Building in a virtual world

Imagine a virtual world where architects and engineers can create three dimensional models of buildings, manipulate building designs, specifications and material properties, simulate thermal performance and share all of this with contractors and building owners.

Building information modelling is now a reality and it’s changing the face of the industry. Carly Fordred discovers how this new approach is providing an innovative solution to improve quality and efficiency in the construction sector.

BIM is a virtual world, a prototype in software, a three dimensional database that can record and store all of the information about a building. It can incorporate elements from the architects’ designs and construction data to servicing and maintenance requirements.

In the past, the lack of software interoperability between the key sectors involved with the creation and ongoing management of buildings, has resulted in a major productivity constraint and cost penalty. The greatest strength of BIM, according to its proponents, is its ability to allow integrated knowledge, input and tracking from all parties involved in the building process.

For successful adoption for the construction sector as a whole, however, both government and industry require a common protocol for model sharing. An open standard called Industry Foundation Classes (IFC) has been developed by the International Alliance for Interoperability (IAI), an international construction industry body, for this purpose.

Potential benefits of BIM can be found at each stage of the building process. An example of how the modelling can dramatically improve traditional methods is demonstrated at three key stages; design, construction and management.

BIM at the Sydney Opera House

BIM is also providing opportunities for the facility management sector to manage the built environment.

The Co-operative Research Centre for Construction Innovation recently published its second FM Exemplar Project report, Adopting BIM for facilities management.

The project was commissioned by the Australian Government’s FM Action Agenda and received support from the Department of Industry, Tourism and Resources and FMA Australia.

The project, which commenced in April 2005, chose to model one of Australia’s most recognisable buildings, the Sydney Opera House.

The Opera House was used for the project because it was completed without basic two-dimensional digital drawings and had no definitive set of plans incorporating service changes made over the years.

“The project focused on digital modelling, services procurement and performance benchmarking themes as dimensions of the FM equation, which, when integrated, improve FM’s ability to support an organisation’s objectives. In the report our research outcomes were then aligned within the broader context of the Sydney Opera House’s total asset management plan in support of their organisation’s business enterprise”, says John McCarthy, chairman of the FM Action Agenda and the CRC for Construction Innovation.

The report concludes that “data on the physical structure of a building can be integrated with facility management functions to provide more effective ways of managing the built environment.”
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Learning new software packages used to model services (mechanical, electrical and hydraulic) and carry out thermal and energy analysis.

Becoming familiar with BIM practices, terminology and how IFC’s can create data-rich engineering and architectural models which have the potential to greatly improve productivity and efficiency within all aspects of our industry from design, through construction to asset management.

“The key is using a common BIM which is created and subsequently enhanced with the addition of architectural/engineering detail and product data, all of which is then readily accessible throughout the whole life cycle of the building”, Moseley adds.

The pilot project demonstrated some of the benefits of BIM:

- It requires a higher level of modelling detail earlier in the project (eg. definition of window/wall material properties, including solar shading to allow the energy simulation software to use the data and give realistic results based on the proposed architectural form). This leads to better collaboration between disciplines and more accurate information.

- Using IFC’s to import a complete building model into the thermal and energy analysis software takes only minutes and allows the engineer to focus on optimising the design and developing innovative solutions. This adds value by not having to build a duplicate model as is the case with many energy analysis software packages.

- Exporting services models back to a fully integrated building model allows model checking software to be run which will detect and report on all clashes (eg. duct to structural beam, hydraulic pipe to duct, etc.)

“We learned a great deal from our initial experience of using BIM on a project, such as how to successfully build and share a common product model, import building model data into the mechanical services modelling software and then export the services model back to the architectural model,” says Moseley.

“As this was our first experience of using BIM and IFC’s we encountered a few difficulties, however, these are considered to be part of the learning process when you are adopting new smarter working practices”.

Some of the difficulties the team encountered include:

- A lack of common integrated modelling guidelines. According to Moseley, more detailed IFC support guidelines would have helped to understand the set up, use and exporting of IFC’s between different IFC compliant software packages.

- IFC compliant modelling software and energy analysis software was sourced from overseas and had to be learned before the team could apply it to the project. More software vendors are moving towards the open IFC protocols.

“This pilot project was just the first step in developing BIM knowledge and capabilities with the longer term goal of fully adopting BIM using IFC’s for the design, documentation, construction, maintenance and asset management of buildings produced by Project Services for the Queensland Government”, says Moseley.

“We propose to build on the experiences of this initial pilot project and already have plans for applying BIM practices to other pilot projects this year. We will be presenting our findings and BIM experiences from our further pilot projects at the IAI Building Smart conference being held in Brisbane on 14 November 2007,” he concludes.

Terms of reference: What does it all mean?

IAI – The International Alliance for Interoperability is an organisation of stakeholders in the building industry with the aim of creating an industry standard for data interoperability across BIM applications. The alliance includes architects, engineers, contractors, building owners, facility managers, manufacturers, software vendors, information providers, government agencies, research laboratories and universities.

IFC – Industry Foundation Classes – is a neutral file format (ISO 19637) that captures geometry and properties of building objects and their relationships within building information models. It is an object oriented database of information that enables data sharing.