



**CRC Construction Innovation**  
BUILDING OUR FUTURE

# Digital modelling and BIM

Maintaining leadership and quality of service in the building and construction industry requires the capacity to manage information.

While computer-aided design is now commonplace, the industry still relies on hand labour and works from drafted drawings. Advanced digital modelling technologies, such as Building Information Models (BIM) offer the potential to integrate information across the supply chain in a single “smart” building model, which will revolutionise the industry.

The benefits of digital modelling also apply to civil and external works such as pavements, retaining walls, bridges and tunnels.

However, a national standard is required to promote communication across software platforms to drive adoption.



The CRC for *Construction Innovation* was established and is supported under the Australian Government's Cooperative Research Centres (CRCs) Program.

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.





# Digital technology and the construction industry

Digital technology is only just beginning to have a major impact in reshaping the building and construction industries.

Computer-aided-design (CAD) initially took the place of manual drafting, and produced 2D flat drawings, without adding significant value or productivity to the process.

3D models add realism to the way buildings are portrayed and can be more readily interpreted than flat drawings. 3D modelling enables the extraction of 2D drawings from 3D building models to improve productivity in documentation, and the use of data embedded in objects contained in the model for the purposes of generating schedules and lists of materials.

BIM (Building Information Modelling) extends upon 3D modelling drawing and schedule production to the creation, management and communication of information about a building.

A BIM is a model-based technology linked with a database of project information and works on design, construction documentation, analysis, and implementation levels.

A BIM carries all information related to the building, including its physical and functional characteristics and project life cycle information, held in a series of "Smart Objects". For example, an air conditioning unit within a BIM would also contain data about its supplier, lead in times, operation and maintenance procedures, flow rates and clearance requirements.

Virtual prototyping is a step beyond this and tests alternative designs using simulation tools, to optimise the building life cycle performance.

## Benefits of BIM

Building performance and predictability of outcomes are greatly improved by adopting BIM.

An Engineers Australia Queensland Division Task Force 2005 report estimates that 60-90% of all variations are due to poor project design documentation. A BIM is one way of significantly improving design and documentation quality.

Stanford University Centre for Integrated Facility Engineering figures based on 32 major projects using BIM indicates benefits such as:

- a 40 per cent elimination of unbudgeted change
- cost estimation accuracy within three per cent
- an 80 per cent reduction in the time taken to generate a cost estimate
- a saving of 10 per cent of the contract value through clash detection
- a seven per cent reduction in project time, and
- a return on investment when using a 3D model of 5-10 times.

## Common standards to drive BIM

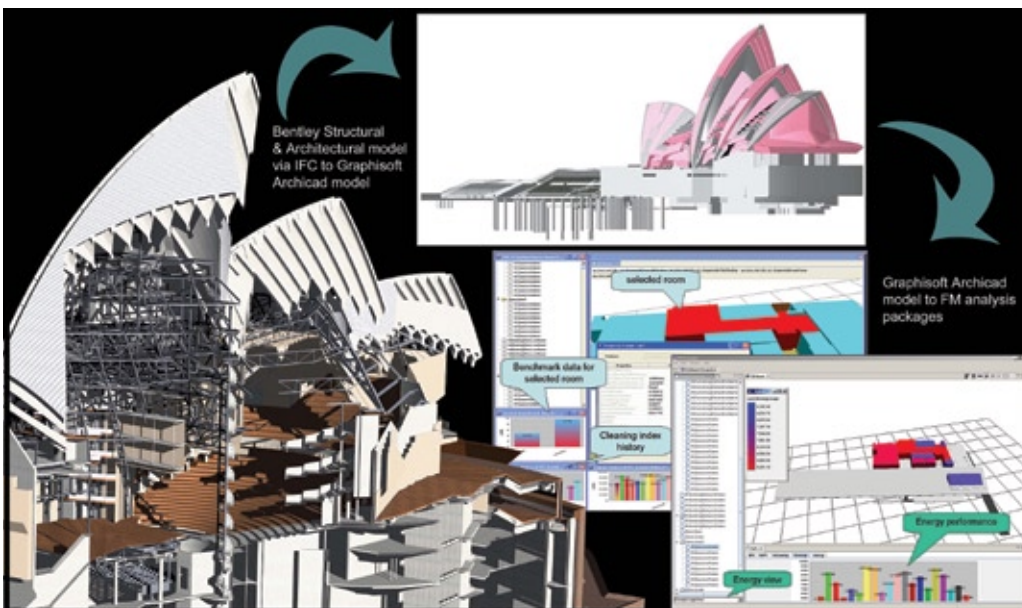
While the benefits of BIM and 3D modelling are well known and some architects and contractors are already using BIM technology, each member of the supply chain tends to have their own copy which cannot be integrated with the others, resulting in duplication of information and poor communication.

A 2004 National Institute of Standards Technology study found incompatible information costs the capital facilities industry at least US\$15.8 billion a year.

The CRC for *Construction Innovation* has partnered with the International Alliance for Interoperability (IAI) through its buildingSMART banner, to drive the adoption of a common standard for BIM software in Australia.

The IAI is a non-profit global alliance of building, construction and software industries with over 650 member organisations in 20 countries. For more than a decade the IAI has supported a single standard for building information – IFC – for the use of object technology in construction and facilities management.

Organisations such as the US General Services Administration's (GSA) Public Building Service, which manages major projects worth \$10.5 billion, have set a policy of using standardised BIMs based on IFCs.



## BIM and facility management

This figure highlights the interoperability between different software systems that the IFC open standard enables to access extensive FM data.

BIM provides the technology for a virtual information model to be handed from the design team to the owners.

© Sydney Opera House and Courtesy of Arup-JPW Architects

# Construction Innovation *BIM* research

## About the CRC for Construction Innovation

*Construction Innovation* plays an important role in providing leadership for the development of technologies and innovation in the property, design, construction and facility management industries. It is Australia's only national organisation designed to facilitate collaboration across sectors at a national level, drawing together industry stakeholders to address complex and challenging issues.

*Construction Innovation* promotes the uptake of advanced digital solutions in the property and construction industry and actively contributes to the development of common standards for information exchange.

*Construction Innovation* has contributed to the international effort in the development of the standard IFC2 and the reinforced concrete part of the latest IFC standard.

## Business drivers for BIM

To further uptake of BIM in Australia, *Construction Innovation* is undertaking a major research project investigating business drivers for the adoption of BIM, the processes necessary for adoption, and understanding of the business drivers and costs of implementing BIM in the property, construction and FM industry.

Due for completion in 2007, this research is the first research to focus specifically on BIM and business benefits — in relation to diminishing the uncertainties regarding economic benefits – leading to a more effective adoption being developed for industry.

More information: [www.construction-innovation.info/index.php?id=959](http://www.construction-innovation.info/index.php?id=959)

## BIM eLearning Module for Designers

*Construction Innovation* has collaborated with the Royal Australian Institute of Architects to offer an accredited online course on Building Information Models for architects and related professions. The offers and introduction to BIM, outlines advantages and disadvantages, business drivers and features case studies.

The course is based on viewing a presentation and answering self assessment questions. It is aimed at architects interested in furthering their knowledge of BIM. Successful completion of the module will earn practitioners Continuing Education points.

[www.continuum.com.au/courses.php](http://www.continuum.com.au/courses.php)

## Sydney Opera House FM Project



Facility management is one of Australia's fastest growing and dynamic industries. It contributes \$8.6 billion to the Australian economy and employs 135,000 people.

The Australian Government (through the Department of Industry, Tourism and Resources) provided funding support to *Construction Innovation* for the Sydney Opera House FM Exemplar project, as part of a Facility Management Action Agenda.

The project showcases the Sydney Opera House, Australia's most iconic building and one of the world's busiest performing

arts centres, as a case study in developing FM as a business enabler.

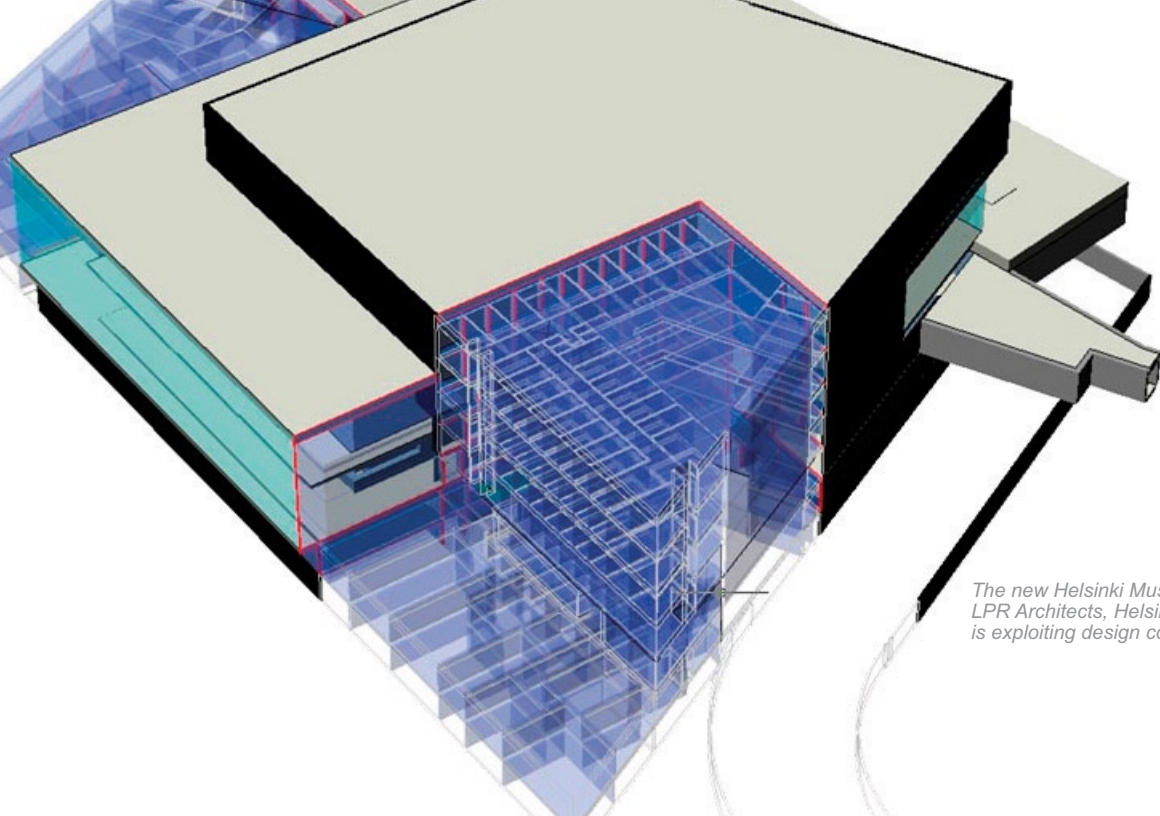
The project, which was undertaken by a team of leading industry, government and research FM specialists, focused on three main research streams: digital modelling, services procurement and performance benchmarking. These have been combined into an integrated FM solution intended to have applications for the broader FM industry.

*Adopting BIM for facilities management* is part of a series of publications produced by the Sydney Opera House: FM Exemplar Project. *FM as a business enabler* is the major publication and it presents the collective findings from the *Digital modelling*, *Services procurement* and *Performance benchmarking* reports. It outlines the integration of these streams into an integrated FM solution that demonstrates FM as a business enabler.

Printed copies of these publications can be ordered online and electronic copies can be downloaded at: [www.construction-innovation.info](http://www.construction-innovation.info)







The new Helsinki Music Centre design, by LPR Architects, Helsinki, Finland uses BIM and is exploiting design collaboration using IFC.

## BETTER PLANNING AND CONTROL OF BUILDING CONSTRUCTION PROJECTS through better collaboration, co-ordination and sharing of project information

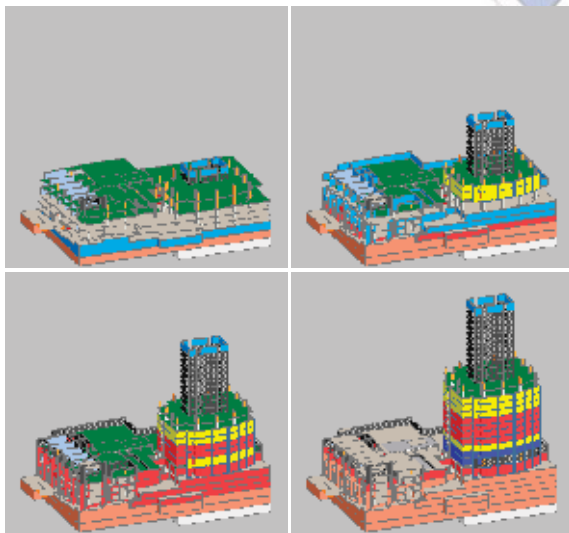
The International Alliance for Interoperability (IAI) has spent the last 10 years establishing an open standard - IFC - for the use of object technology in construction and facilities management.

In the last two years IAI has turned its attention to broader issues of achieving beneficial change in industry, using Building Information Models (BIMs) and IFCs as the trigger to smarter ways of working. This is the origin of the rebranding last year of IAI as **buildingSMART**.

Under the **buildingSMART** banner, IAI is seeking alliances with other similarly motivated organisations to support processes which deliver faster, better, less expensive and more predictable results than can be achieved with traditional methods.

### BuildingSMART = BIM + IFC

Building information modelling is a new approach to describing and displaying the information required for the design, construction and operation of built facilities. IFC provides a comprehensive specification for the totality of information within the lifecycle of a constructed facility



BIM supports simulation of construction activities and integrated costing.

Images courtesy Webcor, San Francisco, USA



Product model based design vision adopted by Finnish construction industry.

Image courtesy ProIT, Helsinki, Finland

