CRC Construction Innovation

BUILDING OUR FUTURE

Cooperative Research Centre
for Construction Innovation

Annual Report 2001–02

CRC AUSTRALIA

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

Contents

Our Vision

Our vision is to lead applied research and development in the Australian property and construction industry – driving innovation and cultural change, knowledge transfer, and commercial outcomes in a collaborative industry environment.

Our Aims

The CRC CI is committed to:

- Creating a research centre of excellence servicing the property, design, construction and facility management sectors, and pursuing world class applied research and development.
- Creating and commercially exploiting tools, technologies and management systems to deliver innovative and sustainable constructed assets to further the financial, environmental and social benefit to the construction industry and the community.
- Combining innovative information and communication technologies, collaboration tools, organisational change and re-engineered construction processes to significantly enhance the construction value chain.

Annual Report 2001–02

Cooperative Research Centre for Construction Innovation

CRC Construction Innovation
BUILDING OUR FUTURE

The Cooperative Research Centre for Construction Innovation (CRC CI) is a national collaborative research and development centre focused on the needs of the property, design, construction and facility management sectors.

Established in 2001 and headquartered at Queensland University of Technology as an unincorporated joint venture under the Australian Government's Cooperative Research Centres (CRC) Program; the CRC CI is developing key technologies, tools and management systems to improve the effectiveness of the construction industry.

Underpinning the CRC CI is the most significant commitment ever made to construction research in Australia – a seven year $14M Commonwealth grant and $50M in industry, research and other government funding. More than 150 researchers and an impressive alliance of 19 partner organisations are involved in and support the activities of the CRC CI.

Cooperative Research Centres Program

CRC AUSTRALIA

CRCs bring together researchers from universities, CSIRO and other government laboratories, and private industry or public sector agencies, in long-term collaborative arrangements which support research and development and education activities that achieve real outcomes of national economic and social significance.

Founding participants

ARUP
ABCB
Bovis Lend Lease
Building Commission
CSIRO
dem
John Holland
HIBF
KENNARDS
Make your job EASY!
Queensland Government
Department of Main Roads
QUT
Queensland Government
Department of Public Works
RMIT UNIVERSITY
Queensland Government
State Development
Rider Hunt
SPRINGFIELD
The University of Newcastle
AUSTRALIA
The University of Sydney
WOODS BAGOT

Chairman's and CEO's Report

CRC CI Chairman, John McCarthy

The past year has seen a major development in advancing the international competitiveness of an industry that represents 14% of the Australian economy and employs 730,000 people – the property and construction industry.

On 18 January 2001 Federal Industry Minister Senator Nick Minchin announced the success of the CRC for Construction Innovation (CRC CI), marking the most significant research and development funding for the construction industry in its history. Prior to the formation of the CRC CI, there was no national research centre to service this critical sector of the economy despite the government's own studies identifying that property and construction provides the greatest spill-over effect to economic growth of any of the service sectors.

The investment of $64milion of cash and in kind support from the Commonwealth and State governments, industry, CSIRO and universities over seven years will be used to create and commercialise tools, technologies and management systems to improve the industry's effectiveness and to develop a more financially, environmentally and socially sustainable construction industry.

2001–02 has been a year of highlights for the CRC CI, the first of which was the execution of the Centre Agreement on 4 October 2001. Under this agreement, 19 participants became formal members of the CRC CI. That we were able to partner successfully with 18 of the 20 initial bid partners, some of whom we have been working with for many years, represents a significant long-term commitment from all involved.

Paralleling the Centre Agreement negotiations, a Research Committee was active throughout the year recommending 16 projects across five program areas with an annual cash value of $1.6million. The synergies developed between industry, government, and research representatives, augurs well for the future development of applied industry research, development and implementation.

An important event in bringing together the Participants was the CRC CI Retreat held in Brisbane in December 2001. Thirty-five participants from Board, Research Committee, Program and Project levels, including at least one representative from each of the participant organisations, attended the Retreat. It proved to be an invaluable networking experience for everyone involved.

In underwriting the CRC CI bid, QUT has delivered on its commitment to provide research and administration facilities at its Gardens Point campus. In February 2002, staff and researchers from the CRC CI moved into newly refurbished premises on Level 9 of L Block at Gardens Point. These world-class facilities are located in Brisbane's CBD with ready access to many of our partners.

Jim Service, AM, served as Interim Board Chair and Inaugural Chair of the CRC CI until December 2001. Jim has a lifetime of experience in the property and construction industries. He provided experienced stewardship of the QUT/CSIRO-led CRC bid throughout 2000 – a contribution that was critical in shaping the mix of CRC participants and in structuring CRC CI governance and Board expectations as the new Centre was developing.

In March 2002 the First Year Visit signalled the Commonwealth Government's first formal review of CRC CI activities. The outcome was extremely positive with the Review Panel noting its approval of the protection and handling of intellectual property through a company; the priority given to commercialisation of research outcomes; QUT's contribution of valuable infrastructure; the effective management control of resources and budget; the enthusiasm of the new Chair and CEO and recognition of the inaugural Chair; and the efforts of the entire CRC CI team. Professor Vernon Ireland was appointed as the CRC CI Visitor and has actively contributed in liaising between our Centre and the CRC Secretariat.

Federal Minister for Science Peter McGauran officially launched the CRC CI on 12 June 2002. It was heartening to see that the Minister is an enthusiastic supporter of the CRC program and his understanding of the importance of the role of the CRC CI in particular.

The CRC CI appointed Professor Peter Brandon, Pro-Vice Chancellor of Research at the United Kingdom's Salford University, as its first International Visitor this year. Professor Brandon was with the CRC CI for three months from June 2002. He is largely credited with taking the University of Salford from a lowly-ranked research institution to the highest performing construction research facility in the UK. Professor Brandon assisted the CRC CI with research management advice and industry liaison. One of his focus areas was also assisting in drafting an international strategic alliance document being used as the foundation for negotiations with a number of leading international research institutions in North America and Europe. It is expected that the outcomes of the international strategic alliance initiative will be evident next year.

We are aware of the need to continually refine our focus against national and international trends if we are to remain relevant. To do this, a Strategic Planning Group has been formed to re-evaluate our vision and objectives. This group consists of Board and Research Committee representation and Program and Project Leaders.

A stronger education and training strategy is under development to incorporate broader industry development and SME outreach. This will form the basis of further discussions at the Annual Retreat in October 2002 to be held in Sydney.

The CRC CI in the last year has offered five research scholarships with that number to double in the second year. These students work alongside the research projects and complement the industry and government research participation at the project level. The selection of these research scholars involves industry, research and CRC input to ensure they act as ambassadors for the CRC concept as well as fulfill academic research requirements. We consider the support and encouragement of the research scholarships – Masters and PhDs – to be an integral component of developing the strength of upcoming talent serving the Australian construction industry.

Despite our early successes, we realise we still have many hurdles ahead. One of these is being a joint venture that relies on long term collaboration for its success while operating with an industry that is reputedly adversarial in nature and short-term focussed. As a result, we have found that the blending of industry, government and research needs, capabilities and expectations is continually requiring refinement. We have focussed heavily on this issue, and in the most recent round of forward planning of our research activities, it was heartening to note that this collaboration continues to improve. We are confident that by more vigorously engaging all partners in research projects, Research Committee and Board Meetings and retreats there will be increased industry leadership, active collaboration and relevance in our research projects.

The Second Year Review scheduled for September/October 2003 poses another challenge. The Review is renowned for its rigour and will focus on the specific applied industry outcomes and implementation achievements of the CRC.

Another challenge will be realising increased levels of in-kind support in this next year. Delays in finalising Project Teams and Project Agreements in Year One has reduced the opportunity for some Participants to mobilise the in-kind support initially committed. The cash expended for research projects during 2001-02 is also minimal due to the late formalisation of Research Agreements and the Board's commitment not to authorise expenditure until the Project Agreements were in place. The research cash expenditure will achieve our target levels this next year.

CRC CI CEO, Keith Hampson

Delivering real outcomes for the property and construction industry remains one of the most satisfying challenges for the future. We have a strong Board providing strategic direction, a vigorous Research Committee evaluating and progressing research projects, developing research teams, a fully functioning senior management team and a close-knit and motivated group of support staff. With the on-going support of our partners we are well positioned to rise to the challenges and achieve our goals.

Structure and Management

The CRC CI has brought together 19 leading players within the Australian property and construction industry spanning private industry, government and research organisations: Arup Australasia, Australian Building Codes Board, Bovis Lend Lease, Building Commission, CSIRO, DEM, John Holland, Kennards Hire, Queensland Department of Main Roads, Queensland Department of Public Works, Queensland Department of State Development, Queensland University of Technology, Rider Hunt, Royal Melbourne Institute of Technology, Springfield Land Corporation, University of Newcastle, University of Sydney, University of Western Sydney and Woods Bagot.

Organisation and Management

The CRC CI is an unincorporated collaborative joint venture with a Governing Board comprising 10 representatives from the 19 partner organisations and an independent Chair. Representation on the Board carries with it the responsibility of taking on the interests of the CRC CI rather than that of the participant organisations.

Leading the CRC CI is Keith Hampson who was appointed CEO as the Centre formally came into existance in October 2001. Keith played an integral role in preparing the bid for the establishment of the Centre. Keith is a registered civil engineer and project manager with extensive industry experience in managing water supply and sewerage, road, port development and marine construction projects. Prior to joining the CRC CI Keith held senior positions in teaching, research, and business development in construction management at QUT. Keith has completed a Bachelor of Civil Engineering and an MBA at QUT, and a PhD in Construction Engineering and Management at Stanford University.

The management structure of the CRC CI is outlined below in Table 1.

The Governing Board

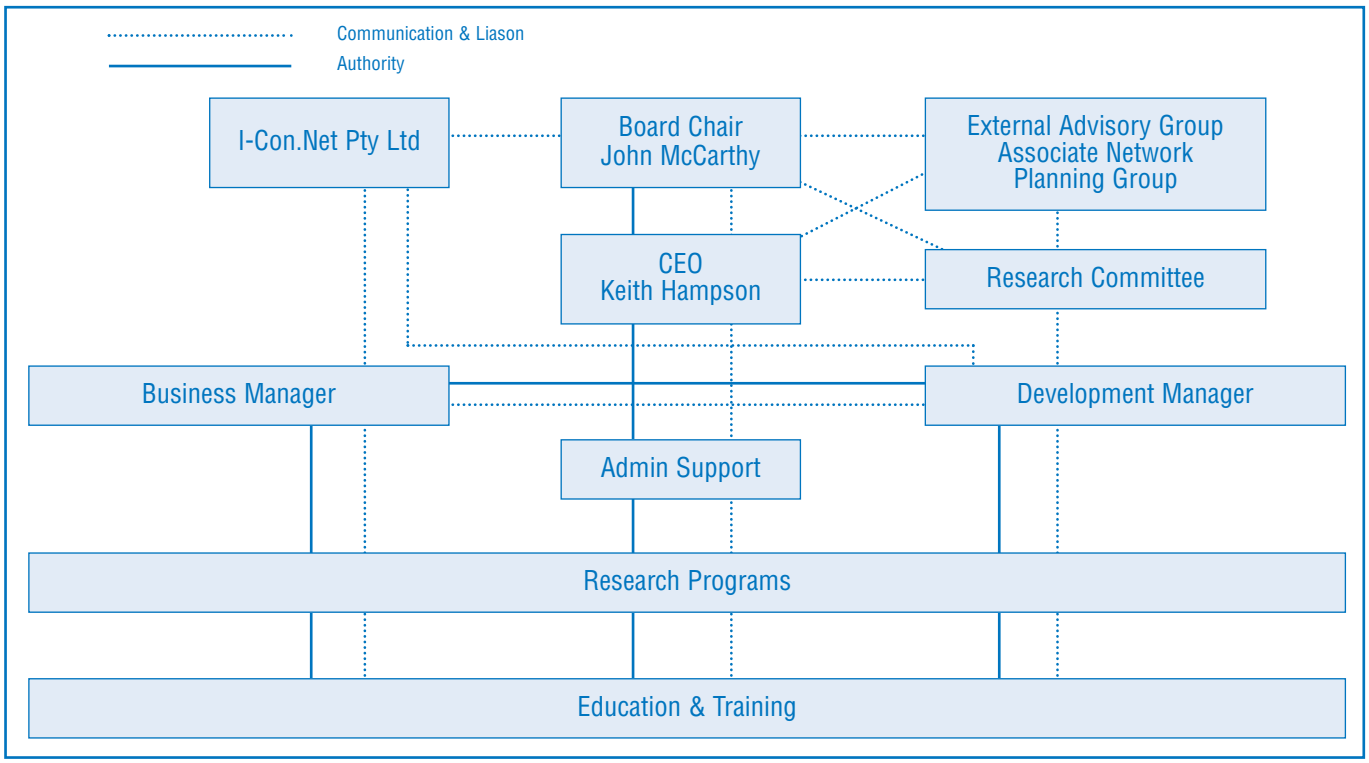
The Governing Board met formally four times in 2001-02 with future meetings planned every quarter. The location of meetings is rotated between Brisbane, Sydney and Melbourne. The Governing Board is responsible for determining CRC CI policy on all matters relating to its objectives and activities and for ensuring these objectives and activities are carried out in accordance with the provisions of the Commonwealth Agreement and Centre Agreement.

Jim Service, who worked closely with the CRC CI through the development of its bid and initial establishment phase stepped down from his role as Chair of the Governing Board at its December 2001 meeting. John McCarthy took over as Chair at the March 2002 meeting. John's joint chairmanship of the CRC CI and the Australian Construction Industry Forum (ACIF), the peak body representing the Australian construction industry associations, makes the national link between industry associations identifying industry needs, and the CRC CI providing applied industry solutions closer than ever. John also serves on the Board of the Australian Building Codes Board (ABCB) which ensures the community's expectations of safety, health and amenity in design, construction and use of buildings are enforced through nationally consistent regulatory systems.

The ABCB is a core partner of the CRC CI.

John Oliver joined the Governing Board at its March 2002 meeting. The three Queensland State Government representatives rotate on the Board so that at any one Board meeting there are only two in attendance.

Table 1: Management Structure of the CRC CI



The Governing Board and Meetings attended by the CRC CI Governing Board

Board Member
John McCarthy
Position
Independent Chair
Number of meetings attended
2

Board Member
Jim Service
Position
Inaugural Independent Chair
Number of meetings attended
1

Board Member
David Singleton
Organisation
Arup Australasia
Number of meetings attended
2 (alternate director attended 2 other meetings in his place)

Board Member
Gavin Stubbs
Organisation
Bovis Lend Lease
Number of meetings attended
4

Board Member
Larry Little
Organisation
CSIRO
Number of meetings attended
2 (alternate director attended 2 other meetings in his place)

Board Member
Richard Barton
Organisation
John Holland
Number of meetings attended
2 (alternate director attended 1 other meeting in his place)

Board Member
Keith Farr
Organisation
Qld Dept of Public Works
Number of meetings attended
3

Board Member
Mike Hefferan
Organisation
Qld Dept of State Development
Number of meetings attended
2

The Governing Board and Meetings attended by the CRC CI Governing Board

Board Member

Dennis Wogan

Organisation

Qld Dept of Main Roads

Number of meetings attended

2

Board Member

David Gardiner

Organisation

QUT

Number of meetings attended

1 (alternate director attended 3 other meetings in his place)

Board Member

John Oliver

Organisation

Rider Hunt

Number of meetings attended

0 (Invited to join Board in March 2002)

Board Member

Neil Furlong

Organisation

RMIT

Number of meetings attended

2

Board Member

Simon Carlile

Organisation

University of Sydney

Number of meetings attended

3 (alternate director attended 1 other meeting in his place)

Board Meeting Attendee

Keith Hampson

Position

CRC CI CEO

Number of meetings attended

4

Board Meeeting Attendee

Carole Green

Position

Board Secretary and CRC CI Business Manager

Number of meetings attended

4

Research Committee

CRC CI Research Committee Meeting

The Research Committee of the CRC CI meets four times a year and is comprised of representatives from the major industry participants, the Program Leaders from each of the research areas, along with other key participating or collaborating researchers as required. The role of the Research Committee is to advise the Board on research policy, strategy and planning; develop and recommend to the Board the Research Management Plan, the Research Budget and research policies and procedures for the CRC; monitor, review and evaluate the implementation and outcomes of the Research Management Plan, the Research Budget and the research policies and procedures; review research programs and research reports in light of the Research Management Plan and the Research Budget; and recommend to the Board on the establishment, continuation or termination of projects and programs.

John Oliver, Managing Director of Rider Hunt Sydney, was appointed Chair of the Research Committee. John has adopted a strong team approach to the research development and management process.

Research Committee Chair, John Oliver

Industry Representatives

Brian Ashe,
Australian Building Codes Board

Richard Hough,
Arup Australasia

Jeff Norton,
Building Commission

Gerry Shutt,
John Holland

Dale Gilbert,
Queensland Department of Public Works

David Thorpe,
Queensland Department of Main Roads

John Oliver,
Rider Hunt (Chair)

Richard Bate,
Bovis Lend Lease
(Photo unavailable)

Research Committee

Research Representatives

Peter Newton,
CSIRO Deputy Chair,
(Leader Program 3)

Tony Sidwell,
QUT (Leader Program 2)

Arun Kumar
RMIT

Denis Lenard,
University of Newcastle

Mary-Lou Maher,
University of Sydney
(Leader Program 1)

Jane Marceau,
University of Western Sydney
(Photo unavailable)

Other Representatives (non-voting)

John McCarthy,
CRC CI Board Chair
(Ex-officio)

Robin Drogemuller,
CSIRO
(Leader Program 4)

Terry Boyd,
QUT (Leader Program 5)

Carole Green,
CRC CI Business Manager

Keith Hampson,
CRC CI CEO

Peter Raisbeck,
CRC CI Development Manager
(Photo unavailable)

CRC CI Strategic Planning Group

The CRC CI Strategic Planning Group met once on 12 June 2002 to draft a revised strategic plan. While further formal meetings are not planned, there is regular interaction by telephone and email and the delegates resolved to meet again if necessary during November 2002. The Strategic Planning Group was established to re-evaluate the CRC CI's vision and objectives as a means of remaining relevant in the face of a constantly changing external environment.

John McCarthy	CRC CI Chair
Gavin Stubbs	Bovis Lend Lease
Peter Newton	CSIRO (Research Committee Deputy Chair and Program Leader)
Larry Little	CSIRO
Robin Drogemuller	CSIRO (Program Leader)
Dale Gilbert	Qld Department of Public Works
Tony Sidwell	QUT (Program Leader)
Terry Boyd	QUT (Program Leader)
Janelle Allison	QUT
Stephen Kajewski	QUT
John Oliver	Rider Hunt (Research Committee Chair)
Mary Lou Maher	University of Sydney (Program Leader)
Peter Brandon	International Visitor, University of Salford, UK
Keith Hampson	CRC CI CEO
Carole Green	CRC CI Business Manager

Icon.Net Pty Ltd

Icon.Net Pty Ltd is a small proprietary company established in May 2002 to hold and commercialise the CRC CI's Intellectual Property.

Company Officers

John McCarthy	CRC CI Chair
David Singleton	Arup Australasia
Gavin Stubbs	Bovis Lend Lease
Richard Barton	John Holland
David Gardner	QUT
John Oliver	Rider Hunt
Neil Furlong	RMIT
Simon Carlile	University of Sydney
Deborah Bullock	Company Secretary

Centre Visitor

CRC Visitors are appointed centrally by the Chair of the CRC Committee to assist in monitoring and liaising with all CRCs. Their industry and research experience makes them invaluable as independent advisors to Centres for the Australian Government.

CRC CI Visitor, Vernon Ireland

The CRC CI's Visitor is Professor Vernon Ireland, CEO and Head of School of the Australian Graduate School of Engineering Innovation in Sydney.

He is also the Vice-President of the Institution of Engineers, Australia - Sydney Division and a Board Member and Deputy Principal of the China-Australia International Construction and Management Training Centre in Shanghai.

Professor Ireland was involved in the CRC CI's First Year Visit and will be attending Research Committee and Governing Board meetings this current year.

Cooperative Linkages

The CRC CI will be measured by its ability to drive identifiable changes within the Australian property and construction industry. It recognises that to do this, genuine collaboration must occur amongst sometimes competitive organisations and in an industry that demonstrates only loose linkages between research users and research providers. It is also necessary to provide a national focus to research and development while ensuring all research activities complement those occurring internationally. To this end, the CRC CI is developing strong links with its 19 participant organisations, with the Australian construction industry generally, and with international partners, particularly in North America and Europe.

CRC CI International Visitor, Peter Brandon

External Linkages

To ensure the CRC CI's work is globally relevant, it has adopted a number of initiatives. The first of which has been to establish an International Visitor Scheme, where a senior international visitor familiar with global activities in applied industry research spends time with the CRC CI and Participants.

Professor Peter Brandon from Salford University in the United Kingdom was the first International Visitor. He has recently headed the UK Research Assessment Exercise for bench-marking UK-based built environment research organisations. Professor Brandon's experience has been invaluable in providing the CRC CI with experienced advice on research management processes.

It is planned that linkages developed with Professor Brandon and other international visitors planned for 2002–03 will provide opportunities for further international collaboration on European and North American research activity and joint student supervision and placement.

In conjunction with Professor Brandon, the CRC CI is developing an International Strategic Alliance for Construction Research. A draft of the proposed Memorandum of Understanding has already been prepared. The Alliance focuses on four areas, the first of which is *project collaboration* where the aim is to develop research projects across national boundaries to facilitate the development of knowledge and the sharing of experience for mutual benefit. We envisage that within a number of years the CRC CI will have joint projects carried out in Australia with input from North American and European research institutes. Conversely, the CRC CI will provide input into projects in those regions.

The second area of focus for the Alliance is *corporate activities,* such as conferences, workshops and agenda setting exercises to increase global understanding and sharing of knowledge and aspirations.

The third area is *research students,* where the aim is to provide a medium for the corporate promotion of research student recruitment and exchange of students between Alliance partners.

The fourth area is *management, promotion and networking* to allow the establishment and promotion of a virtual campus. This would include annual meetings, joint promotion, staff exchanges and possibly the publication of research findings in conjunction with an international publisher.

CRC CI CEO Keith Hampson further strengthened international links in October 2001 when he travelled to the UK for meetings with the UK Government, Reading University and Salford University. He also attended the inaugural workshop of the CIB International *Task Group 47 – Innovation Brokers in Construction* in Manchester. Membership of this group will bring ongoing benefits in networking and accessing international best practice in research management.

We recognise that it is unlikely that we would be able to develop entirely new technology for application to the property and construction industry in the short term. We look forward in the next period to developing collaborative research projects with other CRCs that will build on developed technology for application to the Australian property and construction industry. We have already had a series of discussions and workshops with a number of other CRCs to evaluate opportunities for collaboration in design, construction and facility management.

Internal Linkages

In the early months of Centre operation the amount of email and telephone traffic generated was substantial. To offset this, we are developing an intranet for staff and partner organisations. Currently it offers users access to project information and contact details of project participants. It also allows users to upload and store valuable documents and for important project milestones to be tracked. Initial feedback from partner organisations has been positive and it is expected the intranet will become an integral communication tool of the CRC CI as it develops over the coming year. Given that we have 19 participants spread across Queensland, New South Wales, Victoria and the ACT, determining the appropriate level of communication has been a challenge. The intranet is designed to overcome this with individuals able to access as much or as little information as and when they require.

Our staff and participants held a number of meetings throughout the year. Quarterly Board meetings were established to discuss and report on each project's progress. Fortnightly staff meetings were established for staff based at CRC CI headquarters to update on all matters related to the CRC CI. Weekly senior management team meetings were established for core staff, Program Leaders, Industry Participants and the Research Committee met quarterly to plan, review progress, consider new projects and discuss issues of strategic importance. Regular project team meetings led by Project Leaders were established for project participants to progress the project activities across the parties. Project Leaders also met with the CRC CI Business Manager on a monthly basis to discuss individual project issues. Planning Group meetings were established to discuss strategic issues and operational matters.

We used video conferencing as an adjunct to telephone contact. One of our partners, Bovis Lend Lease, has granted us the use of its video conferencing facilities in Brisbane, Sydney and Melbourne as part of its in-kind support. Audio conferencing is the norm for daily activities.

Each project and program convened a series of workshops throughout the year to strengthen the collaboration between participants and to define the projects to better meet participant requirements. Approximately 30 workshops were hosted in total across all projects through 2001–02.

In December 2001, we convened our first retreat. All Project Leaders, Program Leaders, Research Committee Members, Governing Board Directors and at least one representative from every participant organisation attended the two-day series of workshops and social activities under the theme *Building the Team, Building the Future.* The success of the retreat in bringing participants together confirmed unanimous support for a retreat to be expanded upon as an annual event.

Research

Our research incorporates a balance of short, medium and long-term projects and a portfolio of skills that reflect the diversity of the property and construction industry and the lifecycle of the constructed product. Research projects undergo a rigorous selection process based on their ability to make a real difference to the industry, their research quality and compatibility with partner needs and capabilities, and their potential for industry development or commercialisation.

We focus on the following core areas:

- Virtual Environments for Life Cycle Design and Construction
- Construction Project Delivery Strategies
- Environmental Sustainability
- Integrated Design and Construction Support Systems
- Management, Adaptability and Future of Built Assets.

Each project involves at least two industry partners and two research partners to ensure collaboration and industry focus is optimised throughout the research and implementation phases. The complementary blend of industry partners ensures a real-life environment whereby research can be readily tested and results quickly disseminated.

Research Committee Chair, John Oliver (second from left) with Program Leaders (l-r), Peter Newton, Robin Drogemuller, Terry Boyd and Tony Sidwell. (Mary Lou Maher absent)

Research Program 1:

Virtual Environments for Lifecycle Design and Construction

Program Leader:
Professor Mary Lou Maher, University of Sydney

Research Project 2001-001-1

Modelling Viable Mixed Use Developments through Virtual Environments

Project Leader

Professor Mary Lou Maher, University of Sydney

Project Duration

October 2001 – June 2003

Participants

Bovis Lend Lease
University of Sydney
Queensland University of Technology
Queensland Dept of Public Works

Project Description

This project will lead to the development of viable and innovative designs that respond to market demands and facilitate more integrated approaches to the social, economic, and environmental needs of new residential communities. While master planning can be approached as mixed use development, much of development and financing remains in fixed bundles of 'commercial', 'industrial', 'residential' and so on. The purpose of this project is to consider new strategies for mixed use development that take into account and make direct use of virtual communities and their role in physical communities. This will be achieved through the parallel development of a 3D multi-user virtual environment which allows community feedback to be incorporated into an urban design process in order to support planning and conceptual design. The North Lakes* community development in Queensland (a greenfield site), may be the basis of one of the case studies. The 3D model will be available to the developers and designers for modification and to the community for walkthroughs and feedback. The project will trial new strategies for innovative mixed use development and collect data on how these strategies are developed, applied, and implemented within a virtual environment.

* *North Lakes is located twenty-five kilometres north of Brisbane on a 1,000 hectare site. When completed it will be one of Australia's largest, fully planned communities. Around 8,500 new homes will be built, along with a town centre and business park. A wide range of educational and community facilities will also be provided.*

Progress

The following Commonwealth Agreement milestone was achieved:

- A commercially viable 3D virtual environment was identified.

In addition, the following Project Agreement milestones were achieved:

- Phase 1 – a feasibility study – was commenced.
- Baseline data for the North Lakes development was established.

Projected research for the next 12–24 months

By June 2003 this project will have produced the following:

- Innovative strategies for viable mixed use development in a greenfield site with high quality urban design.
- Databases for 3D virtual mixed use models of master planned communities.
- A showcase of the use of 3D virtual communities in parallel with a physical facility development.
- An analysis of the use of 3D environments in the urban development phase and recommendations for further research.
- An assessment of commercial activities and strategies to achieve these outcomes.

Research Project 2001-002-1

Life Cycle Modelling and Design Knowledge Development in Virtual Environments

Project Leader

Professor John Gero,
University of Sydney3

Project Duration

October 2001 – December 2003

Participants

CSIRO
University of Sydney
Queensland Dept of Public Works
Woods Bagot

Project Description

This project examines the development of a modelling tool within a 3D virtual environment that will enable facility planners and managers to visually simulate and make future projections of the facility or building they are working on in terms of its life cycle needs (ie: maintenance, refurbishment, extension and major replacements) and its response to management action to meet those needs. The project will use existing data on facilities and will develop specialised data mining techniques to demonstrate data mining of historical databases.

Progress

The following Commonwealth Agreement milestone was achieved:

- Feasibility study part one was completed: this included a survey of existing data mining/knowledge discovery algorithms and systems used for data mining in the construction industry.

The following Project Agreement milestone was also achieved:

- Feasibility study part two was completed: this included a survey of available data from industry partners, a survey of existing object-oriented models of building data, and a survey of virtual environment platforms which will be used as the basis for data mining.

Projected research for the next 12-24 months

By the conclusion of April 2004 this project will have produced the following:

- A comprehensive feasibility study.
- A demonstration modelling tool in a 3D environment that can be attached to asset management systems used by industry and government entities responsible for the management of building assets. The demonstration system will use Queensland Department of Public Works data where possible to show implications of the availability of such a system.
- A statement of how this technology will improve maintenance planning methodology and knowledge to be used in the maintenance of existing facilities.
- An improved connection between maintenance and design knowledge. Higher levels of maintenance knowledge will produce improved building designs and improve collaboration between industry partners.

Research Program 2:

Construction Project Delivery Strategies

Program Leader:
Professor Tony Sidwell, QUT

Research Project 2001–003–2

Value Alignment Process for Project Delivery

Project Leader

Professor Tony Sidwell, QUT

Project Duration

October 2001 – December 2003

Participants

Bovis Lend Lease
John Holland Group
Qld Dept of Public Works
RMIT
CSIRO
Qld Dept of Main Roads
QUT
University of Newcastle

Project Description

Value alignment process for project delivery is a decision tool to assist clients and other stakeholders to optimise the project delivery system to meet the needs of stakeholders. The research project will focus on how best to capitalise upon existing re-engineering and value chain studies undertaken in the construction procurement chain. It will make re-engineering the process possible by providing a decision tool based on principles rather than using existing off-the-shelf delivery methods.

Progress

All Commonwealth Agreement milestones were achieved:

- Scoping study completed.
- Main research commenced.

In addition, the following Project Agreement milestones were achieved:

A literature search identifying recent developments in procurement theories was conducted. The review was aided by previous research in this area, however, this research has concentrated on more recent publications and developments in non-traditional project delivery methods.

- A pilot survey was under development to test the theoretical model of the value alignment process. The survey will form a background framework for a series of structured interviews with a range of project participants to document their approach to the value alignment process on a specific project.
- An interim report titled, Framework for Measuring Success of Construction Projects was prepared.

Projected research for the next 12–24 months

By the conclusion of December 2003, this project will have produced the following:

- A decision tool for assisting with the examination of value outcomes for all stakeholders and design of an optimum project delivery process.
- A project delivery design guide.
- A range of key performance measures and benchmarking techniques to achieve value for money for projects.
- A database of case studies and lessons learned to assist participating organisations to use a set of electronic intelligent agents and expert system tools to aid knowledge management. This will support a “project process” consultancy service operated by the CRC CI, which will use best practice exemplars and the design guide to advise clients and industry.

Research Project 2001-004-2

Knowledge Management and Innovation Diffusion

Project Leader | ***Project Duration***

Professor Derek Walker, RMIT | July 2001 – March 2004

Participants

Arup Australasia
Bovis Lend Lease
Building Commission
John Holland
Royal Melbourne Institute of Technology
Queensland Dept of Main Roads
Queensland Dept of Public Works
Queensland University of Technology
University of Newcastle

Project Description

If the construction industry is to become more innovative and take better advantage of innovation, it must improve the way it generates and manages knowledge through an effective knowledge diffusion strategy that provides added value to its paying customers and other stakeholders. The purpose of this project is to develop a leading edge business guide and prototype template (an electronic wizard) that recommends best knowledge management practice including the diffusion of supporting information and communication technologies. The e-wizard, which will be able to be placed on an intranet or extranet for widespread access within an organisation, will provide easy access to available knowledge sources within a company to improve decision-making.

There are two theoretical elements to this research project: studying how knowledge creation and management is best pursued and studying how innovation diffusion (particularly supporting IT infrastructure) is best achieved. Becoming more effective in applying innovation will allow the construction industry to manage any required change process involving knowledge generation and knowledge management. This project also provides a focus on a tangible knowledge management outcome.

Progress

All Commonwealth Agreement milestones were achieved:

- Scoping and feasibility study was completed.
- Literature review was completed.

In addition, the following Project Agreement milestones were achieved:

- Information and communication technology and knowledge management literature review was completed.
- Pilot study testing was completed.
- Information and communication technology survey to industry partners was completed.
- An analysis of survey data was completed.
- An abstract was submitted for a Construction IT innovation diffusion conference which is being held in March 2003 in Hawaii.

Projected research for the next 12–24 months

By the conclusion of March 2004, this project will have produced the following:

- A knowledge management business practice guide.
- A research instrument to measure knowledge management enabling and supporting information and communication technology maturity.
- Knowledge management tools.
- An ICT business practice guide.

Research Program 3:

Environmental Sustainability

Program Leader:
Dr Peter Newton,
CSIRO

Research Project 2001–005–3

Indoor Environments: Design, Productivity and Health

Project Leader | ***Project Duration***

Associate Professor
John Bell, QUT
July 2001 – February 2003

Participants

Arup Australasia
Bovis Lend Lease
CSIRO
Queensland Dept of Public Works
Queensland University of Technology

Project Description

A building's occupants' productivity and health is influenced by conditions of the indoor environment, particularly the indoor air quality, thermal comfort and lighting. In the USA and Europe it has been estimated that poor indoor air quality affects 30%–40% of office occupants and can cost up to 2% of GDP. While there are specifications for thermal comfort, lighting and some indoor air quality factors in Australia, there is a general lack of information about whether these specifications are appropriate to deliver optimum outcomes in terms of health and productivity, and whether these outcomes are achieved.

This project will determine the availability of Australian and international data for thermal comfort, lighting and indoor air quality; the populations and buildings affected; and procedures by which this information can be used to estimate real costs to productivity and the health of Australian office workers. This project is a scoping study which will form the basis for a full study in which procedures for determining the impact of these factors will be established, followed by development of methods for estimating the economic impact of poor quality indoor environments. Design knowledge will be ultimately integrated into building design tools. Part of the scoping study will involve developing a detailed research brief for engineering solutions to Legionella control in cooling towers.

Progress

All Commonwealth Agreement milestones were achieved:

- A two day Legionella workshop was conducted in Melbourne. The purpose of the workshop was to convene a group of Australian experts and stakeholders involved in Legionella control in cooling towers, to discuss the feasibility of enhanced Legionella control through innovative engineering solutions, and to recommend a framework for a CSIRO/CRC CI research project to investigate key engineering solutions. Approximately 30 people from across Australia attended the workshop including representatives from health and public works departments, building regulators, cooling tower engineers, and researchers.
- A full report and proposal for further research on Legionella was completed.

Projected research for the next 12 months

By the conclusion of February 2003 this project will have produced the following:

- A compilation of sources of information in air pollutants in Australian buildings and guidance on how this information can be assembled into a useful database.

- A broad demographic picture of the Australian population based on factors important to their exposure to air pollutants in built environments.
- A comprehensive literature and occupant survey on the impact of thermal comfort, acoustics, and lighting on occupant perceptions of environmental quality and performance in Australian offices and schools.
- A model framework for estimating costs due to lost productivity and health impacts of poor quality indoor environments.
- A full report detailing further research needed to fill identified information gaps and to develop the framework for cost estimation into a methodology acceptable to and usable by the industry.

Research Project 2001-006-3

Environmental Assessment Systems for Commercial Buildings

Project Leader

Dr Peter Newton, CSIRO

Project Duration

September 2001 – April 2004

Participants

Arup Australasia
Bovis Lend Lease
CSIRO
University of Western Sydney
Woods Bagot
Australian Building Codes Board
Building Commission
Queensland Dept of Public Works
Queensland University of Technology

Project Description

The principal drivers for building design in Australia continue to be short-term cost related – not lifetime environmental factors. Most developed countries, including Australia, have now initiated voluntary environmental rating schemes for building design; however Australia is not yet meeting best practice standards in this area. This project combines life cycle assessment, whole of life costing and whole of life performance assessment to develop a suite of CAD-integrated cost and environmental assessment ('eco-efficiency') tools for commercial buildings that can enhance the decision-making process among Architecture/Engineering/Construction professionals and deliver superior built environment outcomes. Benchmark data derived from this project will be applied initially in industry partner projects. It is expected that this eco-efficiency assessment tool and associated databases will become the nominated system for providing a rating assessment of commercial buildings in all Australian jurisdictions.

Progress

All Commonwealth Agreement milestones were achieved:

- An evaluation report was completed.
- A business plan was completed.
- A draft environmental analysis system report was completed.
- Environmental priorities were established.
- A report on CAD-based tools for environmental rating was completed.
- A report on dimensioning building element databases was completed.

In addition, the following Project Agreement milestones were achieved:

- Preliminary workshops were conducted.
- Project workshops were conducted.
- A research plan was completed.
- A draft business plan was completed.
- An international workshop was conducted.
- A research paper was completed.
- A database for environmental metrics of materials for phase 1 (Structures).

Projected research for the next 12–24 months

By the conclusion of April 2004, this project will have produced the following:

Research papers on:

- The inventory of environmentally sustainable development design/assessment data, indicators, benchmarks, methods, tools for environmental assessment of buildings.
- Incentives for green investment in buildings, environmental metrics for commercial buildings.
- A new tool for environmental assessment of commercial buildings.
- A research plan linked to a gap analysis, user requirements, data sources and costs and functionality of databases and tools.
- A business plan that quantifies the market, development costs and commercialisation strategies.
- A database of Environmental Metrics for Building Materials.
- A CAD design appraisal tool.
- A website for Architecture/Engineering/Construction environmental assessment practitioners.
- A workshop with key international experts in green building.

Research Project 2001-013-3

Sustainability and the Building Code of Australia

Project Leader

Mr Brian Ashe,
Australian Building
Codes Board

Project Duration

January 2002 – January 2003

Participants

Arup Australasia
Building Commission
CSIRO
Australian Building Codes Board
Queensland Dept of Public Works
Queensland University of Technology

Project Description

The Australian Building Codes Board (ABCB) is currently developing a Future Building Code that will replace the 1996 Building Code of Australia. The purpose of this project is to provide the ABCB with information that will allow it to determine whether sustainability requirements are necessary in the Future Building Code, and how they may be incorporated. The project will study sustainability requirements and developments in Australia and overseas. It will also identify issues and implications associated with sustainability requirements for buildings and advise how these could be regulated.

Progress

This project is not included in the Commonwealth Agreement therefore its milestones cannot be reported against.

The following Project Agreement milestones were achieved:

- Project scope was established.
- Two steering committee meetings were conducted.
- A literature review was commenced.
- A draft structure of a report and database were established.

Projected research for the next 12-24 months

By the conclusion of January 2003, this project will have produced the following:

- A detailed literature review.
- A report identifying issues and implications associated with sustainability requirements for buildings and the Future Building Code of Australia.
- Workshops in all capital cities to identify issues and implications associated with sustainability and the Future Building Code.
- A final report including a searchable Internet-based database of references.

Research Program 4:

Integrated Design and Construction Support Systems

Program Leader:
Mr Robin Drogemuller, CSIRO

Research Project 2001-007-4

Managing Information Flows with Models and Virtual Environments

Project Leader

Mr Robin Drogemuller, CSIRO

Project Duration

July 2001 – June 2003

Participants

Arup Australasia
CSIRO
Rider Hunt
University of Sydney
Bovis Lend Lease
Queensland Dept of Main Roads
Queensland Dept of Public Works
Woods Bagot

Project Description

This project involves the use of information and communication technologies (ICT) to improve the design and construction process. It examines information flows using models and virtual environments to support design and construction planning for building and civil works. The innovation in this project is to employ object models throughout the information flow process to enable tracking of the development of information through the design process (through virtual environments), leading into the pre-construction process (through estimating and scheduling software). The initial focus of the post-design process for building projects is on the building core and structure. This will be expanded in the later stages according to the interests of the industry partners. The initial focus for civil projects is on the support for e-commerce and e-projects for less sophisticated models. Harmonisation of building and civil models will be undertaken for architectural, structural, hydraulic and site works models.

Progress

All Commonwealth Agreement milestones were achieved:

Work commenced on the following:

- CAD quantities, cost and structural engineering information in buildings.
- CAD data for civil construction.
- Intelligent CAD models and data.
- Product models in virtual environments.
- Development and submission of specifications to standards bodies.

In addition, the following Project Agreement milestones were achieved:

- Sample case study projects were identified.
- A viewer application for structural elements was developed.
- A materials database was established.
- Structural models to International Alliance of Interoperability (IAI) standard were developed.
- Quantity takeoff program working for both local and server-based projects.

Projected research for the next 12–24 months

By the conclusion of June 2003 this project will have produced the following:

- A Building Product Model to support the building elements and processes covered by this project.
- Interfaces from each of the applications developed in the sub-projects to the Building Model.
- A viewer that provides read-only viewing and querying of building models.
- Mapping definitions allowing the import of Industry Foundation Class (IFC) versions 2.0 and 2x files into the Building Model.
- CAD quantities, cost and structural engineering information in buildings.
- CAD data for civil construction.
- Intelligent CAD models and data.
- Product models in virtual environments.
- Development and submission of specifications to standard bodies.

Research Project 2001–008–4

Project Team Integration: Communication Coordination and Decision Support

Project Leader

Dr Stephen Kajewski, QUT

Project Duration

March 2002 – May 2003

Participants

CSIRO
Queensland Dept of Main Roads
Queensland University of Technology
University of Newcastle
Queensland Dept of Public Works

Project Description

This project focuses on the potential of information and communication technology to integrate construction project teams and consists of two complementary components.

Part A: Scoping Studies

The scoping studies aim to identify the major issues and dynamics that should be taken into consideration in the use of information and communication technology to integrate the project team through communication, coordination and decision support. Solution approaches will be conceptualised and methodologies for research and development developed.

Part B: Internet-Based Construction Project Management

This component of the project will benchmark and critically evaluate the use of Internet-based Construction Project Management (ICPM), e-tendering, e-archiving of project information, and cultural/relationship barriers/enablers to the adoption of ICPM. This project will leverage off previous international and local research in the area and draw together the activities being undertaken within both the public and private sectors with a view to establishing a uniform 'best-practice' model that can be adopted by industry.

Progress

All Commonwealth Agreement milestones were achieved:

- Work on scoping studies commenced.
- Work on a report on Internet-based construction project management commenced.

In addition, the following Project Agreement milestones were achieved:

- Work commenced on Part A.
- Literature review for Part B commenced.
- Literature review for Project Team Dynamics, Constructability, Knowledge Management and Visualisation commenced.
- Research methodologies Part B commenced.

Projected research for the next 12–24 months

By the conclusion of May 2003, this project will have produced the following:

- A national Internet-based Construction Project Management adoption report.
- Internet-based Construction Project Management comparative evaluation case study reports.
- A hand-held technology application report.
- A report on e-tendering/e-archiving.

Research Project 2001–009–4

Benchmarking Information and Communication Technology Uptake and Integration in the Australian Construction Industry

Project Leader

Mr Graham Brewer,
University of Newcastle

Project Duration

July 2002 – December 2002

Participants

Queensland Dept of Public Works Rider Hunt
Royal Melbourne Institute of Technology
University of Newcastle

Project Description

The construction industry is traditionally regarded as conservative in its approach to embracing innovation. Integration of information and communication technologies into business practices is slow and patchy which is a significant impediment to industry efficiency. Many theories have been advanced to explain why the construction industry is slow in this area, including its lack of awareness about innovations and the difficulty for organisations to assess their performance relative to others. Benchmarking is one way that organisations can assess their performance. This project will produce a framework within which:

- to conduct a national survey of industry to determine current levels of information communication technology usage that will allow industry members to rate their performance against industry norms and best practice;
- to identify best practice benchmark organisations that can be the subject of detailed case studies; and
- to develop a comprehensive database, developed throughout the life of the CRC, of both industry-wide trends and individual best practice cases.

This project also supports the development of other CRC projects, including Critical Success Factors for Organisations in ICT-mediated Supply Chains, Project Team Integration: Communication Coordination and Decision Support, and Knowledge Management and Innovation Diffusion.

Progress

All Commonwealth Agreement milestones were achieved:

- Work on an information communication technologies survey and benchmarking commenced.
- Work on an Internet-based Construction Project Management (ICPM) case studies commenced.

Projected research for the next 12–24 months

By the conclusion of December 2002 this project will have produced the following:

- A report that determines current levels of information communication technology usage that will allow industry members to rate their performance against industry norms and best practice.
- Case studies of best practice benchmark organisations.

Research Project 2001–016–4

Critical Success Factors for ICT Mediated Supply Chains

Project Leader

Mr Graham Brewer,
University of Newcastle

Project Duration

1 July 2002 – 30 June 2004

Participants

CSIRO
University of Newcastle
Queensland Dept Main Roads
Woods Bagot

Project Description

Many organisations in the construction industry have implemented Information and Communication Technology (ICT) strategies into their business processes but with varying degrees of success. Within the construction industry there is a widespread view that despite the obvious potential to be derived from ICT, the reality is that these costly investments have yet to live up to their promise. Underlying this problem is the fragmentation of the industry and the temporary nature of project teams which are assembled for one job and then disbanded. It is believed a detailed investigation into the business practices of Temporary Project Organisations (TPO) with ICT-mediated supply chains will yield a set of Critical Success Factors (CSF) that will be applicable across the supply chain. This project seeks to identify these ICT-specific Critical Success Factors, allowing construction of a CSF model. The model will be verified by expert peer review using a modified Delphi technique, and validated by application to specific case studies. The model will then be used to establish a robust best practice model that acknowledges the differing needs of individual organisations and participants in TPOs.

Progress

This project is not included in the Commonwealth Agreement therefore its milestones cannot be reported against.

In addition, the following Project Agreement milestones were achieved:

- Literature to ascertain past uses of Critical Success Factors (CSF) methodology was examined and possible applications for the project were determined.
- Social Worlds Theory was examined as a potential mechanism to conceptualise the research problem.
- Mapping links to project 2001-009-4 were as an appropriate progress and development tool to measure process improvement

Projected research for the next 12–24 months

By the conclusion of June 2004, this project will have produced the following:

- A literature review related to candidate success factors.
- A Critical Success Factors prototype model.
- A series of ‘best practice’ implementation guides for main contractors, clients, consultants and sub-contractors.

Research Program 5:

Management, Adaptability and Future of Built Assets

Program Leader:
Professor Terry Boyd, QUT

Research Project 2001–010–5

Investment Decision Framework for Infrastructure Asset Management

Project Leader

Professor Arun Kumar

Project Duration

October 2001 – March 2004

Participants

Arup Australasia
John Holland
Rider Hunt
Royal Melbourne Institute of Technology
University of Western Sydney
Queensland Dept of Main Roads
Queensland Dept of Public Works
Queensland University of Technology

Project Description

This project aims to develop an investment decision-making framework that will enable funds in the area of civil infrastructure, such as roads, buildings, railways and bridges to be better utilised by taking into account both capital investment and rehabilitation and maintenance expenses. In order to achieve this, the project will consider a 'triple plus one bottom line' approach to decision making which includes economical, environmental, social and political factors. In the first stage of the research, existing decision-making models being used in the road sector will be reviewed and a methodology for predicting and incorporating the effect of social, environmental and political factors during decision making will be developed. Following this, an integrated multi-criteria decision making model will be developed and tested for the road sector. Because of the model's flexibility it will be able to be applied to other types of civil infrastructure such as railways, buildings, bridges complementing this financial modelling will be an assessment of the feasibility of the use of non-destructive testing of roads.

Progress

The following Commonwealth Agreement milestone was achieved:

- Work on the investment decision making framework commenced.

In addition, the following Project Agreement milestones were achieved:

- An initial literature review was completed.
- A seminar on *Decision Making in Road Infrastructure Investment* was held on 25 June 2002 at RMIT in Melbourne. Attendees included representatives from relevant public and private sector organisations.
- A workshop focusing on identification and prioritisation of key issues in investment decision making was held on 27 June 2002 in Brisbane. Attendees included representatives from relevant public and private sector organisations.
- A review of current international and national practices was conducted.
- Two conference papers were published.

Projected research for the next 12–24 months

By the conclusion of March 2004, this project will have produced the following:

- A review of current national and international investment practices in the road sector.
- Identification of suitable investment practice for the Queensland Department of Main Roads.
- Development of an investment decision making framework suitable for the Queensland Department of Main Roads.
- A preliminary study of risk assessment methodology for decision-making processes in the Queensland Department of Main Roads.
- A report on the feasibility of non-destructive testing of the road sector.

Research Project 2001-011-5

Evaluation of Functional Performance in Commercial Buildings

Project Leader

Professor Terry Boyd, QUT

Project Duration

December 2001 – May 2004

Participants

Arup Australasia
Rider Hunt
Royal Melbourne Institute of Technology
University of Western Sydney
Queensland Dept of Public Works
Queensland University of Technology

Project Description

This project examines the performance of commercial buildings as investment assets. Its purpose is to enhance commercial real estate performance within both operational and investment contexts through the development of a model designed to support improved decision making. A risk adjusted discounted cash flow model will be developed and applied to assess operational and investment performance within the commercial office property sector. This research is unique in that it focuses on the accuracy of the input variables required for the model which are determined through the use of market-based research. The project considers probability-based risk analysis techniques which also require market-based assessment. Four of Queensland's Department of Public Works properties will initially be used as case studies however results will also be relevant to privately owned commercial property assets.

Progress

All Commonwealth Agreement milestones were achieved:

- Relevant databases were established.
- A methodology was established.
- Model relationships were established.
- Industry input was received.

In addition, the following Project Agreement milestones were achieved:

- An industry partner workshop was conducted.
- Key project structures and processes were established including the formation of a steering committee and the development of a resource database.
- A subject property portfolio was selected.
- Initial data was collected and data analysis commenced.
- Scoping portion of literature review was completed.
- Basic model structure was developed.
- Risk analysis methodologies were established.

Projected research for the next 12–24 months

By the conclusion of May 2004, this project will have produced the following:

- A systematic decision support model to evaluate the financial and operational performance of commercial buildings and improve the property management process.
- Valuable modelling tools to be used by building owners and investors in the evaluation of ex post (historical) and ex ante (forecast) building performance within both operational and investment contexts. The research seeks to enhance property management practices and processes and provide tools to support decision making.

Education and Training

Research training is underway for the first year of operation, with five postgraduate scholarships confirmed for 2001-02 through all university partners. A further five scholarships will be offered for year two of operation.

The Board has supported the notion that a PhD scholarship may be considered equivalent to two Masters scholarships where industry and educational partners recognise it is more appropriate to undertake particular research at a Masters level.

Each scholarship is worth $30,000 which includes a $24,000 stipend. The remaining $6,000 is dedicated to ongoing graduate student support including project management and applied research management skills to ensure industry-ready graduates that provide long-term opportunities in either government, industry or research organisations in the future.

In the next period, we will further involve industry partners in the selection process and, where possible, in identifying a pool of candidates for postgraduate programs.

The RMIT node of the Doctorate of Project Management is operating strongly with 14 students enrolled. The QUT program has been approved through academic approval processes and is now finalising joint collaboration.

The CRC CI views this program as an important adjunct to existing coursework and research Masters and doctoral programs in the partner universities, and is working with industry and government partners to canvass potential enrolments. The research projects that Doctorate of Project Management students undertake are real industry-based projects, making the doctorate more attainable and relevant for busy senior managers.

Table 2:

Scholarships Allocated to Partner Universities	
QUT	4
RMIT	2
University of Sydney	2
University of Western Sydney	1
University of Newcastle	1

Table 3:

2001–02 CRC CI Scholars	
Name	**Peter Ned Wales**
Degree	PhD, QUT
Commenced	18 February 2002
Funding	CRC CI
Supervision	Supervisors: Associate Professor Janelle Allison, QUT; Professor Keith Hampson, CRC CI; and Associate Professor John Bell, QUT. An industry supervisor is to be appointed.
Consultants	Dr Peter Newton, CSIRO and Maria Atkinson, Lend Lease.
Title	Guidelines for Incorporating Ecological Sustainability in Greenfield Master Planned Sites
Research Focus	Mr Wales' research is concerned with developing guidelines to incorporate Ecological Sustainable Development (ESD) in greenfield masterplanned sites and the intentions of developing public policy that reinforces these ESD best practices within all new development sites. The objectives include developing a model that can closely examine various alternatives with regard to ESD and greenfield masterplanning, determining implementation costs and strategies, and proposing a basic formula that can be easily adopted and followed by the development industry.
Name	**Qindong Li**
Degree	PhD, RMIT
Commenced	11 January 2002
Funding	CRC CI
Supervision	Supervisor: Professor Arun Kumar, RMIT and Dr Sujeeva Setunge, RMIT. An industry supervisor is to be appointed.
Consultants	Dr David Thorpe, Queensland Department of Main Roads and Dr Anthony Piyatrapoomi, RMIT.
Title	Multiple Objective Optimisation Framework for Road Maintenance Budget Allocation.
Research Focus	The objective of this research is to develop a framework that optimises road maintenance funds based on priority road agency goals such as increasing safety, minimising users' costs, greenhouse emissions and life-cycle cost of assets, and accommodating community expectations and government objectives.

Education and Training

Research Mentoring

All Program Leaders have been involved in activities which impact on research training for graduate students, mentoring and knowledge management through key educational partnerships during the 2001 financial year. For example:

1. Professor Mary Lou Maher from the University of Sydney collaborated with MIT in the US on sabbatical, developing links in the area of virtual environments for the lifecycle design and construction for ongoing development of the focus of her CRC CI commitments.
2. QUT's Professor Tony Sidwell continued as a Visiting Professor at RMIT and Departmental Academic Advisor to the Hong Kong Polytechnic University, and Secretary to the Construction Industry Institute, Australia.
3. CSIRO's Dr Peter Newton joined QUT's School of Design and Built Environment as Adjunct Professor. Following publication of the 2001 SoE Report on Human Settlements in Australia he gave a number of presentations to tertiary students as well as practitioners in the planning and design professions.
4. CSIRO's Robin Drogemuller continues to liaise internationally with organisations, particularly in the US, Europe and Scandinavia, that provide complementary input to integrated design and construction support systems.
5. QUT's Professor Terry Boyd ran professional development programs for the construction industry through the university and has instigated preliminary discussions between the CRC CI and university for these programs to be leveraged through the Centre as the national body for property and construction innovation.

Each Project and Program Leader typically has a complementary commitment to undergraduate and postgraduate coursework development. This provides an ideal conduit for ensuring the activities of the CRC CI are channeled into such programs. For example, Project Leader Professor Derek Walker's CRC CI project on knowledge management is providing an ideal source of current knowledge for course material presented in the Doctorate of Project Management offered at RMIT and QUT.

CRC CI CEO Dr Keith Hampson is providing PhD supervision of two students at QUT, one as Principal Supervisor and the other in Associate Supervision capacity.

The CRC CI is hosting several visits which will have significant impact on its higher degree research programs:

- The CRC CI has hosted International Visitor Professor Peter Brandon from the University of Salford. Professor Brandon's role involved reviewing the research program selection and management process, and assisting in aligning research at an international level to prevent duplication. Professor Brandon's work will guide PhD and Masters research within the CRC. As a senior and experienced educational leader in construction, his discussions with university and industry partners on educational outcomes will also ensure research undertaken is relevant globally.
- Plans for the coming year include hosting a visit by Professor John Bennett from Reading University in the UK who will focus on providing industry communication of research outcomes. John Bennett's expertise in construction innovation will ensure that preliminary results of research are clearly and effectively communicated through industry-focused publications and workshops.
- Former CSIRO Team Leader, Dr Ron Sharpe has taken up a position as Adjunct Professor in QUT's School of Construction Management and Property. In this role, he is assisting to identify new research opportunities and feeding into educational programs at an undergraduate and research Masters level, as well as assisting at the interface of QUT and the CRC CI.

Educational Programs including Continuing Education

CRC CI staff have undertaken a number of guest lectures throughout 2001-02. The majority of Project and Program Leaders are involved in this activity on a day-to-day basis as part of their educational roles.

In terms of continuing education, the construction industry presents unique challenges as it represents a diverse set of cultures around the life cycle of the constructed product such as finance, property development, design, construction, operation, maintenance and refurbishment. Coupled with this, traditional adversarial relationships often exist across the industry. This is exacerbated through a lack of experience, often expressed as cynicism for research activities in the sector. During the establishment phase of the CRC CI, significant effort has been made to come to a joint understanding between representatives meeting face-to-face in project meetings, program workshops, research committee meetings and the CRC CI annual retreat as well as workshops at a project level.

Involving Industry in Education Innovation

With several educational partners involved in the CRC CI, input from research and industry expertise is an important and overarching theme of its operations.

During the establishment phase, wide-ranging discussions took place on the best processes for industry involvement in research projects. The latest rounds of research proposals demonstrate a much stronger engagement of the industry partners in the research development process. In 2002-03, it is expected that several research projects will be formally led by industry participants, rather than using the conventional model of researcher leadership.

This innovation will require substantial commitment from industry partners to strengthen the applied-industry focus of research projects. Concurrently, this *two-way-street* approach will strengthen industry participants' understanding and appreciation of research while reinforcing the client-industry focus for researchers. Training programs for CRC CI students and researchers will focus on the need to balance research excellence with a *business savvy* approach.

While education and training is a priority, its implementation will primarily be addressed in future years as the results of research programs become clearer.

Initiatives

- ***Publications Guidelines***

  In 2001–02, the CRC CI formalised a publications document which has been distributed to all Leaders. It formalises requirements for appropriate referencing and acknowledgement of CRC CI support for research scholarship programs, and encourages collaboration with partner institutions while protecting potentially commercially valuable IP. It is expected in 2002-03 that an increase in CRC CI publications will occur as results from research programs become evident and research teams move into the dissemination phase of activities.

- ***TAFE and VET linkages***

  The CRC CI is moving to engage the TAFE and VET sectors in the important industry dissemination process for site and trade personnel, and joint research education projects are being developed to bring university students and trade apprentices together on building design and construction activities.

  In the next period, it is expected these discussions will increase to a stage where a collaborative national dissemination strategy is developed.

  The CRC CI highly values the importance of this link in ensuring the majority of property and construction activity carried out by small and medium-sized enterprises across Australia can be addressed by this Centre's activities

- The CRC CI in the future is considering appointment of an Education and Training Manager to oversee implementation of an education strategy.

- The first CRC CI Conference and Researchers' Workshop will take place early in 2003, with the goal being to bring together all CRC CI participants and provide opportunities for all researchers, including students, to network and share details of their activities – both challenges and successes.

Utilisation and Application of Research, Commercialisation, Links with Users

It is of course early days for the CRC CI and its efforts to apply and commercialise its research outcomes, however, we have developed strong links with users and have strategies in place to ensure the research conducted by and for participants is readily applicable to the Australian property and construction industry.

Strategies for Utilisation and Application plus Links to User Groups

Through the diversity of our participant organisations, developed strong links with users. Our user group, both private and government, reflects the life cycle of the constructed product which allows us to collaborate on the development and management of projects and ensure participants and the industry adopts innovative practices. From a client perspective, we have close links with the Queensland Departments of Main Roads and Public Works, with industry development input from the Department of State Development. At the government level, the Australian Building Code Board and Building Commission – which help shape industry regulation – are also involved. From a developer perspective we have strong input from Bovis Lend Lease and Springfield Land Corporation and at a consultant and designer level, from Rider Hunt, Arup Australasia, Woods Bagot and DEM. Constructors are represented by Bovis Lend Lease and John Holland. A focus on application and maintenance comes from organisations such as Kennards Hire, Bovis Lend Lease and John Holland as well as the major government clients mentioned above.

The CRC CI has developed conceptually from the belief that the organisations around the value chain would best work together and benefit from complementary collaboration. As a result, there are a series of tiered activities structured across the CRC to ensure that user collaboration occurs, for example, each of our participants are represented at either Board, Research Committee, Program or Project level. This, together with the fact that participants bring complementary perspectives to discussions, ensures the CRC CI's activities are relevant to all sectors of the Australian property and construction industry.

This network of participants is also integral to ensuring the utilisation of its research and sets it apart from some other CRCs. The union of researchers, government regulators and clients, and fellow industry participants provides a network of influence and leadership across the sector that provides benefits potentially as significant as any *black box* technology. This is a non-traditional and somewhat qualitative outcome that will be as important to our success as other more traditionally assessed commercial outcomes.

SME's

We have a mix of medium and large organisations represented in our CRC group. In our consultant group for example, DEM and Woods Bagot are medium-sized architectural consultants and Kennards Hire is a medium-sized specialist building construction equipment hire company. Their needs, expectations and understanding of construction industry participants is very important for us to ensure the application of our research to the broader industry. In our external activities we have a focus on SME involvement. Major industry leaders such as Bovis Lend Lease, John Holland and Arup Australasia have a substantial *pull* effect on smaller players. By working with layers of sub-contractors and consultants they expose them to the practices and technologies developed in the CRC CI and assist in driving change through the industry.

Commercialisation

Since the CRC CI is made up of a mix of private and public sector participants and research institutions, it is essential to balance public good and purely commercial outcomes. In seeking this balance, it is fair to say that the CRC CI's private sector participants are committed to industry leadership and development while its public sector participants understand the need to take advantage of commercial opportunities. The CRC CI has initially embarked on a series of research projects that closely resembles the initial bid document and the priorities determined at the May 2001 Research Committee meeting. However, as we become more mature, increased focus is being placed on research with more direct application and commercial outcomes.

Each CRC CI research program has an element of industry development or public good outcome. This is balanced with the commercial outcomes of each program. Industry dissemination, as a means of technology transfer, is planned during this next period for a number of research projects. For example, Professor Arun Kumar's leadership of the project Investment Decision Framework in Infrastructure resulted in a one-day workshop hosted by the Queensland Department of Main Roads. At this workshop, approximately 30 participants shared their joint learnings from the project to-date and made relevant work recommendations for the future.

It is expected that such technology transfer from many other projects will be realised during this next period.

In the next period, a number of projects are expected to yield opportunities for technology licensing and we are working closely with Project and Program Leaders to ensure that IP is captured and protected. We have an ongoing relationship with IP lawyers and we expect to involve them more in the formal legal protection of IP next period. The importance of protecting IP is also reflected in the Project Agreements being developed for each project.

It is important to note however that commercialisation outcomes will be different for the CRC CI than those for some other CRCs. In the construction industry, it is difficult to hide process technologies for very long given the very public nature of the construction site and the fragmentation of the industry. It is not like a manufacturing process that can readily be protected – a new methodology can be copied by others. As a result, the commercial advantage often is more often the early adoption and understanding of the technologies and management systems that can be used to secure projects and deliver construction project outcomes moreso than a *widget* or black box that might traditionally reflect commercial outcomes in other industries.

Staffing and Administration

The CRC CI senior management team was fully established during this first year of operation, with CEO Keith Hampson being appointed to his position in a permanent capacity in October 2001 after acting in the role during the CRC CI's establishment phase.

In October 2001 Carole Green also joined the CRC CI as Business Manager providing a depth of understanding and experience in financial and research management and commercialisation. Her appointment has complemented the senior management team and provided a stability that is certain to reap rewards in the future.

In addition to Carole and Keith, the following support staff were appointed, Senior Administration Officer, Bradley Warner; Administration Officer Amanda Cooper; and part-time Communications Officer, Vanessa O'Sullivan.

Recruitment for a new Development Manager began at the end of this reporting cycle, following the departure of Peter Raisbeck. Peter Scuderi commenced work with the CRC CI in August 2002. The appointment of Peter completes the current senior management team. This role is critical for ongoing success and application of research direction and industry focus to ensure close industry collaboration and support.

Within the next period, the CRC CI will consider recruitment of an Education and Training Manager to oversee education and training strategies.

At the end of February 2002, the team moved into newly refurbished offices at QUT. The major renovation incorporates highly functional workspaces for the CRC CI central node team as well as a number of workstations for researchers who are working at least 50 per cent of their time on CRC CI projects.

(l to r) Carole Green, Vanessa O'Sullivan, Peter Scuderi, Brad Warner, Keith Hampson and Amanda Cooper

No large equipment purchases were made during this financial period.

QUT has provided the CRC CI headquarters with world class facilities that makes available 23 work spaces to create a critical mass of researchers within the physical location of the central node, and presents an ideal operating environment for collaboration. With physical and human resources now in place, the central node is well-placed to focus on meeting its targets for the next financial period.

Table 4: Specified Personnel

Name	Contributing Organisation	Total Working Time in CRC CI	Total Working Time in CRC CI	Position
Professor Keith Hampson	CRC CI	100%	100%	CEO
Dr Peter Newton	CSIRO	50%	25%	Program Leader, Research Committee
Mr Robin Drogemuller	CSIRO	50%	68%	Program Leader, Research Committee
Mr David Thorpe	Queensland Department of Main Roads	50%	33%	DMR Projects Coordinator, Research Committee
Mr Dale Gilbert	Queensland Department of Public Works	10%	8%	DPW Projects Coordinator, Research Committee
Professor Tony Sidwell	QUT	30%	17%	Program Leader, Research Committee
Professor Terry Boyd	QUT	50%	21%	Program Leader, Research Committee
Mr John Oliver	Rider Hunt	22%	22%	Rider Hunt Projects Coordinator, and Chair, Research Committee
Professor Derek Walker	RMIT	50%	55%	Program Leader
Professor Chen Swee Eng	University of Newcastle	50%	14%	Program Leader, Research Committee
Professor Mary-Lou Maher	University of Sydney	50%	38%	Program Leader, Research Committee
Professor Jane Marceau	University of Western Sydney	10%	3%	Project Leader, Research Committee

An additional contribution by QUT is Associate Professor Janelle Allison (34%) who in future will be 50% total working time to coordinate QUT input to the CRC CI.