



BIM IN AUSTRALIA

REPORT ON BIM/IPD FORUMS

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Australian
Institute of
Architects



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BIM IN AUSTRALIA 2010

The report BIM in Australia provides an overview of the discussions at BIM forums held in Perth, Melbourne, Brisbane and Sydney in October and November 2010. Approximately 35 executives of leading Australian companies attended each event, comprising business owners, architects, engineers and constructors. The forums were jointly hosted by the Australian Institute of Architects, Consult Australia and Autodesk.

At each forum BIM case studies were presented by leading firms from the Architectural, Engineering and Construction (AEC) industry to stimulate discussion by participants. These discussions focussed on identifying the challenges and successes of using BIM to optimise workflows and create supply chain efficiencies within the AEC sector.

The objectives of the forums were to:

- Develop a common understanding of what BIM is, to identify key drivers of the process and issues that can help accelerate the implementation/ take-up of BIM in the value chain.
- Enable AEC companies to lead within an integrated project delivery process as a catalyst to drive revenue, reduce costs and be world class firms in design practices.
- Report back to members of the associations and the participants in the forums, as a basis for facilitating and accelerating the development of BIM in Australia.

Each forum was attended by Geraldine Star, principal of Star Monde Communications who drafted the report based on the forum discussions. The report covers the main topics discussed and represents a national perspective; comments from participants from each state have been aggregated into this single integrated report.

Building Information Modeling (BIM) is an integrated process for sharing key physical and functional characteristics digitally before it is built. With BIM, AEC professionals can deliver projects faster and more economically while minimising environmental impacts.

Autodesk

1. BIM LEADERSHIP

BIM is shaping the way the Architectural, Engineering and Construction (AEC) industry and its associated professions will work for years to come. All players including business, consultants, contractors, subcontractors, government, education institutions, professional associations and software manufacturers need to collaborate to develop and expand BIM tools, skills and resources to reap the financial and productivity gains that should result, with the ultimate aim of making the built environment more economically, socially and environmentally sustainable.

Leadership is required to move the AEC industry forward. Users of BIM are taking different approaches to solving the issues that are presented, and the resulting fragmented approach across the industry has made it difficult to capitalise on the considerable benefits of a coordinated approach based on trust, communication and commitment.

What form this leadership should take is not yet clear but it is believed that all players have a role in assisting the industry to develop further. Some forum participants talked of government involvement, others of a non-regulative environment, and others of setting up a high level task force. Most agreed that there is a need for more action from government and industry associations and they both have an important role to play in driving change.

CHANGE DRIVER - GOVERNMENT

BIM should be part of a federal government initiative to drive the changes that are needed. The Green Star initiative in relation to sustainability is an example of a government involvement that drove significant changes for the AEC industry.

A number of presenters explained the importance of a government mandate in the US to move BIM forward. The General Services Administration (GSA) in the US is committed to a strategic and incremental adoption of 3D, 4D, and BIM technologies and has worked with industry to enable this since 2003. This has important flow-on impacts to state, local government and businesses with standards developed incrementally and added to each year.

The Australian Productivity Commission is looking for productivity gains in the construction and building industry and having government involvement could assist industry focus on the issues that need to be addressed to deliver them.

CHANGE DRIVER - INDUSTRY ASSOCIATIONS

Most participants want industry associations to be more pro-active, to lead and coordinate the many changes required in the industry. BIM has the capacity to change information management, workplaces and traditional job demarcations. So a partnership between industry associations is important to help facilitate these changes. The members of organisations such as Consult Australia, the Australian Institute of Architects, Engineers Australia, Australian Constructors Association, Australian Institute of Quality Surveyors, Australian Institute of Building Surveyors, Master Builders Australia, Property Council of Australia and Australian Institute of Building will have to encourage their professional bodies to work in partnership with other industry associations.

Peak bodies such as the Australian Construction Industry Forum (ACIF), Australian Procurement and Construction Council (APCC), Built Environment Industry Innovation Council (BEIIC) and the Australian Sustainable Built Environment Council (ASBEC) can also play a substantial role in facilitating this collaboration.

Future actions by industry associations could include: facilitating working groups, information sessions and forums, training, research, advice and guidance to industry through the development of guidelines, standards, templates and protocols.

Both the Australian Institute of Architects and Consult Australia are committed to ongoing collaboration and to facilitating, as a priority, the development of tools, skills and resources required for the structured and coordinated implementation of BIM in Australia.

2. BIM IMPLEMENTATION TO DATE

No one shape or size fits all. Some companies have been involved in the implementation of BIM for over ten years, others for much less. The BIM implementation rate for companies at the forums was generally very high.

Some companies were interested in BIM but had not yet made the transition. The implementation costs of BIM were perceived, by some companies, as potentially prohibitive in the short term. It was acknowledged that as clients, governments and construction firms made the transition to BIM, smaller businesses could find implementation easier, more cost effective and more compelling.

Figure 1 below illustrates the stages in the implementation of BIM as companies move towards integration. The journey starts with the movement from 2D CAD to 3D modelling with different disciplines increasingly working collaboratively. The initial stages take place in-house but then opportunities arise to integrate information from other consultants, contractors, sub-contractors and others who are working on the same project. The final stage is integration, with full information capture for the project. Many companies in Australia are currently in the 3D modelling and collaborative stages.

There are opportunities for leaner design, more sustainable outcomes in BIM particularly with some of the tools available. The 'I' for information in BIM is fundamental.

Craig Muir, GHD

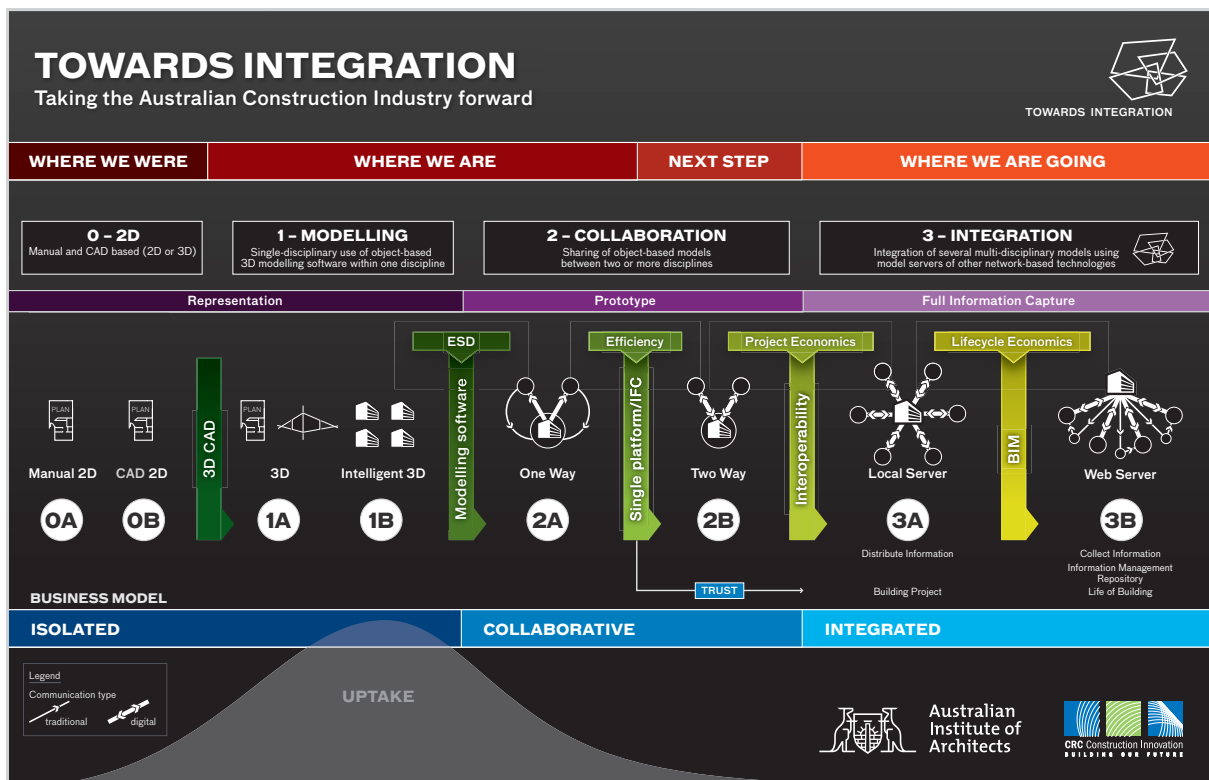


Figure 1: Implementing BIM Source: Australian Institute of Architects and CRC for Construction Innovation

Forum participants explained that in most cases the 'life cycle' capabilities of BIM are not realised because of the lack of client demand and appropriate software. However, models for the Sydney Opera House and Barangaroo have been optimised to include facilities management.

While firms are gradually moving to integration, there are significant costs involved with each stage in the implementation process. Making the commitment to BIM may mean a large financial outlay but participants believe that the commercial benefits will follow. Data and information management requirements are more sophisticated and staff require different knowledge and skill sets to process this information.

Business decisions for the introduction of BIM are often complex and made with the realisation that there are considerable costs involved. The Triple 'M' Group of Companies made the transition as they realised that they were losing competitive advantage, and outcomes in terms of decreases in manufacturing costs, installation time and enhanced reputation have justified the move to BIM. They also believe that it is important that consultants, contractors and all other players in the building supply chain are engaged and able to develop efficient workflows without the need for duplication.

Similarly, Bornhorst + Ward a consulting engineering firm have made the move to BIM and have seen some positive results.

THE BENEFITS OF BIM INCLUDE:

- Staff, consultants, contractors, sub-contractors are engaged and enjoy working in 3D
- More informed decision making
- Improved risk and opportunity management
- Higher quality documentation, quality of information
- Improved efficiency for design production
- Efficient and intelligent 3D modelling
- Real time coordination across disciplines

TRIPLE 'M' OUTCOMES – INTRODUCTION OF BIM

The Good

- 7% reduction in manufactured cost
- 9% reduction in installation time
- Recognised as industry leaders in 3D and now BIM

The Bad

- Retraining of staff
- Other trades reaction to 3D virtual co-ordination
- 22% increase in drafting/3D modelling costs

The Ugly

- \$250K software investment
- \$500K re-training investment
- Very "lonely" world for first two years

Mark Lowe Triple 'M' Group of Companies

- Improved ability for analysis and design audit
- Quicker client approvals via showing design intent
- Increased return on investment (ROI) from better communication and understanding of 3D modelling from all players in the supply chain.

Based on information provided by Brett Taylor
Bornhorst + Ward Consulting Engineers

3. INTEGRATED PROJECT DELIVERY AND BIM

Forum participants believe significant benefits will arise when there is fully integrated project delivery (IPD). The ability of multi-disciplinary teams including architects, engineers, builders, contractors and subcontractors to work with a single, integrated BIM model for design and construction is exciting. However, for most parts of the industry, the capacity to do this is not yet widely apparent.

In some cases, there is duplication of models within a single project and some parties are unable to collaborate because of incompatible software, different standards or techniques. There are also a number of issues which arise such as who owns the 3D model and who takes responsibility if the model does not line up with the real world.

The real benefits of IPD cannot be realised for a project if only a limited number of businesses in the supply chain have the understanding and knowledge to work with models. The Air Conditioning and Mechanical Contractors Association's (AMCA) BIM initiative involves the early collaboration of all parties in the supply chain to produce 3D models. This initiative defines the standards to use in BIM and establishes seamless workflows so all contractors are working from the one 3D model. There are now standardised products from software vendors to assist with work in this environment.

In the bigger picture of the built environment, we should be able to do a 3D model of the City of Sydney with all the services.

John Hainsworth ARUP

4. CHANGE MANAGEMENT

INTERNAL CHANGE MANAGEMENT - COMPANIES

In introducing BIM, there is often a lag time before other businesses in the supply chain catch up. This period of 'isolated' BIM can sometimes coincide with a period of considerable internal change management and significant cultural change. Examples of the changes in a BIM environment that have occurred include CAD staff leaving; staff interested in BIM retraining to develop their skills further and the recruitment of more staff with the skills required to drive BIM.

The introduction of BIM leads to a sense of excitement and engagement as business owners, management and staff work together to integrate information and produce models that are 'real to life'. With more information available there can be a higher level of confidence in the deliverables and the more difficult it is to misrepresent or misinterpret the design intent. This leads to increased efficiencies, improved productivity and enhanced communication between and within teams.

Resolution of clashes or inconsistencies between the work of different disciplines can also occur in the 'virtual' environment, significantly shifting the time commitment for consultants from the construction phase back into the design phases, with resultant impacts on project team management and fee structures.

WORKFORCE MANAGEMENT

Planning for workforce management is important. People management with BIM requires building capacity as BIM is a 'way of work'. There is more team work involved; people require high level thinking and communication skills as well as the technical skills to work with 3D and/or 4D models in a collaborative, social environment with an emphasis on peer to peer learning. As a BIM leader, it also means being an employer of choice.

MULTIDISCIPLINARY APPROACH – UNDERGRADUATE EDUCATION

Universities partly prepare their students for the BIM environment, and while some graduates are now BIM-ready they generally do not have significant cross-faculty experience e.g. architects working with engineers which is an important part of the BIM/IPD environment. Forum participants commented that universities should focus on a multidisciplinary approach to enable a higher level of collaborative capability in those entering the industry.

STAFF COMPETENCY

Staff training is one of the major costs associated with the introduction of BIM. Staff who have recently graduated from university may have some of the necessary skill set for BIM but do not have the workplace experience, while existing staff have to be retrained to develop these skills. One of the first steps in the training process is to 'train the trainer' and deliver courses that meet the specialised needs in this situation. BIM changes the demarcation between professions which has to be a factor in preparing BIM specific training programs on an AEC industry basis.

FORUM OPTIONS FOR TRAINING

Participants are concerned about the high costs of training and the lack of support from training bodies and industry associations. They are looking for industry leadership and support in this area.

An unexpected consequence of introducing BIM was that our staff retention was high at a time when there were significant movements in the industry. Staff wanted to work with BIM.

Philip Parker Hames Sharley

EXTERNAL CHANGE MANAGEMENT - INDUSTRY

BIM allows for higher levels of detail, accuracy and coordination during the design process and documentation up front. However, collaboration and integration with other consultants, contractors, and sub-contractors can be challenging. The reasons for this are varied:

- The lack of common standards and protocols.
- The inability of different computer software platforms to work together.
- The disconnect in data, information and knowledge in the supply chain e.g. architects and some engineers may have found a common way of working but other players in the supply chain – the builders, other consultants and subcontractors – may not yet have the level of understanding of BIM to participate in a fully integrated way.

Preparing appropriate project standards and protocols is important when sharing information and responsibilities and these can be allocated at the beginning of a project but it takes time e.g. the first three months was spent preparing standards and protocols for the Hong Kong Airport project. At present, companies are duplicating this process so a national approach to developing standards and protocols is needed.

FORUM OPTIONS FOR INDUSTRY STANDARDS

There were a number of options put forward to develop national standards and protocols immediately. These include:

- *A working party of representatives of a number of large companies could pool their standards and work towards preparing a common set for the industry. In New Zealand, the key players in the building sector (through the NZ Construction Industry Council) developed the NZCIC Design Documentation Guidelines. These clearly define the various design stages possible in a building project covering architectural, structural, electrical, hydraulic, fire protection, fire engineering, HVAC, as well as ancillary services. These are now being updated in the same way.*
- *Modifying existing standards prepared in the UK and the US for the Australian environment including, for example, the State of Ohio BIM Protocol, Ohio State Architect's Office. (<http://das.ohio.gov/Divisions/GeneralServices/StateArchitectsOffice>)*

5. SOFTWARE

Computer software developers are important players in the BIM environment. Design companies are using a range of hardware and software platforms from different vendors' e.g. Autodesk, Graphisoft, Bentley, Tekla. These BIM tools are complemented by other specialist design software to suit the needs of the company, the design discipline and the project.

There are a number of challenges with currently available BIM software products:

- Each stage in the process requires more tools; some are expensive and place an increasing financial burden on companies.
- Proprietary BIM tools result in companies in the AEC industry feeling they have to 'pick a winner' by being increasingly linked to a specific software vendor and the success or failure of that vendor.
- This can result in businesses deferring their take-up of BIM, due to concern that in the long term, with constant changes to technology, they may not have backed the right BIM vendor.

One of the major barriers to integrated project delivery is the limited ability of the different BIM platforms to obtain data from one another and support supply chain workflows. Application protocol interface (API) requirements are not standard with few specifications for data structure, routines and protocols.

A potential solution is the development of open source e.g. IFC-based software but this is also considered to have commercial and other practical limitations, as IFC standards have been slow to evolve.

While not all companies and clients yet require asset or facilities management (FM) capability in BIM models, it is expected that in the future, when clients fully realise the benefits, there will be considerable demand. One of the difficulties at present of developing this capability is the variability in requirements of each building owner and each individual building.

FORUM OPTIONS FOR CO-ORDINATED COMPUTER PRODUCTS

Participants want industry associations to work with computer software manufacturers to explore communication and/or transfer synergies so there is a co-ordinated industry solution.

Participants want software manufacturers to work on FM solutions.

BIM tools don't allow us to do everything we want; at BVN we complement the use of BIM with other design software to suit our needs!

*Dominik Holzer
Practice Director Modus
BVN Architecture*

6. LEGAL, CONTRACTUAL, LICENSING, INSURANCE, INTELLECTUAL PROPERTY ISSUES

Legal and contractual requirements within the AEC industry have not yet developed to reflect the collaborative potential of BIM. There are difficulties working out how liabilities and responsibilities are shared, and while licensing agreements are feasible to allow appropriate use of BIM models, there are difficulties with embedded data and 'whole of life' risk and audit. This may also have an impact on insurance issues. Companies have to explain clearly what BIM involves to insurers. The movement of risk and other boundaries is causing tensions in the industry and a whole new world of BIM and intellectual property law is emerging to deal with these uncertainties.

Intellectual property is complex. On one hand, putting parameters around intellectual property is difficult as BIM models are shared by definition; staff moving to different firms may take the 3D models and associated protocols with them. Some companies, particularly those that want 'end to end solutions' and facilities management would like to own the intellectual property in a model, rather than use licences. There is certainly a valid question as to whether a building may be worth more if the developer can provide a fully integrated facilities management model.

FORUM OPTIONS FOR LEGAL, CONTRACTUAL, LICENSING, INSURANCE, INTELLECTUAL PROPERTY ISSUES

Participants want industry associations to lead in this area and provide national and international advice and guidance about BIM models and the legal and contractual issues associated with sharing of information.

7. BIM'S VALUE - COSTS, VALUE ADDING

BIM's value is multifaceted. BIM involves a major process change, but the investment in change required is not necessarily rewarded as clients may persist in awarding projects based on cost rather than quality and the features included. There are savings for building owners of time and money using BIM, but not all clients are convinced of this.

From the demand side, clients require different things from BIM; a developer may only be concerned with use of BIM up to the completion of the building, whereas government and many other building owners want 'whole of life' FM for their assets.

There are opportunities for value adding with BIM through analysis and simulation. By demonstrating smoke/fire simulations to building owners, the impact of these situations can be shown on their insurance and their property portfolio. Other value-adding simulation possibilities enabled by BIM include thermal performance, acoustic performance, 'walk-throughs', construction sequencing and site logistics.

Participants are concerned that clients, while they may request BIM for a project, do not fully understand what BIM means and the value it adds. Such requests are not yet widely translated into higher consulting fees to reflect this added value and the concurrent reduction of owner risk. This is frustrating for all BIM users although a few are starting to find ways of making the 'value case' to prospective clients.

Studies have shown that there are considerable benefits with BIM particularly with return on investment (ROI). Figure 2 below shows the ROI for a study undertaken at Stanford University Center, Integrated Facilities Engineering (CIFE) based on 32 major projects using BIM.

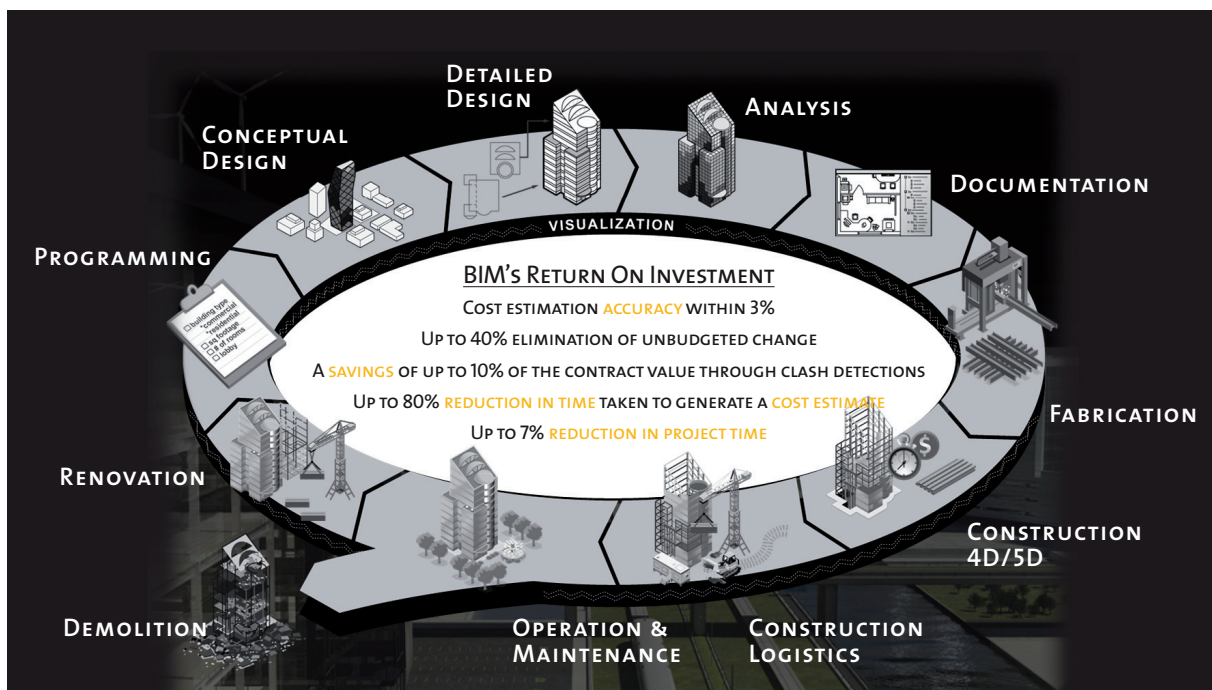


Figure 2: Stanford University Center for Integrated Facilities Engineering (CIFE) figures based on 32 major projects using BIM

8. GOVERNMENT – IMPORTANT CLIENTS

Federal, state and local governments are significant clients for building and construction work in Australia. As the BIM environment changes, it becomes increasingly important that government representatives have a good understanding and knowledge of BIM and what it can offer.

One representative explained that government still needs to be convinced that BIM is not just ‘pretty pictures’. BIM needs to deliver better building outcomes, more quickly, with lower risk and at less cost. At present, there are not enough benefits to pay higher fees.

Government thinking is gradually changing as the value of asset management and the whole of ‘life cycle’ benefits become more realistic. This in turn will change the government tendering process.

PROVISION OF MODELS – QUEENSLAND GOVERNMENT

There are changes to the government procurement process in Queensland. For a recent tender on the Sunshine Coast, a 3D model was shared with contractors and subcontractors as additional free information without warranty. In another case, a tender for multi-residential public housing included:

- A fully integrated model.
- Coaching on how to understand and use the model.

While these BIM models were not the primary, formal source of project information, contractors and subcontractors have the opportunity to access the best information available and provide the most efficient price in the tender process. This approach removes some of the uncertainties of the tender process.

FORUM OPTIONS FOR EDUCATING CLIENTS

Participants believe the industry associations have a role in educating clients, and particularly government clients, about BIM.

The message to clients is that BIM is about value adding rather than cost cutting. There should be more communication about how all firms can profit from BIM, and national and international research information should be distributed to members.

For the tender process, we want to give contractors and sub-contractors the best possible information available. We hope to be able to guarantee our 3D models for selected projects within a year.

*Thomas Fussell
Project Services*

9. THE PATH AHEAD

Forum participants provided a number of suggestions to move the AEC industry forward. A summary of these suggestions is shown below.

1. Leadership, co-ordination across industry

- **Government involvement**

There needs to be a government push for BIM to bring about significant changes to productivity in the AEC industry.

- **Industry association partnership**

Industry associations need to work together to help facilitate the changes to the AEC industry. There is a lot to be done including sponsoring working parties; holding information sessions, forums; providing research, advice and guidance to the industry.

2. Industry skills development

There needs to be a more co-ordinated approach to training particularly with the high costs involved in moving staff to the BIM environment. Training programs will have to be tailored to provide communication and 'thinking' skills to suit collaborative work.

3. Multidisciplinary approach to education

Education institutions such as universities and TAFE could establish BIM programs that work across faculties. In this way students would be simulating the collaborative environment they will increasingly have to work within.

4. Software compatibility development

Software manufacturers could be brought together to work out ways that their platforms can 'communicate' to enable meta-data and other information to be easily transferred in a collaborative environment.

5. Client awareness and education strategy for BIM

Increasing awareness of BIM and what it can offer to clients is important. The education of clients will support the drive to look at different objectives for their projects and could change present procurement procedures. It would also assist in placing a proper value on BIM.

ACKNOWLEDGEMENTS

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Geraldine Star, Star Monde Communications, for managing the complex task of recording the forum proceedings and crafting the disparate views of many into this well-organised report.

The forum facilitators for their wisdom and discernment in leading the groups, their extensive knowledge and understanding of the BIM environment must be acknowledged.

Neil Evans, Christou Design Group

Thomas Fussell, Executive Director, Chief Architect, Project Services, Queensland Government

Dominik Holzer, Practice Director, BVN Architecture

The forum presenters who provided case studies which were informative and of value in moving the discussion forward:

Perth

Craig Muir, Senior Principal Architect, GHD

Philip Parker, Director, Hames Sharley

Melbourne

David Sutherland, Director Planning & Design, Fender Katsalidis Australia

Tim Whitefield, Director, Whitefield McQueen Irwin Alsop

Brisbane

Keith Marr, Group Manager – Delivery Partners, SKM

Brett Taylor, Director Bornhorst + Ward Consulting Engineers

Jon Williams, General Manager Building Services, Beca NZ

Sydney

Mark Lowe Group Managing Director Triple 'M' Group of Companies

John Hainsworth, Associate/Virtual Construction Co-ordinator, ARUP

All participants, who attended and contributed their knowledge and experience to the discussions at the forums, have our special thanks.

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