue 3, Vol 3, No.1, ISSN: 1998-4308, pp 79-87

Beilharz, K. and Vande Moere, A. (2008), 'Sonic drapery as a folding metaphor for a wearable visualization and sonification display' in *Visual Communication*, Vol 7, No 3, pp 271-290

Biggs, H., Dingsdag, D., Sheahan, V. (2007), 'Risk management and Injury Prevention: Competencies, Behaviours, and Attitudes to Safety in the Construction Industry,' *Australian Journal of Rehabilitation Counselling*, Vol 13, No 2, pp 63-67, ISSN: 1323-8922

Biggs, H., Dingsdag, D. and Sheahan, V. (2008), 'Understanding and defining OH&S competency for construction site roles: Worker perceptions,' *Safety Science*, Issue 46, pp 619-633, ISSN: 0925-7535

Blismas, N. and Fussell, T. (2008), 'A review of off-site manufacture at skilled stadium', *Construct*, The Australian Institute of Building

Blismas, N. and Wakefield, R. (2008), 'Drivers, Constraints and the Future of Off-Site Manufacture in Australia', *Construction Innovation Special Edition 2008* (check when published [http://irc.nrc-cnrc.gc.ca/pubs/ci/toc\\_e.html](http://irc.nrc-cnrc.gc.ca/pubs/ci/toc_e.html)) - submitted to CRC CI 21.12.07

Brown, K., Furneaux, C., Logan, I. and McFallan, S. (2008), 'Sewer Mining: Barriers and drivers of an underutilised resource, Forthcoming in *Public Administration Today*

Brown, K., Charles, M., Paredes Castillo, C. and Ryan, R. (2008), 'Safe and Sound? The Public Value Trade-Off in Worker Safety and Infrastructure Procurement', *Public Money and Management*, Vol 28, No 3, pp 159-166

Hardie, M., Khan, S., O'Donnell, A. and Miller, G. (2007), 'The efficacy of waste management plans in Australian commercial construction refurbishment projects', *Australian Journal of Construction Economics and Building*, Vol 7, No 3, pp 26-36

Manley, K. (2008), 'Implementation of Innovation by Manufacturers Subcontracting to Construction Projects', *Journal of Engineering, Construction and Architectural Management*, Vol 15, No 3, pp 230-245

Paevere, P. (2008), 'GEN 79: Impact of Indoor Environmental Quality on Occupant Productivity and Wellbeing in Office Buildings', *The BEDP Environment Design Guide*, Australian Institute of Architects

Paevere, P. (2008), 'Indoor Environment Quality and Occupant Productivity in Office Buildings', in *Technology, Design and Process Innovation in the Built Environment*, Newton, P., Hampson, K. and Drogemuller, R., Taylor & Francis Books Ltd. (in press)

## **Refereed Conference Papers**

Adams, R., Brown, S., Leman, A. and Paevere, P., 'Indoor Environment Quality and Occupant Productivity in the CH2 Building', Proceedings of the World Sustainable Buildings Conference 2008, Melbourne, Australia, 2008

Allan, D., Brown, K., Furneaux, C. and Janssen, S., 'Harmonisation of OH&S Regulation in Australia: An Evaluation of Three Initiatives', Clients Driving Innovation: Benefiting from Innovation Conference, CRC for Construction Innovation, Gold Coast, Australia, 12-14 March, 2008

Aranda-Mena, G., Calder, J., Chevez, A. and Edwards, P., 'Reaching Singularity Point in Workplace Architecture', Proceedings of the Clients Driving Innovation: Benefiting from Innovation Conference, CRC for Construction Innovation, Gold Coast, Australia, 12-14 March, 2008

Aranda-Mena, G., Calder, J., Chevez, A. and Edwards, P., 'Research model for evaluating the impact of technology in workplace design in Australia', Proceedings of the Third Scottish Conference for Postgraduate Researchers of the Built and Natural Environment (PRoBE). Glasgow Caledonian University, Scotland, 20-22 November 2007

Aranda-Mena, G., Chevez, A., Crawford, J. and Froese, T., 'An Australian perspective of the business drivers for Building Information Modelling', International Conference of Information Technology in Construction. ICCCBE-XII & INCITE 2008, Beijing, China, 16-18 October 2008

Aranda-Mena, G., Chevez, A., Crawford, J. and Froese, T., 'BIM Demystified: Does it make business sense to adopt Building Information Modelling?' CIM-W78 IT in Construction, Santiago, Chile, 15-17 July 2008

Aranda-Mena, G., Chevez, A., Crawford, J. and Froese, T., 'Structuring the Business Case for Building Information Models', Congrès annuel 2008 de la SCGC CSCE, Quebec, QC, Canada, 10-13 June 2008

Aranda-Mena, G., Chevez, A., Edwards, P. and Lopez, R., 'Human reliability as a source of error in research', Association of Researchers in Construction Management [ARCOM] 24th Annual Conference University of Glamorgan, Cardiff, Wales, United Kingdom. 1-3 September 2008

Aranda-Mena, G., Froese, T., Goodman, N., Sher, W. and Yum, K.K., 'A Feasibility Study for Model Based Estimating for Concrete Bridges', Clients Driving Innovation: Benefiting from Innovation Conference, CRC for Construction Innovation, Gold Coast, Australia, 12-14 March, 2008 - Abstract submitted 1.7.07, Full Paper submitted 16.11.07

Aranda-Mena, G., Sperling, J. and Wakefield, R., 'E-Business Adoption: Case Study on Melbourne City Council CH2 Building', The World Sustainable Conference series SB08 Melbourne, Australia, 21-25 September 2008

Austen, S. and Seymour, R., 'Can Government use their Procurement Contracts to Improve Training Outcomes', paper presented at the 17<sup>th</sup> International Purchasing & Supply Education & Research Association (IPSERA) Conference, Perth, Australia, 9-12 March 2008

Austen, S. and Seymour, R., 'The Competitive Impacts of Leveraged Training Outcomes', Clients Driving Innovation: Benefiting from Innovation Conference, CRC for Construction Innovation, Gold Coast, Australia, 12-14 March, 2008

Baccarini, D., Davis, P., Lopez, R., Love, P. and Wilson, G., 'Opening Pandora's Box: Revisiting Procurement Selection in the Public Sector Projects', The Postgraduate Researchers of the Built & Natural Environment (PRoBE) International Conference for Postgraduate Researchers of the Built and Natural Environment (PRoBE), Glasgow Caledonian University, Glasgow, Scotland, United Kingdom, 20-22 November 2007

Baccarini, D., Davis, P., Lopez, R., Love, P. and Wilson, G., 'Procurement Selection in the Public Sector: a Tale of Two States', Clients Driving Innovation: Benefiting from Innovation Conference, CRC for Construction Innovation, Gold Coast, Australia, 12-14 March, 2008 - submitted to CRC CI 16.10.07

Beilharz, K., Cabrera, D. and Song, H., 'Evaluation of Spatial Presentation in Sonification for Identifying Concurrent Audio Streams' in ICAD, International Conference on Auditory Display, Montreal, Canada, pp.285-292, 2007

Beilharz, K. and Ferguson, S., 'Gestural Hyper Instrument Collaboration with Generative Computation for Real Time Creativity' in Fischer, G., Giaccardi, E. and Eisenberg, M. (eds) Creativity and Cognition Conference '07, Washington D.C. USA, ACM CHI Sheridan Printing, pp 213-222, 2007

Beilharz, K. and Jakovich, J., 'Adaptive Systems of Engagement: Art, space and cities', in Media Infinity: Taiwan-Australia New Media Arts Forum, Kuandu Museum of Fine Arts Taipei, Taiwan, 2007

Beilharz, K. and Jakovich, J., 'ParticleTecture: Interactive Granular Soundspaces for Living and Entertainment, New Interfaces for Musical Expression, NIME'07, NYC, pp 185-190, 2007

Beilharz, K. and Song, H., 'Information Sonification Changing the Culture of Communication' in Young Investigator's Forum on Culture Technology 2008, KAIST, Korea, 22-24 August 2008

Biggs, H., Cipolla, D. and Dingsdag, D. (2008), 'Safety Effectiveness Indicators (SEIs): Measuring Construction Industry Safety Performance,' Proceedings in *Third International Conference Clients Driving Innovation: Benefiting from Innovation*, Thomas, J. and Piekkala-Fletcher, A. (eds), Gold Coast, Australia, 12-14 March, 2008, CD-ROM, pp 1-11

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Blismas, N., Fleming, T., Jellie, D., Lingard, H. and Wakefield, R., 'Safer Construction: The Development of a Guide to Best Practice', Clients Driving Innovation: Benefiting from Innovation Conference, CRC for Construction Innovation, Gold Coast, Australia, 12-14 March, 2008

Blismas, N., Fussell, T. and Gisik, G., 'Offsite manufacture on Skilled Park, Robina'. Proceedings of the Clients Driving Innovation: Benefiting from Innovation Conference, CRC for Construction Innovation, Gold Coast, Australia, 12-14 March, 2008, Published on CD-Rom, no pagination [Case Study Paper]



Blismas, N. and Lingard, H., 'Occupational Health and Safety in Australia: the Construction Industry's Response to the National Strategy 2001-2012', CIB W99 International Conference: Evolution of and Directions in Construction Safety and Health, Florida, USA, 9-11 March 2008

Blismas, N. and Wakefield, R., 'Offsite Manufacture in Australia: – Barriers and Opportunities', Clients Driving Innovation: Benefiting from Innovation Conference, CRC for Construction Innovation, Gold Coast, Australia, 12-14 March, 2008

Brown, K., Burgess, J., Furneaux, C., Vassilev, N. and Ward, M., 'Streamlining Local Government: Evaluating and eGovernment Initiative in South East Queensland', Clients Driving Innovation: Benefiting from Innovation Conference, CRC for Construction Innovation, Gold Coast, Australia, 12-14 March, 2008

Brown, K., Furneaux, C. and McCabe, A., 'Managing multi-objective building contracts: public art in public building procurement', Paper accepted for delivery at the 22nd Annual Australian and New Zealand Academy of Management Conference, New Zealand, December 2008

Brown, K; Pillay, J and Hampson, KD, "Benefiting from Innovation", in Brown, K; Hampson, KD; Brandon, PS and Pillay, J, *Clients Driving Construction Innovation: Benefiting from Innovation*, pp2-4, 2008

Brown, S., 'High Quality Indoor Environments for Sustainable Office Buildings', Clients Driving Innovation: Benefiting from Innovation Conference, CRC for Construction Innovation, Gold Coast, Australia, 12-14 March, 2008

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Galvin, P., Sutherland, J. and Tywoniak, S., 'Building Organisational Capabilities Through Reconceptualising And Redefining The Knowledge Boundaries Of The Firm', Conference Paper For The European Academy Of Management, Ljubljana, Slovenia, 14-17 May 2008

Galvin, P., Sutherland, J. and Tywoniak, S., 'Knowledge and the Boundaries of the Firm: The Implications for the Construction Industry', Clients Driving Innovation: Benefiting from Innovation Conference, CRC for Construction Innovation, Gold Coast, Australia, 12-14 March, 2008

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Gauravaram, P. and Foo, E. Designing Secure e-Contracting Systems, *Proceedings COLLECTeR 2007 - 21st Conference on eCommerce / 10th Anniversary COLLECTeR Australia conference*, Melbourne., 9-11 December, 2007

Ge, E., Li, Y., Nayak, R. and Xu, Y., 'A User Driven Data Mining Process Model and Learning System', The 13th International Conference on Database Systems for Advanced Applications, New Delhi, India, 19-21 March 2008

Hampson, K.D; Brown, K; Pillay, J and Brandon, P.S, "Key Lessons and Conclusions", in Brown, K; Hampson, K.D; Brandon, P.S and Pillay, J, *Clients Driving Construction Innovation: Benefiting from Innovation*, pp249-251, 2008

Hampson, K.D, *Leading Change in Australian Construction: Promoting the Benefits of Innovation*, CITC-IV, Accelerating Innovation in Engineering, Management and Technology, Gold Coast, 13 July 2007

Hardie, M. and Manley, K., 'Enabling Factors for Innovation by Small Contractors', in Proceedings Clients Driving Innovation: Benefiting from Innovation Conference, CRC for Construction Innovation, Gold Coast, Australia, 12-14 March, 2008

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## Appendix 2 Staff Tables

### Staff Table 1 - CRC In Kind Staff

#### Arup

| Name   | Main activity | Total % of time | Program A   | Program B   | Program C   | Extension Program | Research total (%) | Education (%) | External Comm. (%) | Commercialisation (%) | CRC Admin. (%) |
|--|---------------|-----------------|-------------|-------------|-------------|-------------------|--------------------|---------------|--------------------|-----------------------|----------------|
| John Hainsworth                              | R             | 1.6%            | -           | -           | -           | 1.0%              | 1.6%               | -             | -                  | -                     | -              |
| Richard Hough                                | R             | 3.5%            | 0.1%        | 0.1%        | -           | 0.7%              | 3.5%               | -             | -                  | -                     | -              |
| Steve Pennel                                 | R             | 1.6%            | -           | -           | -           | -                 | 1.6%               | -             | -                  | -                     | -              |
| <b>TOTAL CONTRIBUTED (% of PERSON YEARS)</b> |               | <b>6.7%</b>     | <b>0.1%</b> | <b>0.1%</b> | <b>0.0%</b> | <b>1.7%</b>       | <b>6.7%</b>        | <b>0.0%</b>   | <b>0.0%</b>        | <b>0.0%</b>           | <b>0.0%</b>    |

#### Bovis Lend Lease

| Name   | Main activity | Total % of time | Program A   | Program B   | Program C   | Extension Program | Research total (%) | Education (%) | External Comm. (%) | Commercialisation (%) | CRC Admin. (%) |
|--|---------------|-----------------|-------------|-------------|-------------|-------------------|--------------------|---------------|--------------------|-----------------------|----------------|
| Ross Daddo                                   | R             | 1.3%            | -           | -           | -           | -                 | 0.4%               | -             | -                  | 0.9%                  | -              |
| Guy Gibson                                   | R             | 1.9%            | -           | 1.9%        | -           | -                 | 1.9%               | -             | -                  | -                     | -              |
| Simon Hardy                                  | R             | 3.7%            | 0.8%        | -           | -           | 1.8%              | 2.6%               | -             | -                  | 0.4%                  | 0.8%           |
| Tom McFadyen                                 | R             | 5.0%            | 5.0%        | -           | -           | -                 | 5.0%               | -             | -                  | -                     | -              |
| <b>TOTAL CONTRIBUTED (% of PERSON YEARS)</b> |               | <b>11.9%</b>    | <b>5.8%</b> | <b>1.9%</b> | <b>0.0%</b> | <b>1.8%</b>       | <b>9.9%</b>        | <b>0.0%</b>   | <b>0.0%</b>        | <b>1.3%</b>           | <b>0.8%</b>    |

#### John Holland Group

| Name         | Main activity | Total % of time | Program A | Program B | Program C | Extension Program | Research total (%) | Education (%) | External Comm. (%) | Commercialisation (%) | CRC Admin. (%) |
|--------------|---------------|-----------------|-----------|-----------|-----------|-------------------|--------------------|---------------|--------------------|-----------------------|----------------|
| Chris Burton | R             | 21.5%           | -         | -         | -         | -                 | 0.0%               | -             | -                  | -                     | 21.5%          |
| Dean Cipolla | R             | 10.0%           | -         | -         | -         | 2.5%              | 2.5%               | -             | -                  | -                     | 7.5%           |

### John Holland Group continued

| Name   | Main activity | Total % of time | Program A   | Program B   | Program C   | Extension Program | Research total (%) | Education (%) | External Comm. (%) | Commercialisation (%) | CRC Admin. (%) |
|--|---------------|-----------------|-------------|-------------|-------------|-------------------|--------------------|---------------|--------------------|-----------------------|----------------|
| David Golightly                              | R             | 2.4%            | -           | -           | -           | -                 | 0.0%               | -             | -                  | -                     | 2.4%           |
| Jim Pevitt                                   | R             | 0.8%            | -           | -           | -           | -                 | 0.0%               | -             | -                  | -                     | 0.8%           |
| Stephen Sasse                                | R             | 5.4%            | -           | -           | -           | -                 | 0.0%               | -             | -                  | -                     | 5.4%           |
| <b>TOTAL CONTRIBUTED (% of PERSON YEARS)</b> |               | <b>18.6%</b>    | <b>0.0%</b> | <b>0.0%</b> | <b>0.0%</b> | <b>2.5%</b>       | <b>2.5%</b>        | <b>0.0%</b>   | <b>0.0%</b>        | <b>0.0%</b>           | <b>16.1%</b>   |

### Leighton Contractors

| Name   | Main activity | Total % of time | Program A   | Program B   | Program C   | Extension Program | Research total (%) | Education (%) | External Comm. (%) | Commercialisation (%) | CRC Admin. (%) |
|--|---------------|-----------------|-------------|-------------|-------------|-------------------|--------------------|---------------|--------------------|-----------------------|----------------|
| Josh Baker                                   | R             | 1.9%            | -           | -           | -           | -                 | 1.9%               | -             | -                  | -                     | -              |
| Ivan Chan                                    | R             | 3.0%            | -           | -           | -           | 3.0%              | 3.0%               | -             | -                  | -                     | -              |
| Rick Collins                                 | R             | 56.4%           | -           | -           | -           | 56.4%             | 56.4%              | -             | -                  | -                     | -              |
| Rod Houliston                                | R             | 3.6%            | -           | -           | -           | 3.6%              | 3.6%               | -             | -                  | -                     | -              |
| Steve Martin                                 | R             | 0.9%            | -           | -           | -           | 0.9%              | 0.9%               | -             | -                  | -                     | -              |
| Tony Stapledon                               | R             | 0.9%            | -           | -           | -           | -                 | 0.9%               | -             | -                  | -                     | -              |
| <b>TOTAL CONTRIBUTED (% of PERSON YEARS)</b> |               | <b>66.7%</b>    | <b>0.0%</b> | <b>0.0%</b> | <b>0.0%</b> | <b>63.9%</b>      | <b>66.7%</b>       | <b>0.0%</b>   | <b>0.0%</b>        | <b>0.0%</b>           | <b>0.0%</b>    |

## Mirvac

| Name   | Main activity | Total % of time | Program A   | Program B   | Program C   | Extension Program | Research total (%) | Education (%) | External Comm. (%) | Commercialisation (%) | CRC Admin. (%) |
|--|---------------|-----------------|-------------|-------------|-------------|-------------------|--------------------|---------------|--------------------|-----------------------|----------------|
| Andrew Madsen                                | R             | 0.5%            | -           | -           | -           | 0.5%              | 0.5%               | -             | -                  | -                     | -              |
| Shane McAtee                                 | R             | 2.6%            | -           | -           | -           | 2.6%              | 2.6%               | -             | -                  | -                     | -              |
| Gary McCann                                  | R             | 5.1%            | -           | -           | -           | 5.1%              | 5.1%               | -             | -                  | -                     | -              |
| Richard Rizzali                              | R             | 4.0%            | -           | -           | -           | 4.0%              | 4.0%               | -             | -                  | -                     | -              |
| <b>TOTAL CONTRIBUTED (% of PERSON YEARS)</b> |               | <b>11.6%</b>    | <b>0.0%</b> | <b>0.0%</b> | <b>0.0%</b> | <b>11.6%</b>      | <b>11.6%</b>       | <b>0.0%</b>   | <b>0.0%</b>        | <b>0.0%</b>           | <b>0.0%</b>    |

## Nexus Point

| Name   | Main activity | Total % of time | Program A   | Program B   | Program C   | Extension Program | Research total (%) | Education (%) | External Comm. (%) | Commercialisation (%) | CRC Admin. (%) |
|--|---------------|-----------------|-------------|-------------|-------------|-------------------|--------------------|---------------|--------------------|-----------------------|----------------|
| Rainer Hillermann                            | R             | 1.8%            | -           | -           | -           | 1.8%              | 1.8%               | -             | -                  | -                     | -              |
| Claudelle Taylor                             | R             | 10.0%           | -           | -           | -           | 10.0%             | 10.0%              | -             | -                  | -                     | -              |
| <b>TOTAL CONTRIBUTED (% of PERSON YEARS)</b> |               | <b>11.8%</b>    | <b>0.0%</b> | <b>0.0%</b> | <b>0.0%</b> | <b>11.8%</b>      | <b>11.8%</b>       | <b>0.0%</b>   | <b>0.0%</b>        | <b>0.0%</b>           | <b>0.0%</b>    |

## Rider Levett Bucknall

| Name   | Main activity | Total % of time | Program A   | Program B   | Program C   | Extension Program | Research total (%) | Education (%) | External Comm. (%) | Commercialisation (%) | CRC Admin. (%) |
|--|---------------|-----------------|-------------|-------------|-------------|-------------------|--------------------|---------------|--------------------|-----------------------|----------------|
| Stephen Ballesty                             | R             | 4.6%            | -           | -           | -           | -                 | 4.6%               | -             | -                  | -                     | -              |
| Angie Chui                                   | R             | 14.5%           | -           | -           | -           | -                 | 0.0%               | -             | -                  | 14.5%                 | -              |
| Neil Newman                                  | R             | 1.3%            | -           | -           | -           | -                 | 0.0%               | -             | -                  | 1.3%                  | -              |
| Greg Nowak                                   | R             | 0.5%            | -           | -           | -           | -                 | 0.0%               | -             | -                  | 0.5%                  | -              |
| John Oliver                                  | R             | 17.3%           | -           | -           | -           | 0.7%              | 8.7%               | -             | -                  | 8.6%                  | -              |
| David Stewart                                | R             | 0.4%            | 0.4%        | -           | -           | -                 | 0.4%               | -             | -                  | -                     | -              |
| Reginald Streifler                           | R             | 1.9%            | -           | -           | -           | -                 | 0.0%               | -             | -                  | 1.9%                  | -              |
| <b>TOTAL CONTRIBUTED (% of PERSON YEARS)</b> |               | <b>40.6%</b>    | <b>0.4%</b> | <b>0.0%</b> | <b>0.0%</b> | <b>0.7%</b>       | <b>13.7%</b>       | <b>0.0%</b>   | <b>0.0%</b>        | <b>27.0%</b>          | <b>0.0%</b>    |

## Sydney Opera House

| Name   | Main activity | Total % of time | Program A   | Program B   | Program C   | Extension Program | Research total (%) | Education (%) | External Comm. (%) | Commercialisation (%) | CRC Admin. (%) |
|--|---------------|-----------------|-------------|-------------|-------------|-------------------|--------------------|---------------|--------------------|-----------------------|----------------|
| Paul Akhurst                                 | R             | 0.7%            | -           | -           | -           | 0.7%              | 0.7%               | -             | -                  | -                     | -              |
| Michael Clarke                               | R             | 22.8%           | -           | -           | -           | 22.8%             | 22.8%              | -             | -                  | -                     | -              |
| Chris Linning                                | R             | 4.5%            | -           | -           | -           | 4.5%              | 4.5%               | -             | -                  | -                     | -              |
| Greg McTaggart                               | R             | 1.2%            | -           | -           | -           | 1.2%              | 1.2%               | -             | -                  | -                     | -              |
| <b>TOTAL CONTRIBUTED (% of PERSON YEARS)</b> |               | <b>29.1%</b>    | <b>0.0%</b> | <b>0.0%</b> | <b>0.0%</b> | <b>29.1%</b>      | <b>29.1%</b>       | <b>0.0%</b>   | <b>0.0%</b>        | <b>0.0%</b>           | <b>0.0%</b>    |

## Thiess

| Name   | Main activity | Total % of time | Program A   | Program B   | Program C   | Extension Program | Research total (%) | Education (%) | External Comm. (%) | Commercialisation (%) | CRC Admin. (%) |
|--|---------------|-----------------|-------------|-------------|-------------|-------------------|--------------------|---------------|--------------------|-----------------------|----------------|
| Dean Bingham                                 | R             | 3.3%            | -           | -           | -           | 3.3%              | 3.3%               | -             | -                  | -                     | -              |
| Kike Boyle                                   | R             | 0.2%            | -           | -           | -           | 0.2%              | 0.2%               | -             | -                  | -                     | -              |
| William Buckland                             | R             | 0.2%            | -           | -           | -           | 0.2%              | 0.2%               | -             | -                  | -                     | -              |
| Scott Caton                                  | R             | 0.2%            | -           | -           | -           | 0.2%              | 0.2%               | -             | -                  | -                     | -              |
| Dirk Clapham                                 | R             | 1.6%            | -           | -           | -           | 1.6%              | 1.6%               | -             | -                  | -                     | -              |
| Erik Isokangas                               | R             | 9.6%            | -           | -           | -           | 9.6%              | 9.6%               | -             | -                  | -                     | -              |
| Josef Smogerzewski                           | R             | 0.5%            | -           | -           | -           | 0.5%              | 0.5%               | -             | -                  | -                     | -              |
| Ted Williams                                 | R             | 2.5%            | -           | -           | -           | 2.5%              | 2.5%               | -             | -                  | -                     | -              |
| <b>TOTAL CONTRIBUTED (% of PERSON YEARS)</b> |               | <b>3.8%</b>     | <b>0.0%</b> | <b>0.0%</b> | <b>0.0%</b> | <b>3.8%</b>       | <b>3.8%</b>        | <b>0.0%</b>   | <b>0.0%</b>        | <b>0.0%</b>           | <b>0.0%</b>    |

## Transfield Services

| Name   | Main activity | Total % of time | Program A   | Program B   | Program C   | Extension Program | Research total (%) | Education (%) | External Comm. (%) | Commercialisation (%) | CRC Admin. (%) |
|--|---------------|-----------------|-------------|-------------|-------------|-------------------|--------------------|---------------|--------------------|-----------------------|----------------|
| Philip Warren                                | R             | 3.3%            | -           | -           | -           | 2.9%              | 3.3%               | -             | -                  | -                     | -              |
| <b>TOTAL CONTRIBUTED (% of PERSON YEARS)</b> |               | <b>3.3%</b>     | <b>0.0%</b> | <b>0.0%</b> | <b>0.0%</b> | <b>2.9%</b>       | <b>3.3%</b>        | <b>0.0%</b>   | <b>0.0%</b>        | <b>0.0%</b>           | <b>0.0%</b>    |

### Woods Bagot

| Name   | Main activity | Total % of time | Program A   | Program B   | Program C   | Extension Program | Research total (%) | Education (%) | External Comm. (%) | Commercialisation (%) | CRC Admin. (%) |
|--|---------------|-----------------|-------------|-------------|-------------|-------------------|--------------------|---------------|--------------------|-----------------------|----------------|
| John Flynn                                   | R             | 0.1%            | -           | 0.1%        | -           | -                 | 0.1%               | -             | -                  | -                     | -              |
| David Marchant                               | R             | 4.0%            | -           | -           | 0.2%        | 1.5%              | 1.6%               | -             | -                  | 1.4%                  | 0.9%           |
| <b>TOTAL CONTRIBUTED (% of PERSON YEARS)</b> |               | <b>4.1%</b>     | <b>0.0%</b> | <b>0.1%</b> | <b>0.2%</b> | <b>1.5%</b>       | <b>1.8%</b>        | <b>0.0%</b>   | <b>0.0%</b>        | <b>1.4%</b>           | <b>0.9%</b>    |

### Australian Building Codes Board

| Name   | Main activity | Total % of time | Program A   | Program B   | Program C   | Extension Program | Research total (%) | Education (%) | External Comm. (%) | Commercialisation (%) | CRC Admin. (%) |
|--|---------------|-----------------|-------------|-------------|-------------|-------------------|--------------------|---------------|--------------------|-----------------------|----------------|
| Brian Ashe                                   | R             | 0.6%            | -           | -           | -           | -                 | 0.6%               | -             | -                  | -                     | -              |
| Ivan Donaldson                               | R             | 0.2%            | -           | -           | -           | -                 | 0.2%               | -             | -                  | -                     | -              |
| <b>TOTAL CONTRIBUTED (% of PERSON YEARS)</b> |               | <b>0.9%</b>     | <b>0.0%</b> | <b>0.0%</b> | <b>0.0%</b> | <b>0.0%</b>       | <b>0.9%</b>        | <b>0.0%</b>   | <b>0.0%</b>        | <b>0.0%</b>           | <b>0.0%</b>    |

### Brisbane City Council

| Name              | Main activity | Total % of time | Program A | Program B | Program C | Extension Program | Research total (%) | Education (%) | External Comm. (%) | Commercialisation (%) | CRC Admin. (%) |
|-------------------|---------------|-----------------|-----------|-----------|-----------|-------------------|--------------------|---------------|--------------------|-----------------------|----------------|
| Heidi Astin       | A             | 0.3%            | -         | -         | -         | -                 | 0.0%               | -             | -                  | -                     | 0.3%           |
| Alexia Bates      | R             | 0.2%            | -         | -         | -         | 0.2%              | 0.2%               | -             | -                  | -                     | -              |
| Steve Berwick     | R             | 0.5%            | -         | -         | -         | 0.5%              | 0.5%               | -             | -                  | -                     | -              |
| Paul Champtaloup  | R             | 0.2%            | -         | -         | -         | 0.2%              | 0.2%               | -             | -                  | -                     | -              |
| Michael Griffiths | R             | 4.9%            | -         | -         | -         | 4.9%              | 4.9%               | -             | -                  | -                     | -              |
| Joyce Law         | R             | 1.0%            | -         | -         | -         | 1.0%              | 1.0%               | -             | -                  | -                     | -              |
| Phillip Lord      | R             | 3.8%            | -         | -         | -         | 3.8%              | 3.8%               | -             | -                  | -                     | -              |



### Brisbane City Council continued

| Name   | Main activity | Total % of time | Program A   | Program B   | Program C   | Extension Program | Research total (%) | Education (%) | External Comm. (%) | Commercialisation (%) | CRC Admin. (%) |
|--|---------------|-----------------|-------------|-------------|-------------|-------------------|--------------------|---------------|--------------------|-----------------------|----------------|
| Dean Morse                                   | R             | 3.6%            | -           | -           | -           | 0.8%              | 1.6%               | -             | -                  | -                     | 2.0%           |
| Aaron Payne                                  | R             | 0.6%            | -           | -           | -           | -                 | 0.0%               | -             | -                  | -                     | 0.6%           |
| <b>TOTAL CONTRIBUTED (% of PERSON YEARS)</b> |               | <b>15.1%</b>    | <b>0.0%</b> | <b>0.0%</b> | <b>0.0%</b> | <b>11.5%</b>      | <b>12.3%</b>       | <b>0.0%</b>   | <b>0.0%</b>        | <b>0.0%</b>           | <b>2.8%</b>    |

### Building Commission

| Name   | Main activity | Total % of time | Program A   | Program B   | Program C   | Extension Program | Research total (%) | Education (%) | External Comm. (%) | Commercialisation (%) | CRC Admin. (%) |
|--|---------------|-----------------|-------------|-------------|-------------|-------------------|--------------------|---------------|--------------------|-----------------------|----------------|
| Tony Arnel                                   | R             | 0.6%            | -           | -           | -           | -                 | 0.6%               | -             | -                  | -                     | -              |
| Paul Crapper                                 | R             | 0.9%            | -           | -           | -           | -                 | 0.9%               | -             | -                  | -                     | -              |
| Dennis Hogan                                 | R             | 2.1%            | -           | -           | -           | -                 | 2.1%               | -             | -                  | -                     | -              |
| Peter Nassau                                 | R             | 1.0%            | -           | -           | -           | -                 | 1.0%               | -             | -                  | -                     | -              |
| Jeff Norton                                  | R             | 1.1%            | -           | -           | -           | -                 | 0.9%               | -             | 0.2%               | -                     | -              |
| <b>TOTAL CONTRIBUTED (% of PERSON YEARS)</b> |               | <b>5.7%</b>     | <b>0.0%</b> | <b>0.0%</b> | <b>0.0%</b> | <b>0.0%</b>       | <b>5.5%</b>        | <b>0.0%</b>   | <b>0.2%</b>        | <b>0.0%</b>           | <b>0.0%</b>    |

### Queensland Building Services Authority

| Name   | Main activity | Total % of time | Program A   | Program B   | Program C   | Extension Program | Research total (%) | Education (%) | External Comm. (%) | Commercialisation (%) | CRC Admin. (%) |
|--|---------------|-----------------|-------------|-------------|-------------|-------------------|--------------------|---------------|--------------------|-----------------------|----------------|
| Chris Boyle                                  | R             | 0.8%            | -           | -           | -           | -                 | 0.1%               | -             | -                  | -                     | 0.6%           |
| Peter Hope                                   | R             | 2.9%            | -           | 0.2%        | 0.6%        | -                 | 2.6%               | 0.1%          | 0.1%               | -                     | 0.1%           |
| Cameron Murphy                               | R             | 0.3%            | 0.3%        | -           | -           | -                 | 0.3%               | -             | -                  | -                     | -              |
| Diane Russell                                | A             | 0.8%            | -           | -           | -           | -                 | 0.0%               | -             | -                  | -                     | 0.8%           |
| Jason Smith                                  | R             | 2.3%            | 1.5%        | -           | -           | -                 | 1.5%               | -             | -                  | -                     | 0.8%           |
| <b>TOTAL CONTRIBUTED (% of PERSON YEARS)</b> |               | <b>6.9%</b>     | <b>1.8%</b> | <b>0.2%</b> | <b>0.6%</b> | <b>0.0%</b>       | <b>4.5%</b>        | <b>0.1%</b>   | <b>0.1%</b>        | <b>0.0%</b>           | <b>2.2%</b>    |

## Queensland Department of Main Roads

| Name   | Main activity | Total % of time | Program A   | Program B   | Program C   | Extension Program | Research total (%) | Education (%) | External Comm. (%) | Commercialisation (%) | CRC Admin. (%) |
|--|---------------|-----------------|-------------|-------------|-------------|-------------------|--------------------|---------------|--------------------|-----------------------|----------------|
| Stephen Clague                               | R             | 0.5%            | -           | -           | -           | -                 | 0.5%               | -             | -                  | -                     | -              |
| Navneet Dutt                                 | R             | 2.1%            | -           | -           | -           | -                 | 0.0%               | -             | -                  | 2.1%                  | -              |
| John Fenwick                                 | R             | 0.2%            | 0.2%        | -           | -           | -                 | 0.2%               | -             | -                  | -                     | -              |
| Ross Guppy                                   | R             | 2.2%            | 1.0%        | -           | -           | -                 | 1.0%               | -             | -                  | -                     | 1.2%           |
| Arthur Hall                                  | R             | 0.1%            | -           | -           | -           | -                 | 0.0%               | -             | -                  | 0.1%                  | -              |
| Don Hicks                                    | R             | 1.4%            | -           | -           | 1.4%        | -                 | 1.4%               | -             | -                  | -                     | -              |
| Noppadol Piyatrapoomi                        | R             | 6.2%            | -           | -           | -           | -                 | 6.2%               | -             | -                  | -                     | -              |
| Cedric Roberts                               | R             | 0.4%            | -           | -           | -           | -                 | 0.0%               | -             | -                  | 0.4%                  | -              |
| Wayne Roberts                                | R             | 0.2%            | 0.2%        | -           | -           | -                 | 0.2%               | -             | -                  | -                     | -              |
| John Spathonis                               | R             | 1.7%            | -           | -           | -           | -                 | 0.0%               | -             | -                  | -                     | 1.7%           |
| Mike Swainston                               | R             | 0.5%            | 0.5%        | -           | -           | -                 | 0.5%               | -             | -                  | -                     | -              |
| Lex Vanderstaay                              | R             | 3.0%            | 3.0%        | -           | -           | -                 | 3.0%               | -             | -                  | -                     | -              |
| Justin Weligamage                            | R             | 1.2%            | -           | -           | -           | -                 | 1.2%               | -             | -                  | -                     | -              |
| Dennis Wogan                                 | R             | 2.7%            | -           | -           | -           | 1.0%              | 1.0%               | -             | -                  | -                     | 1.7%           |
| <b>TOTAL CONTRIBUTED (% of PERSON YEARS)</b> |               | <b>22.2%</b>    | <b>4.8%</b> | <b>0.0%</b> | <b>1.4%</b> | <b>1.0%</b>       | <b>15.1%</b>       | <b>0.0%</b>   | <b>0.0%</b>        | <b>2.6%</b>           | <b>4.6%</b>    |

## Queensland Department of Public Works

| Name           | Main activity | Total % of time | Program A | Program B | Program C | Extension Program | Research total (%) | Education (%) | External Comm. (%) | Commercialisation (%) | CRC Admin. (%) |
|----------------|---------------|-----------------|-----------|-----------|-----------|-------------------|--------------------|---------------|--------------------|-----------------------|----------------|
| Don Allan      | R             | 4.0%            | 1.8%      | -         | -         | -                 | 2.8%               | -             | -                  | -                     | 1.1%           |
| Ron Apelt      | R             | 11.3%           | -         | 1.3%      | 10.0%     | -                 | 11.3%              | -             | -                  | -                     | -              |
| Michael Ball   | R             | 1.9%            | -         | 1.9%      | -         | -                 | 1.9%               | -             | -                  | -                     | -              |
| Ashely Byrnes  | R             | 3.5%            | -         | -         | -         | 3.5%              | 3.5%               | -             | -                  | -                     | -              |
| Dayv Carter    | R             | 1.7%            | 0.2%      | -         | -         | 1.5%              | 1.7%               | -             | -                  | -                     | -              |
| Thomas Fussell | R             | 22.0%           | -         | -         | -         | 21.6%             | 22.0%              | -             | -                  | -                     | -              |
| Bob Giles      | R             | 0.8%            | -         | -         | -         | 0.8%              | 0.8%               | -             | -                  | -                     | -              |
| Delwyn Jones   | R             | 60.1%           | -         | -         | -         | 16.0%             | 16.8%              | 1.6%          | 5.45%              | 35.5%                 | 0.8%           |

Queensland Department of Public Works continued

| Name   | Main activity | Total % of time | Program A   | Program B   | Program C    | Extension Program | Research total (%) | Education (%) | External Comm. (%) | Commercialisation (%) | CRC Admin. (%) |
|--|---------------|-----------------|-------------|-------------|--------------|-------------------|--------------------|---------------|--------------------|-----------------------|----------------|
| Peter Kamp                                   | R             | 0.1%            | -           | -           | -            | -                 | 0.0%               | -             | -                  | 0.1%                  | -              |
| Pat O'Brien                                  | R             | 0.1%            | 0.1%        | -           | -            | -                 | 0.1%               | -             | -                  | -                     | -              |
| Lee Rapley                                   | A             | 1.9%            | 0.3%        | -           | -            | -                 | 1.8%               | -             | -                  | -                     | 0.1%           |
| Peter Richards                               | A             | 7.4%            | -           | -           | -            | 5.9%              | 7.4%               | -             | -                  | -                     | -              |
| Max Smith                                    | A             | 1.0%            | -           | -           | -            | -                 | 0.0%               | -             | -                  | -                     | 1.0%           |
| Julia Willis                                 | A             | 2.0%            | -           | -           | -            | -                 | 1.6%               | -             | -                  | -                     | 0.5%           |
| <b>TOTAL CONTRIBUTED (% of PERSON YEARS)</b> |               | <b>117.5%</b>   | <b>2.3%</b> | <b>3.2%</b> | <b>10.0%</b> | <b>49.2%</b>      | <b>71.5%</b>       | <b>1.6%</b>   | <b>5.5%</b>        | <b>35.6%</b>          | <b>3.4%</b>    |

Western Australia Department of Housing and Works

| Name   | Main activity | Total % of time | Program A    | Program B   | Program C   | Extension Program | Research total (%) | Education (%) | External Comm. (%) | Commercialisation (%) | CRC Admin. (%) |
|--|---------------|-----------------|--------------|-------------|-------------|-------------------|--------------------|---------------|--------------------|-----------------------|----------------|
| Trina Baillie                                | R             | 3.2%            | 1.3%         | -           | -           | -                 | 2.9%               | -             | -                  | -                     | 0.3%           |
| Tim Butcher                                  | R             | 0.3%            | -            | -           | -           | -                 | 0.0%               | -             | -                  | -                     | 0.3%           |
| Wayne Carter                                 | R             | 4.3%            | 2.2%         | -           | 1.5%        | -                 | 3.9%               | -             | -                  | -                     | 0.4%           |
| Greg Fraser                                  | R             | 0.2%            | 0.2%         | -           | -           | -                 | 0.2%               | -             | -                  | -                     | -              |
| Michael Pearson                              | R             | 3.9%            | 2.4%         | -           | 1.1%        | -                 | 3.6%               | -             | -                  | -                     | 0.3%           |
| Ashwin Raj                                   | R             | 8.0%            | 3.8%         | -           | 2.9%        | -                 | 7.7%               | -             | -                  | -                     | 0.3%           |
| Emma Shaw                                    | A             | 0.3%            | -            | -           | -           | -                 | 0.0%               | -             | -                  | -                     | 0.3%           |
| Marleen Voortman                             | R             | 1.1%            | 0.8%         | -           | -           | -                 | 0.8%               | -             | -                  | -                     | 0.2%           |
| Other Research Staff                         | R             | 3.5%            | -            | -           | 3.5%        | -                 | 3.5%               | -             | -                  | -                     | -              |
| <b>TOTAL CONTRIBUTED (% of PERSON YEARS)</b> |               | <b>24.7%</b>    | <b>10.8%</b> | <b>0.0%</b> | <b>9.1%</b> | <b>0.0%</b>       | <b>22.6%</b>       | <b>0.0%</b>   | <b>0.0%</b>        | <b>0.0%</b>           | <b>2.0%</b>    |

## CSIRO

| Name   | Main activity | Total % of time | Program A    | Program B     | Program C   | Extension Program | Research total (%) | Education (%) | External Comm. (%) | Commercialisation (%) | CRC Admin. (%) |
|--|---------------|-----------------|--------------|---------------|-------------|-------------------|--------------------|---------------|--------------------|-----------------------|----------------|
| Michael Ambrose                              | R             | 1.0%            | -            | 1.0%          | -           | -                 | 1.0%               | -             | -                  | -                     | -              |
| Fanny Boulaire                               | R             | 3.3%            | -            | 3.3%          | -           | -                 | 3.3%               | -             | -                  | -                     | -              |
| Peter Boxhall                                | R             | 9.3%            | -            | 0.3%          | -           | -                 | 0.3%               | -             | -                  | 9.0%                  | -              |
| Angela Bradbury                              | R             | 5.6%            | -            | 5.6%          | -           | -                 | 5.6%               | -             | -                  | -                     | -              |
| Steven Brown                                 | R             | 28.5%           | -            | 28.5%         | -           | -                 | 28.5%              | -             | -                  | -                     | -              |
| Wan Yee Chan                                 | R             | 15.5%           | -            | 15.5%         | -           | -                 | 15.5%              | -             | -                  | -                     | -              |
| Ivan Cole                                    | R             | 11.2%           | -            | 11.2%         | -           | -                 | 11.2%              | -             | -                  | -                     | -              |
| Penny Corrigan                               | R             | 0.6%            | -            | 0.6%          | -           | -                 | 0.6%               | -             | -                  | -                     | -              |
| Angelo Delsante                              | R             | 11.3%           | -            | 11.3%         | -           | -                 | 11.3%              | -             | -                  | -                     | -              |
| Lan Ding                                     | R             | 1.8%            | -            | -             | -           | -                 | 0.0%               | -             | -                  | 1.8%                  | -              |
| Stephen Egan                                 | R             | 57.0%           | -            | 21.3%         | -           | -                 | 21.3%              | -             | -                  | 35.8%                 | -              |
| Greg Foliente                                | R             | 2.5%            | -            | 2.5%          | -           | -                 | 2.5%               | -             | -                  | -                     | -              |
| Wayne Ganther                                | R             | 17.2%           | -            | 17.2%         | -           | -                 | 17.2%              | -             | -                  | -                     | -              |
| Murray Hall                                  | R             | 6.5%            | -            | 5.3%          | -           | -                 | 5.3%               | -             | -                  | 1.3%                  | -              |
| Loretta Kivlighon                            | R             | 54.8%           | -            | 54.8%         | -           | -                 | 54.8%              | -             | -                  | -                     | -              |
| Kevin McDonald                               | R             | 17.8%           | -            | -             | -           | -                 | 0.0%               | -             | -                  | 17.8%                 | -              |
| Stephen McFallen                             | R             | 17.1%           | 17.1%        | -             | -           | -                 | 17.1%              | -             | -                  | -                     | -              |
| Cheryl McNamara                              | R             | 14.0%           | -            | -             | -           | -                 | 0.0%               | -             | -                  | 14.0%                 | -              |
| Phillip Paevere                              | R             | 41.5%           | -            | 41.5%         | -           | -                 | 41.5%              | -             | -                  | -                     | -              |
| Seongwon Seo                                 | R             | 3.0%            | -            | 3.0%          | -           | -                 | 3.0%               | -             | -                  | -                     | -              |
| Michael Syme                                 | R             | 3.3%            | -            | 3.3%          | -           | -                 | 3.3%               | -             | -                  | -                     | -              |
| Angela Williams                              | R             | 4.3%            | -            | -             | -           | -                 | 0.0%               | -             | -                  | 4.3%                  | -              |
| Emily Yip                                    | R             | 10.5%           | -            | 10.5%         | -           | -                 | 10.5%              | -             | -                  | -                     | -              |
| <b>TOTAL CONTRIBUTED (% of PERSON YEARS)</b> |               | <b>337.3%</b>   | <b>17.1%</b> | <b>236.4%</b> | <b>0.0%</b> | <b>0.0%</b>       | <b>253.5%</b>      | <b>0.0%</b>   | <b>0.0%</b>        | <b>83.8%</b>          | <b>0.0%</b>    |

## Curtin University of Technology

| Name  | Main activity | Total % of time | Program A    | Program B   | Program C    | Extension Program | Research total (%) | Education (%) | External Comm. (%) | Commercialisation (%) | CRC Admin. (%) |
|---|---------------|-----------------|--------------|-------------|--------------|-------------------|--------------------|---------------|--------------------|-----------------------|----------------|
| Siobhan Austen                              | R             | 10.0%           | 10.0%        | -           | -            | -                 | 10.0%              | -             | -                  | -                     | -              |
| David Baccarini                             | R             | 16.3%           | 7.5%         | -           | 8.8%         | -                 | 16.3%              | -             | -                  | -                     | -              |
| Peter Davis                                 | R             | 39.3%           | 1.8%         | -           | 21.3%        | 16.3%             | 39.3%              | -             | -                  | -                     | -              |
| Peter Galvin                                | R             | 35.0%           | 35.0%        | -           | -            | -                 | 35.0%              | -             | -                  | -                     | -              |
| Peter Love                                  | R             | 42.5%           | -            | -           | 18.8%        | 18.8%             | 42.5%              | -             | -                  | -                     | -              |
| Verena Marshall                             | R             | 3.8%            | 3.8%         | -           | -            | -                 | 3.8%               | -             | -                  | -                     | -              |
| Sarah Niran                                 | A             | 4.3%            | -            | -           | -            | -                 | 4.3%               | -             | -                  | -                     | -              |
| Lily Tandi                                  | A             | 1.8%            | -            | -           | -            | -                 | 1.8%               | -             | -                  | -                     | -              |
| <b>TOTAL CONTRIBUTED(% of PERSON YEARS)</b> |               | <b>151.0%</b>   | <b>58.0%</b> | <b>0.0%</b> | <b>48.8%</b> | <b>35.0%</b>      | <b>151.0%</b>      | <b>0.0%</b>   | <b>0.0%</b>        | <b>0.0%</b>           | <b>0.0%</b>    |

## The University of Newcastle

| Name   | Main activity | Total % of time | Program A    | Program B   | Program C   | Extension Program | Research total (%) | Education (%) | External Comm. (%) | Commercialisation (%) | CRC Admin. (%) |
|--|---------------|-----------------|--------------|-------------|-------------|-------------------|--------------------|---------------|--------------------|-----------------------|----------------|
| Ljiliana Brankovic                           | R             | 7.5%            | -            | -           | -           | 7.5%              | 7.5%               | -             | -                  | -                     | -              |
| John Burgess                                 | R             | 3.8%            | 3.8%         | -           | -           | -                 | 3.8%               | -             | -                  | -                     | -              |
| Ning Gu                                      | R             | 13.8%           | -            | -           | -           | 13.8%             | 13.8%              | -             | -                  | -                     | -              |
| Marcus Jeffries                              | R             | 3.8%            | -            | -           | -           | 3.8%              | 3.8%               | -             | -                  | -                     | -              |
| Kerry London                                 | R             | 17.4%           | 2.5%         | -           | -           | 14.9%             | 17.4%              | -             | -                  | -                     | -              |
| Amir Mahmood                                 | R             | 7.5%            | 7.5%         | -           | -           | -                 | 7.5%               | -             | -                  | -                     | -              |
| Guilherme Piers                              | R             | 1.3%            | 1.3%         | -           | -           | -                 | 1.3%               | -             | -                  | -                     | -              |
| Peter Ward                                   | R             | 6.9%            | -            | -           | -           | 6.9%              | 6.9%               | -             | -                  | -                     | -              |
| <b>TOTAL CONTRIBUTED (% of PERSON YEARS)</b> |               | <b>54.3%</b>    | <b>15.0%</b> | <b>0.0%</b> | <b>0.0%</b> | <b>39.3%</b>      | <b>54.3%</b>       | <b>0.0%</b>   | <b>0.0%</b>        | <b>0.0%</b>           | <b>0.0%</b>    |

## Queensland University of Technology

| Name   | Main activity | Total % of time | Program A     | Program B    | Program C    | Extension Program | Research total (%) | Education (%) | External Comm. (%) | Commercialisation (%) | CRC Admin. (%) |
|--|---------------|-----------------|---------------|--------------|--------------|-------------------|--------------------|---------------|--------------------|-----------------------|----------------|
| Martin Betts                                 | R             | 1.3%            | 1.3%          | -            | -            | -                 | 1.3%               | -             | -                  | -                     | -              |
| Bert Biggs                                   | R             | 55.0%           | -             | -            | -            | 25.0%             | 25.0%              | -             | -                  | 30.0%                 | -              |
| Kerry Brown                                  | R             | 26.3%           | 26.3%         | -            | -            | -                 | 26.3%              | -             | -                  | -                     | -              |
| Michael Charles                              | A             | 2.5%            | 2.5%          | -            | -            | -                 | 2.5%               | -             | -                  | -                     | -              |
| Sharon Christensen                           | R             | 11.3%           | 11.3%         | -            | -            | -                 | 11.3%              | -             | -                  | -                     | -              |
| Andrew Colin                                 | R             | 1.9%            | 1.9%          | -            | -            | -                 | 1.9%               | -             | -                  | -                     | -              |
| Steve Coyne                                  | R             | 0.5%            | -             | 0.5%         | -            | -                 | 0.5%               | -             | -                  | -                     | -              |
| Nur Demirbilek                               | R             | 5.0%            | -             | 5.0%         | -            | -                 | 5.0%               | -             | -                  | -                     | -              |
| Donald Dingsdag                              | R             | 33.8%           | -             | 5.0%         | -            | 13.8%             | 18.8%              | -             | -                  | 15.0%                 | -              |
| Robin Drogemuller                            | R             | 57.2%           | -             | -            | 6.7%         | 32.0%             | 38.7%              | -             | -                  | 18.5%                 | -              |
| Bill Duncan                                  | R             | 3.0%            | 3.0%          | -            | -            | -                 | 3.0%               | -             | -                  | -                     | -              |
| John Frazer                                  | R             | 2.0%            | -             | -            | 2.0%         | -                 | 2.0%               | -             | -                  | -                     | -              |
| Craig Furneaux                               | R             | 10.8%           | 10.8%         | -            | -            | -                 | 10.8%              | -             | -                  | -                     | -              |
| Natalie Gallery                              | R             | 7.5%            | 7.5%          | -            | -            | -                 | 7.5%               | -             | -                  | -                     | -              |
| Stef Gard                                    | R             | 6.3%            | -             | -            | 5.0%         | 1.3%              | 6.3%               | -             | -                  | -                     | -              |
| Keryn Gray                                   | A             | 20.0%           | -             | -            | -            | -                 | 20.0%              | -             | -                  | -                     | -              |
| Mark Haynes                                  | A             | 0.5%            | -             | -            | -            | -                 | 0.5%               | -             | -                  | -                     | -              |
| David Hood                                   | R             | 0.8%            | -             | -            | -            | -                 | 0.8%               | -             | -                  | -                     | -              |
| Norman Katter                                | R             | 5.0%            | 5.0%          | -            | -            | -                 | 5.0%               | -             | -                  | -                     | -              |
| Rosemary Kennedy                             | R             | 2.5%            | -             | 2.5%         | -            | -                 | 2.5%               | -             | -                  | -                     | -              |
| Anne Krupa                                   | A             | 1.3%            | -             | -            | -            | -                 | 1.3%               | -             | -                  | -                     | -              |
| Donald Lam                                   | A             | 2.8%            | -             | -            | -            | -                 | 2.8%               | -             | -                  | -                     | -              |
| Karen Manley                                 | R             | 32.5%           | 32.5%         | -            | -            | -                 | 32.5%              | -             | -                  | -                     | -              |
| Lidia Morawska                               | R             | 0.8%            | -             | 0.8%         | -            | -                 | 0.8%               | -             | -                  | -                     | -              |
| Richi Nayak                                  | R             | 12.5%           | -             | 12.5%        | -            | -                 | 12.5%              | -             | -                  | -                     | -              |
| David Neilsen                                | R             | 25.0%           | -             | -            | -            | 25.0%             | 25.0%              | -             | -                  | -                     | -              |
| Stephane Tywoniak                            | R             | 2.5%            | 2.5%          | -            | -            | -                 | 2.5%               | -             | -                  | -                     | -              |
| Yue Xu                                       | R             | 7.5%            | -             | 7.5%         | -            | -                 | 7.5%               | -             | -                  | -                     | -              |
| <b>TOTAL CONTRIBUTED (% of PERSON YEARS)</b> |               | <b>337.6%</b>   | <b>104.5%</b> | <b>33.8%</b> | <b>13.7%</b> | <b>97.0%</b>      | <b>274.1%</b>      | <b>0.0%</b>   | <b>0.0%</b>        | <b>63.5%</b>          | <b>0.0%</b>    |

## RMIT University

| Name   | Main activity | Total % of time | Program A    | Program B   | Program C    | Extension Program | Research total (%) | Education (%) | External Comm. (%) | Commercialisation (%) | CRC Admin. (%) |
|--|---------------|-----------------|--------------|-------------|--------------|-------------------|--------------------|---------------|--------------------|-----------------------|----------------|
| Guillermo Aranda-Mena                        | R             | 18.8%           | -            | -           | 13.8%        | 5.0%              | 18.8%              | -             | -                  | -                     | -              |
| Nick Blismas                                 | R             | 12.5%           | 3.8%         | -           | 8.8%         | -                 | 12.5%              | -             | -                  | -                     | -              |
| Andrew Carre                                 | R             | 8.8%            | -            | -           | -            | -                 | 0.0%               | 8.8%          | -                  | -                     | -              |
| Usha Iyer-Raniga                             | R             | 4.8%            | -            | -           | -            | -                 | 0.0%               | 2.8%          | -                  | 2.0%                  | -              |
| Helen Lingard                                | R             | 1.3%            | -            | -           | 1.3%         | -                 | 1.3%               | -             | -                  | -                     | -              |
| Anthony Mills                                | R             | 3.8%            | -            | -           | 3.8%         | -                 | 3.8%               | -             | -                  | -                     | -              |
| Horne Ralph                                  | R             | 1.8%            | -            | -           | -            | -                 | 0.0%               | 1.0%          | -                  | 0.8%                  | -              |
| Mark Vines                                   | R             | 0.5%            | -            | -           | 0.5%         | -                 | 0.5%               | -             | -                  | -                     | -              |
| Ron Wakefield                                | R             | 11.0%           | 6.3%         | -           | 1.5%         | 3.3%              | 11.0%              | -             | -                  | -                     | -              |
| Kendra Wasiluk,                              | R             | 26.5%           | -            | -           | -            | -                 | 0.0%               | 22.3%         | -                  | 4.3%                  | -              |
| <b>TOTAL CONTRIBUTED (% of PERSON YEARS)</b> |               | <b>89.5%</b>    | <b>10.0%</b> | <b>0.0%</b> | <b>29.5%</b> | <b>8.3%</b>       | <b>47.8%</b>       | <b>34.8%</b>  | <b>0.0%</b>        | <b>7.0%</b>           | <b>0.0%</b>    |

## The University of Sydney

| Name   | Main activity | Total % of time | Program A   | Program B   | Program C   | Extension Program | Research total(%) | Education (%) | External Comm.(%) | Commercialisation(%) | CRC Admin. (%) |
|--|---------------|-----------------|-------------|-------------|-------------|-------------------|-------------------|---------------|-------------------|----------------------|----------------|
| Kirsty Beilharz                              | R             | 3.8%            | -           | -           | -           | -                 | 0.0%              | 3.8%          | -                 | -                    | -              |
| Megan Haig                                   | A             | 0.8%            | -           | -           | -           | -                 | 0.0%              | -             | -                 | -                    | 0.8%           |
| Suzanne Roberts                              | A             | 1.5%            | -           | -           | -           | -                 | 0.0%              | -             | -                 | -                    | 1.5%           |
| Julian Tam                                   | A             | 0.5%            | -           | -           | -           | -                 | 0.3%              | -             | -                 | -                    | 0.3%           |
| Lisette Tennant                              | A             | 0.5%            | -           | -           | -           | -                 | 0.0%              | -             | -                 | -                    | 0.5%           |
| Julia Warren                                 | A             | 1.5%            | -           | -           | -           | -                 | 0.0%              | -             | -                 | -                    | 1.5%           |
| <b>TOTAL CONTRIBUTED (% of PERSON YEARS)</b> |               | <b>7.0%</b>     | <b>0.0%</b> | <b>0.0%</b> | <b>0.0%</b> | <b>0.0%</b>       | <b>0.3%</b>       | <b>3.8%</b>   | <b>0.0%</b>       | <b>0.0%</b>          | <b>3.0%</b>    |

\* Research total includes Research Administration in some cases

**Staff Table 2 - CRC Paid Program Staff**

| Name                              | Employing organisation | Main activity | Total % of time | % spent on Research Program |     |     |    | % spent on Education Program | % spent on External Comm. | % spent on Commercialisation | % spent on CRC Administration |                   |
|-----------------------------------|------------------------|---------------|-----------------|-----------------------------|-----|-----|----|------------------------------|---------------------------|------------------------------|-------------------------------|-------------------|
|                                   |                        |               |                 | Subprogram                  |     |     |    |                              |                           |                              |                               | Total on Research |
|                                   |                        |               |                 | A                           | B   | C   | EP |                              |                           |                              |                               |                   |
| Michael Ambrose                   | CSIRO                  | R             | 2%              | -                           | 2%  | -   | -  | 2%                           | -                         | -                            | -                             | -                 |
| Guillermo Aranda-Mena             | RMIT                   | R             | 24%             | -                           | -   | 24% | -  | 24%                          | -                         | -                            | -                             | -                 |
| Margaret Bates                    | RMIT                   | R             | 14%             | -                           | 14% | -   | -  | 14%                          | -                         | -                            | -                             | -                 |
| Lorraine Bell                     | QUT                    | R             | 10%             | -                           | 10% | -   | -  | 10%                          | -                         | -                            | -                             | -                 |
| Harminder Bhar                    | QUT                    | R             | 10%             | -                           | 10% | -   | -  | 10%                          | -                         | -                            | -                             | -                 |
| Richard Bird                      | RMIT                   | R             | 20%             | 3%                          | -   | 18% | -  | 20%                          | -                         | -                            | -                             | -                 |
| Fanny Boulaire                    | CSIRO                  | R             | 58%             | -                           | 7%  | -   | -  | 7%                           | -                         | -                            | 51%                           | -                 |
| Peter Boxhall                     | CSIRO                  | R             | 5%              | -                           | 4%  | -   | -  | 4%                           | -                         | -                            | 2%                            | -                 |
| Angela Bradbury                   | CSIRO                  | R             | 31%             | -                           | 31% | -   | -  | 31%                          | -                         | -                            | -                             | -                 |
| Stephen Brown                     | CSIRO                  | R             | 4%              | -                           | 4%  | -   | -  | 4%                           | -                         | -                            | -                             | -                 |
| Laurie Buys                       | QUT                    | R             | 3%              | -                           | 3%  | -   | -  | 3%                           | -                         | -                            | -                             | -                 |
| Cinthy Paredes Castillo           | QUT                    | R             | 25%             | 25%                         | -   | -   | -  | 25%                          | -                         | -                            | -                             | -                 |
| Andrew Carre                      | RMIT                   | R             | 13%             | -                           | -   | -   | -  | 0%                           | 13%                       | -                            | -                             | -                 |
| Jessica Chen                      | UN                     | R             | 25%             | 25%                         | -   | -   | -  | 25%                          | -                         | -                            | -                             | -                 |
| Brianna Chesworth                 | UN                     | R             | 1%              | -                           | -   | -   | 1% | 1%                           | -                         | -                            | -                             | -                 |
| Fiona Cheung                      | QUT                    | R             | 50%             | 50%                         | -   | -   | -  | 50%                          | -                         | -                            | -                             | -                 |
| Agustin Chevez Bernaldo de Quiros | RMIT                   | R             | 20%             | -                           | -   | 20% | -  | 20%                          | -                         | -                            | -                             | -                 |
| Tracy Cooke                       | RMIT                   | R             | 6%              | 6%                          | -   | -   | -  | 6%                           | -                         | -                            | -                             | -                 |
| Penny Corrigan                    | CSIRO                  | R             | 22%             | -                           | 22% | -   | -  | 22%                          | -                         | -                            | -                             | -                 |
| John Crawford                     | RMIT                   | R             | 17%             | -                           | -   | 14% | 3% | 17%                          | -                         | -                            | -                             | -                 |
| Lan Ding                          | CSIRO                  | R             | 41%             | -                           | -   | -   | -  | 0%                           | -                         | -                            | 41%                           | -                 |
| Clare Diaper                      | CSIRO                  | R             | 6%              | -                           | 6%  | -   | -  | 6%                           | -                         | -                            | -                             | -                 |
| Stephen Egan                      | CSIRO                  | R             | 14%             | -                           | 1%  | -   | -  | 1%                           | -                         | -                            | 13%                           | -                 |
| Michael Falta                     | QUT                    | R             | 75%             | 75%                         | -   | -   | -  | 75%                          | -                         | -                            | -                             | -                 |
| Greg Foliente                     | CSIRO                  | R             | 5%              | -                           | 5%  | -   | -  | 5%                           | -                         | -                            | -                             | -                 |
| Susan Fower                       | UN                     | R             | 1%              | 1%                          | -   | -   | -  | 1%                           | -                         | -                            | -                             | -                 |



**Staff Table 2 - CRC Paid Program Staff continued**

| Name               | Employing organisation | Main activity | Total % of time | % spent on Research Program |      |     |    | % spent on Education Program | % spent on External Comm. | % spent on Commercialisation | % spent on CRC Administration |                   |
|--------------------|------------------------|---------------|-----------------|-----------------------------|------|-----|----|------------------------------|---------------------------|------------------------------|-------------------------------|-------------------|
|                    |                        |               |                 | Subprogram                  |      |     |    |                              |                           |                              |                               | Total on Research |
|                    |                        |               |                 | A                           | B    | C   | EP |                              |                           |                              |                               |                   |
| Anne Francis       | Curtin                 | R             | 50%             | 50%                         | -    | -   | -  | 50%                          | -                         | -                            | -                             | -                 |
| Timothy French     | RMIT                   | R             | 1%              | 1%                          | -    | -   | -  | 1%                           | -                         | -                            | -                             | -                 |
| Tom Froese         | RMIT                   | R             | 7%              | -                           | -    | 7%  | -  | 7%                           | -                         | -                            | -                             | -                 |
| Craig Furneaux     | QUT                    | R             | 75%             | 75%                         | -    | -   | -  | 75%                          | -                         | -                            | -                             | -                 |
| Gayleen Furneaux   | QUT                    | R             | 5%              | 5%                          | -    | -   | -  | 5%                           | -                         | -                            | -                             | -                 |
| Michelle Gane      | QUT                    | R             | 8%              | -                           | 8%   | -   | -  | 8%                           | -                         | -                            | -                             | -                 |
| Praveen Gauravaram | QUT                    | R             | 41%             | 41%                         | -    | -   | -  | 41%                          | -                         | -                            | -                             | -                 |
| Ting (Esther) Ge   | QUT                    | R             | 100%            | -                           | 100% | -   | -  | 100%                         | -                         | -                            | -                             | -                 |
| Carole Green       | CRC HQ                 | A             | 100%            | -                           | -    | -   | -  | 10%                          | 10%                       | 10%                          | 15%                           | 55%               |
| Murray Hall        | CSIRO                  | R             | 10%             | -                           | 10%  | -   | -  | 10%                          | -                         | -                            | 0%                            | -                 |
| Sandra Hancock     | UN                     | R             | 1%              | -                           | -    | 1%  | -  | 1%                           | -                         | -                            | -                             | -                 |
| Mary Hardie        | QUT                    | R             | 15%             | 15%                         | -    | -   | -  | 15%                          | -                         | -                            | -                             | -                 |
| Keith Hampson      | CRC HQ                 | R             | 100%            | -                           | -    | -   | -  | 25%                          | 10%                       | 25%                          | 20%                           | 20%               |
| Aaron Manderson    | UN                     | R             | 8%              | -                           | -    | 3%  | 5% | 8%                           | -                         | -                            | -                             | -                 |
| James Harley       | RMIT                   | R             | 2%              | 0%                          | -    | 1%  | -  | 2%                           | -                         | -                            | -                             | -                 |
| Congrong He        | QUT                    | R             | 13%             | -                           | 13%  | -   | -  | 13%                          | -                         | -                            | -                             | -                 |
| Mike Hefferan      | QUT                    | R             | 10%             | -                           | 10%  | -   | -  | 10%                          | -                         | -                            | -                             | -                 |
| Ralph Horne        | RMIT                   | R             | 1%              | -                           | -    | -   | -  | 0%                           | -                         | -                            | 1%                            | -                 |
| Usha Iyer-Raniga   | RMIT                   | R             | 11%             | -                           | 9%   | -   | -  | 9%                           | 1%                        | -                            | -                             | -                 |
| Payungsak Jailang  | RMIT                   | R             | 2%              | -                           | -    | 2%  | -  | 2%                           | -                         | -                            | -                             | -                 |
| Sandra Janssen     | QUT                    | R             | 13%             | 13%                         | -    | -   | -  | 13%                          | -                         | -                            | -                             | -                 |
| David Jellie       | RMIT                   | R             | 5%              | 5%                          | -    | -   | -  | 5%                           | -                         | -                            | -                             | -                 |
| Steven Kenway      | CSIRO                  | R             | 3%              | -                           | 3%   | -   | -  | 3%                           | -                         | -                            | -                             | -                 |
| Loretta Kivlighon  | CSIRO                  | R             | 40%             | -                           | 40%  | -   | -  | 40%                          | -                         | -                            | -                             | -                 |
| Robert Lopez       | Curtin                 | R             | 36%             | -                           | -    | 36% | -  | 36%                          | -                         | -                            | -                             | -                 |
| Karen Manley       | QUT                    | R             | 68%             | 68%                         | -    | -   | -  | 68%                          | -                         | -                            | -                             | -                 |
| Stawomir Marcinski | RMIT                   | R             | 1%              | 1%                          | -    | -   | -  | 1%                           | -                         | -                            | -                             | -                 |
| Andrew Martin      | CSIRO                  | R             | 25%             | -                           | 25%  | -   | -  | 25%                          | -                         | -                            | -                             | -                 |

**Staff Table 2 - CRC Paid Program Staff continued**

| Name                  | Employing organisation | Main activity | Total % of time | % spent on Research Program |     |     |     | % spent on Education Program | % spent on External Comm. | % spent on Commercialisation | % spent on CRC Administration |                   |
|-----------------------|------------------------|---------------|-----------------|-----------------------------|-----|-----|-----|------------------------------|---------------------------|------------------------------|-------------------------------|-------------------|
|                       |                        |               |                 | Subprogram                  |     |     |     |                              |                           |                              |                               | Total on Research |
|                       |                        |               |                 | A                           | B   | C   | EP  |                              |                           |                              |                               |                   |
| Angela McCabe         | QUT                    | R             | 4%              | 4%                          | -   | -   | 4%  | -                            | -                         | -                            | -                             |                   |
| Kevin McDonald        | CSIRO                  | R             | 59%             | -                           | -   | -   | 0%  | -                            | -                         | 59%                          | -                             |                   |
| Stephen McFallan      | CSIRO                  | R             | 16%             | 16%                         | -   | -   | 16% | -                            | -                         | -                            | -                             |                   |
| Cheryl McNamara       | CSIRO                  | R             | 100%            | -                           | -   | -   | 0%  | -                            | -                         | 100%                         | -                             |                   |
| Judith McNamara       | QUT                    | R             | 1%              | 1%                          | -   | -   | 1%  | -                            | -                         | -                            | -                             |                   |
| Anne Miller           | CSIRO                  | R             | 10%             | -                           | 10% | -   | 10% | -                            | -                         | -                            | -                             |                   |
| Evonne Miller         | CSIRO                  | R             | 5%              | -                           | 5%  | -   | 5%  | -                            | -                         | -                            | -                             |                   |
| Brett Mitchell        | QUT                    | R             | 4%              | 4%                          | -   | -   | 4%  | -                            | -                         | -                            | -                             |                   |
| Evonne Mitchell       | QUT                    | R             | 10%             | -                           | 10% | -   | 10% | -                            | -                         | -                            | -                             |                   |
| Trivess Moore         | RMIT                   | R             | 34%             | -                           | 16% | -   | 16% | -                            | -                         | 18%                          | -                             |                   |
| Andrew Walker Morison | RMIT                   | R             | 17%             | -                           | 17% | -   | 17% | -                            | -                         | -                            | -                             |                   |
| Clinton McMurray      | Curtin                 | R             | 5%              | 5%                          | -   | -   | 5%  | -                            | -                         | -                            | -                             |                   |
| Gavin Munroe          | Curtin                 | R             | 25%             | -                           | -   | -   | 0%  | -                            | -                         | 25%                          | -                             |                   |
| Tim Muster            | CSIRO                  | R             | 12%             | -                           | 12% | -   | 12% | -                            | -                         | -                            | -                             |                   |
| David Nielson         | QUT                    | R             | 25%             | -                           | -   | 25% | 25% | -                            | -                         | -                            | -                             |                   |
| Kathryn O'Shea        | QUT                    | R             | 3%              | 3%                          | -   | -   | 3%  | -                            | -                         | -                            | -                             |                   |
| Lisa Opray            | RMIT                   | R             | 1%              | -                           | 1%  | -   | 1%  | -                            | -                         | -                            | -                             |                   |
| Phillip Paevere       | CSIRO                  | R             | 1%              | -                           | 1%  | -   | 1%  | -                            | -                         | -                            | -                             |                   |
| David Paterson        | CSIRO                  | R             | 7%              | -                           | 7%  | -   | 7%  | -                            | -                         | -                            | -                             |                   |
| Ishara Ratnayake      | QUT                    | R             | 12%             | 12%                         | -   | -   | 12% | -                            | -                         | -                            | -                             |                   |
| Collett Roos          | QUT                    | R             | 75%             | -                           | -   | -   | 0%  | -                            | -                         | 75%                          | -                             |                   |
| Rachel Ryan           | QUT                    | R             | 66%             | 66%                         | -   | -   | 66% | -                            | -                         | -                            | -                             |                   |
| Peter Scuderi         | CRC HQ                 | R             | 100%            | -                           | -   | -   | 60% | 10%                          | 10%                       | 10%                          | 10%                           |                   |
| Seongwon Seo          | CSIRO                  | R             | 4%              | -                           | 4%  | -   | 4%  | -                            | -                         | -                            | -                             |                   |
| Richard Seymour       | Curtin                 | R             | 25%             | 25%                         | -   | -   | 25% | -                            | -                         | -                            | -                             |                   |
| Vishal Singh          | UN                     | R             | 50%             | -                           | -   | -   | 50% | -                            | -                         | -                            | -                             |                   |
| Linden Spindler       | QUT                    | R             | 30%             | 30%                         | -   | -   | 30% | -                            | -                         | -                            | -                             |                   |
| Tony Stapeldon        | CSIRO                  | R             | 7%              | -                           | 7%  | -   | 7%  | -                            | -                         | -                            | -                             |                   |

**Staff Table 2 - CRC Paid Program Staff continued**

| Name                | Employing organisation | Main activity | Total % of time | % spent on Research Program |             |             |             | % spent on Education Program | % spent on External Comm. | % spent on Commercialisation | % spent on CRC Administration |                   |
|---------------------|------------------------|---------------|-----------------|-----------------------------|-------------|-------------|-------------|------------------------------|---------------------------|------------------------------|-------------------------------|-------------------|
|                     |                        |               |                 | Subprogram                  |             |             |             |                              |                           |                              |                               | Total on Research |
|                     |                        |               |                 | A                           | B           | C           | EP          |                              |                           |                              |                               |                   |
| James Steel         | CSIRO                  | R             | 25%             | -                           | -           | -           | -           | 0%                           | -                         | -                            | 25%                           | -                 |
| Michael Syme        | CSIRO                  | R             | 4%              | -                           | 4%          | -           | -           | 4%                           | -                         | -                            | -                             | -                 |
| Grace Tjandramadja  | CSIRO                  | R             | 1%              | -                           | 1%          | -           | -           | 1%                           | -                         | -                            | -                             | -                 |
| Bilal Succar        | RMIT                   | R             | 9%              | -                           | -           | -           | 9%          | 9%                           | -                         | -                            | -                             | -                 |
| Jenny Summerville   | QUT                    | R             | 5%              | -                           | 5%          | -           | -           | 5%                           | -                         | -                            | -                             | -                 |
| Janet Sutherland    | Curtin                 | R             | 100%            | 100%                        | -           | -           | -           | 125%                         | -                         | -                            | -                             | -                 |
| Alison Terry        | RMIT                   | R             | 25%             | -                           | 25%         | -           | -           | 25%                          | -                         | -                            | -                             | -                 |
| Nikola Vassilev     | QUT                    | R             | 8%              | 8%                          | -           | -           | -           | 8%                           | -                         | -                            | -                             | -                 |
| Srikanth Venkatesan | RMIT                   | R             | 26%             | -                           | -           | 26%         | -           | 26%                          | -                         | -                            | -                             | -                 |
| Kendra Wasiluk      | RMIT                   | R             | 86%             | -                           | 52%         | -           | -           | 52%                          | 15%                       | -                            | 19%                           | -                 |
| Angela Williams     | CSIRO                  | R             | 60%             | -                           | 14%         | -           | -           | 14%                          | -                         | -                            | 46%                           | -                 |
| Emily Yip           | CSIRO                  | R             | 15%             | -                           | 15%         | -           | -           | 15%                          | -                         | -                            | -                             | -                 |
| Nina Yousefpour     | QUT                    | R             | 6%              | 6%                          | -           | -           | -           | 6%                           | -                         | -                            | -                             | -                 |
| Kwok-Keung Yum      | CSIRO                  | R             | 14%             | -                           | -           | 14%         | -           | 14%                          | -                         | -                            | -                             | -                 |
| Philip Kirk         | QUT                    | R             | 50%             | -                           | -           | -           | 50%         | 50%                          | -                         | -                            | -                             | -                 |
| Geoffrey Wilson     | Curtin                 | R             | 25%             | -                           | -           | 25%         | -           | 25%                          | -                         | -                            | -                             | -                 |
| <b>TOTAL CRC</b>    |                        |               | <b>2455%</b>    | <b>762%</b>                 | <b>541%</b> | <b>217%</b> | <b>118%</b> | <b>1734%</b>                 | <b>59%</b>                | <b>45%</b>                   | <b>532%</b>                   | <b>85%</b>        |

**Staff Table 3 - Summary of contribution in Person Years**

|  | Total equiv. Person Years | Person Years Spent on Research Program |            |            |            | Total on Research | Person Years spent on Education | Person Years spent on External Comm. | Person Years spent on Commercialisation | Person Years spent on CRC Admin. |
|--|---------------------------|--|------------|------------|------------|-------------------|---------------------------------|--------------------------------------|---|----------------------------------|
|  |                           | Subprogram                             |            |            |            |                   |                                 |                                      |   |                                  |
|  |                           | A                                      | B          | C          | EP         |                   |                                 |                                      |   |                                  |
| TOTAL CONTRIBUTED                                | 13.8                      | 2.3                                    | 2.8        | 1.1        | 3.7        | 10.7              | 0.4                             | 0.1                                  | 2.2                                     | 0.4                              |
| TOTAL FUNDED BY CRC                              | 24.4                      | 7.6                                    | 5.4        | 2.2        | 1.2        | 17.3              | 0.6                             | 0.4                                  | 5.3                                     | 0.8                              |
| <b>GRAND TOTAL</b>                               | <b>38.3</b>               | <b>9.9</b>                             | <b>8.2</b> | <b>3.3</b> | <b>4.9</b> | <b>28.1</b>       | <b>1.0</b>                      | <b>0.5</b>                           | <b>7.5</b>                              | <b>1.2</b>                       |
| Proportion of total professional staff resources | 100%                      | 26%                                    | 21%        | 9%         | 13%        | 73%               | 3%                              | 1%                                   | 20%                                     | 3%                               |

