

**Construction 2030** has highlighted three priority areas for active research including:

- Model-based design / business models – to provide a link between the capital asset and more effective asset delivery and management.
- Intelligent infrastructure and buildings – to enable a longer term view of investment and planning with reduced life cycle costs.
- Solutions for a more sustainable built environment – to adapt to changing business conditions including market and regulatory environment.

All these phases have then informed the recommendations contained in **Built environment industry at a crossroad**, which outlines a vision for the future defined by a long-term strategic focus with appropriate funding; procurement mechanisms which support innovation; and world-leading interdisciplinary capabilities.

## Benefits to industry

- Meaningful data about the decline in R&D investment in the Australian built environment, highlighting the need for stronger engagement between construction and R&D organisations.
- Evidence that external innovation linkages along with the timely execution of research can deliver tangible outcomes.
- Identification of priority areas for research globally
- Policy guideline recommendations

Research findings have been actively disseminated through a number of forums including; industry publications and presentations; academic journal papers; and peer reviewed conferences. Full transcripts can be found at: [www.sbenrc.com.au/research/developing-innovation-and-safety-cultures/leveraging-rad-for-the-australian-built-environment](http://www.sbenrc.com.au/research/developing-innovation-and-safety-cultures/leveraging-rad-for-the-australian-built-environment)

The Sustainable Built Environment National Research Centre (SBEncr) is the successor to Australia's CRC for Construction Innovation. The SBEncr is a key research broker between industry, government and research organisations servicing the built environment.

The SBEncr is continuing to build an enduring value-adding national research and development centre in sustainable infrastructure and building with significant support from public and private partners around Australia and internationally.

Benefits from SBEncr activities are realised through national, industry and firm-level competitive advantages; market premiums through engagement in the collaborative research and development process; and early adoption of Centre outputs. The Centre integrates research across the economic, social and environmental sustainability areas in programs respectively titled: Driving Productivity through Innovation; People, Processes and Performance; and Greening the Built Environment.

**This research wouldn't be possible without the ongoing support of our industry, government and research partners:**



### Project partners:

- Qld Department of Transport and Main Roads
- QLD Department of Housing and Public Works
- WA Department of Finance, Building Management and Works
- John Holland
- Queensland University of Technology
- Swinburne University of Technology
- VTT Technical Research Centre of Finland
- Built Environment Industry Innovation Council
- CIB (International Council for Research and Innovation in Building and Construction)



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# Leveraging R&D for the Australian Built Environment

Australia's infrastructure and building industry has long sought to enhance its commitment to continuous improvement by leveraging the benefits on offer through investment in research and development (R&D). This endeavour has historically been problematic, in no small way due to the complexity of accessing R&D subsidies and negotiating a vast array of funding models and strategies.

This project has set out to determine how to maximise the benefits of R&D to Australia's infrastructure and building industry through improved alignment of funding strategies with industry needs. The research aims to build new understandings and knowledge relevant to: R&D funding strategies; research team formation and management; and how research outcomes are shared and utilised.

## Approach

The project has explored the issue from four distinct angles, with each phase feeding into the next:

1. **Audit and analyse R&D investment in the Australian built environment since 1990** – better understand past trends, publically available data relating to Australian R&D investments by both public and private organisations was accessed and examined.

2. **Examine distribution mechanisms of R&D support and how they impact on public and private organisations.** Case studies of specific R&D investments were undertaken to examine the process, including: how research direction is established; how research projects were engaged with by organisations; research outcomes; and pathways to adoption.
3. **Develop a strategic roadmap for the future of this critical Australian industry.** Using the *Construction 2030* report as a basis, an assessment was made of the likely future landscapes that R&D investment will need to respond to and anticipate within the Australian built environment.
4. **Develop policy to maximise the value of R&D investments to public and private organisations** – through working with industry and end user groups to translate the findings of the project into policy guidelines.

## Our vision for the future

1. A national industry steering body which defines long-term strategic industry R&D priorities, and funds associated research in public organisations.
2. Government procurement equipped to support construction innovation and supply matching funds for strategic R&D.
3. Research institutions with world-leading interdisciplinary capabilities to provide expertise relevant to the goals of the Australian construction industry.

This vision is underpinned by a culture of self-improvement, mutual recognition, respect and support.



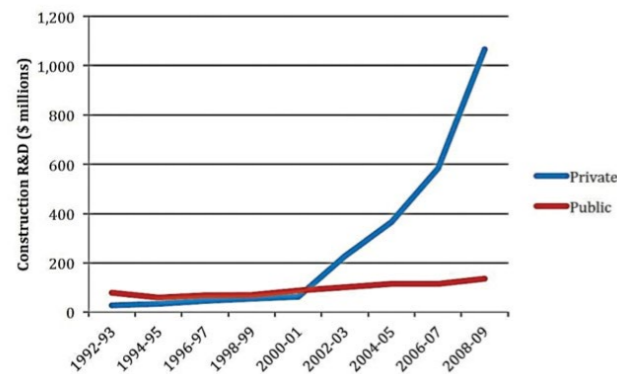
# The research

## Phase 1: R&D investment 1992-2010

A key outcome of this early phase of work was the report prepared in conjunction with research strategist, Dr Thomas Barlow, entitled **R&D Investment Study: 1992-2010**. The report drew on data from Australian government sources, the private sector and the Organisation for Economic Co-operation and Development (OECD) to provide a snapshot of R&D investment trends in the built environment.

The data reveals that there was a substantial increase in private sector investment from 1992-2010 (Figure 1).

**Figure 1 – Private versus public R&D investment in ‘construction’**

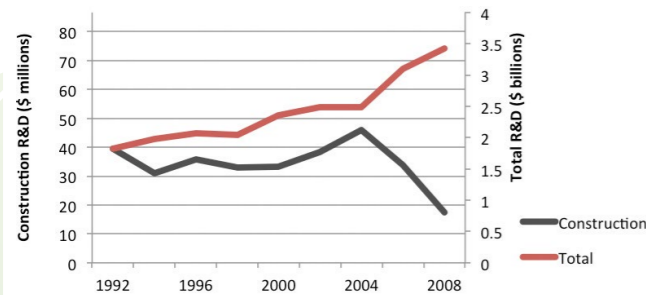


Note: (i) Derived from ABS 8112 and Barlow 2011. (ii) Shows R&D expenditures by sector focused on the socio-economic objective ‘construction’. (iii) ‘Public R&D’ counts R&D from the university sector and from state and federal government agencies.

In the early 1990s, Australian public institutions were spending three times more on construction related R&D than Australian businesses did. Yet by 2008, Australian businesses were spending eight times as much on construction-related R&D as public research institutions.

Australian government R&D agencies have also reduced their emphasis on construction R&D as a proportion of total spending. Between 1992 and 2008, government agency spending on construction R&D fell from 2.2% to 0.5% of total government sector R&D expenditure.

**Figure 2 – Government agency R&D focused on ‘construction’**



Note: Derived from ABS 8109 and Barlow 2011. (ii) Compares government intramural R&D expenditures focused on the socio-economic objective ‘construction’ (left axis) with total government intramural R&D expenditures across all objectives (right axis). (iii) The right axis has been adjusted so that the growth-rates of both curves from 1992 are comparable.

## Phase 2: Pathways to innovation

Researchers worked with government agencies to undertake three case studies of past R&D investment in Australia to illustrate:

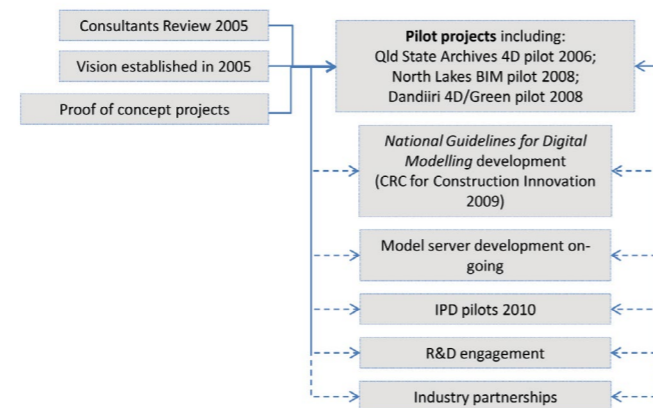
1. The nature of R&D investment by construction organisations.
2. Drivers, successes of and barriers to investment.
3. Organisational capabilities which contributed to outcomes.

**Road construction safety with Queensland Transport and Main Roads** – investigating three recent initiatives which contributed to safety performance. These projects engaged a formal R&D process that included trials, options analysis and deployment.

**Green building case study with the Western Australian Government** – This revealed an ongoing focus on policy development, building external relationships, and establishing green targets for commercial building outcomes.

**Digital modelling case study with the Queensland Department of Public Works** – initiatives spanning from the mid-1980’s to more recent implementation of building information modelling (BIM) and moves towards integrated project delivery (IPD) were examined (Figure 3).

**Figure 3 – Digital modeling pathway to innovation**



## Phase 3: Construction 2030

### A Roadmap for R&D Priorities for Australia’s Built Environment Industry

Industry organisations and government agencies need to consider a realistic vision for the future when contemplating investment priorities and opportunities. Construction 2030 provides an overview of key drivers of the large-scale social environment to which the industry may need to adjust. The report captures the greatest inherent uncertainties of this environment and outlines a broad range relevant emerging trends.

The process was used to generate decision scenarios that incorporate various combinations of likely future uncertainties including: climate change, skills, economy, attitudes, policies/governance, energy and technology. The scenarios were tested with industry representatives in a series of national workshops with participants selecting the possible technology capabilities that best matched the scenario conditions.

This list was then subjected to expert review regarding the timing and likelihood that they would emerge. Outcomes indicated: (1) that some technologies may be expected to emerge from existing research in construction or in other industries; and (2) that others will not, unless the property and construction industry undertakes the research.

Three priority areas for conducting active research were identified:

- Model-based design – business models.
- Intelligent infrastructure and buildings.
- Solutions for a greener built environment.

Further priority areas for research were also identified as: information and communications technology for radical redesign; and biotechnology for tree-based materials.

## Phase 4: Built environment industry at a crossroads

Several potential obstacles to investment in R&D by the construction industry were highlighted in the research outcomes. They relate to:

- Drop in government spend.
- Mismatch in R&D activity timeframes between public and private sectors.
- The fragmented nature of the industry (project-based work; lost information as project teams disperse, allowing little capacity for retained information or ongoing organisational learning).
- The SME-based nature of the industry restricting capacity for R&D investment.
- Government risk aversion.
- The level of public sector expertise.
- Lack of incentive for researchers to engage in industry collaborations.

Several models for engagement with R&D organisations have been considered in detail including:

- Industry-sponsored research councils.
- Government-mediated industry R&D.
- Government R&D tax programs.
- Government grants.
- Government agency research.

Specific **recommendations** that emerged from this phase include:

- Establishing a national industry steering body to define long-term R&D priorities and their dissemination to help align the research priorities and capacity building activities.
- Provide a new funding stream derived in part from industry sources and distributed directly by this body.
- Establish consistent procurement standards to drive innovation.
- Direct a proportion of state government training levy funds towards long-term strategic R&D.
- Federal funding for Centres of Excellence, CRCs, ARC Linkage funding, and CSIRO should reflect the long-term strategic priorities identified by the proposed national industry steering body.
- Integration of industry priorities and regional industry capability by government agencies and universities

- Build strategic partnerships between research organisations industry which retain a focus on leading-edge practice and transformational change.
- Emphasise interdisciplinary models, including social as well as technical research, to ensure that outcomes are globally connected.

## International focus

The International Council for Research and Innovation in Building and Construction (CIB), Task Group 85, is focused on R&D investment and impact and has received significant international interest with 35 members to date from 15 countries. The focus is strongly aligned with that of Project 2.7. The intent is to improve understanding of how public and private sector policy and practice can be enhanced to better leverage investments. The objectives of this task group include:

- Establishing an international network to exchange knowledge and undertake an agreed research agenda to further facilitate discussion and debate.
- Potentially build a consensus of metrics to better enable the ongoing exchange of knowledge and findings.
- Promote publication in this field to enable greater global dialogue regarding R&D investment and its impacts (both academic knowledge-base and industry outcomes). To this end Taylor and Francis have confirmed their interest in publishing TG85 findings in 2013.

## The outcomes

This has delivered a number of tangible benefits.

**R&D investment 1992-2008** – highlighted the shift in R&D investment in this sector in the past two decades. This emphasises the need to establish new models of engagement to maximise the return on R&D investment.

**The Pathways to innovation** case studies highlight the importance of external innovation linkages for organisations and the need for timely and practical research available through a range of innovation pathways. In addition, each case study has revealed the beneficial outcomes of past R&D investments such as:

- Thermal imaging cameras being installed in 27 Barrier Trucks across QTMR’s fleet in 2011/12; Mechanical Traffic Aids being redesigned for use in Queensland conditions; and Trailer Cameras now approved for implementation throughout the State of Queensland.
- WA Government’s Office Accommodation Policy (2004); Liveable Neighbourhoods Policy (2007); Sustainable Non-Residential Buildings Policy (2008); and the Primary School Brief (2012) as outcomes of their R&D focus in this area.
- The integration of BIM related R&D activities into built assets in Queensland with tangible environmental and safety benefits.