



# COBRA AUBEA 2015

Sydney, Australia

8 – 10 July 2015



# **RICS COBRA AUBEA 2015**

**The Construction, Building and Real Estate Research Conference  
of the Royal Institution of Chartered Surveyors**

**The Australasian Universities' Building Educators Association  
Conference**

**Held in Sydney, Australia in association with AUBEA, the University  
of Technology Sydney and University of Western Sydney**

**8 -10 July 2015**

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ISBN: 978-1-78321-071-8

Royal Institution of Chartered Surveyors

Parliament Square

London

SW1P 3AD

United Kingdom

[www.rics.org/cobra](http://www.rics.org/cobra)

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## HOW DO YOU LIKE YOUR BIM?

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### ABSTRACT

This paper's objective is to investigate what practitioners across various disciplines in NZ construction including academia expect to find in BIM models. What specific information do they actually want from models and can this be provided in reality? Traditionally building designers received and developed client briefs to help produce successful designs but it seems not enough time is spent presently at BIM briefing stages determining what information is explicitly required from digital models, producing frustrating results for end users expecting to find selective, productive information embedded therein. This situation arises in academia also where some BIM endeavors investigate its' potential as an educational tool. However, if lecturing colleagues fail to adequately brief model authors on how the final model will be used pedagogically, it will inevitably fail to benefit teaching as envisaged. At the moment it appears not enough BIM briefing is actually taking place across the New Zealand construction industry nor sufficient use made of published guidance. Helping people better express their BIM requirements at briefing stage, exploring their feasibility for present and future work roles should result in more effective briefing of BIM authoring colleagues. Hopefully leading to more valuable, information rich models benefitting the entire construction sector.

Keywords: BIM, briefing, construction, digital, models

### INTRODUCTION

This research examines why many BIM (Building Information Modeling) models produced for construction and also it seems academia are often deemed "unsuitable" and further seeks to identify whether this is due to an inadequate briefing process if any. An Auckland architect stated to the author that "*a BIM model cannot be all things to all men*" therefore this project will seek to investigate what data construction professionals would ideally like to find included in digital models and whether it is explicitly requested in any brief.

This study is important because many governments including New Zealand and the UK have mandated that firms seeking future public sector construction work must be capable of producing projects using BIM to certain standards. This major government commitment reflects similar directions taken in the US, Scandinavia and elsewhere. Also, as present day construction students are the work force of tomorrow it is consequently imperative that education ensures students are ready for potential BIM roles in future employment. Taking and comparing samples from current practice across industry and academia helps to align educational delivery, ensure currency and underpin what happens in the drawing offices and building sites now and in future. "*BIM systems are only as good as their users*" (AT 111 Autumn 2014)

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## **CONTEXT**

With BIM becoming an increasingly important feature of design, construction and now also maintenance, future designers, project managers, building managers, indeed practically all disciplines across a building's life cycle should be conversant with its' concepts and practical use. Feedback has been received on academic BIM models studied stating a lack of data quantity surveyors, project managers and others may require, and where present it's not in an accessible user-friendly form reflecting traditional workflows and methods. Many lecturers wish to avail of BIM models in teaching to bridge learning gaps but some produced by colleges to date have seemed inadequate. This dearth of "suitable models" could be due to navigation issues in terms of elements not labeled for elemental cost analysis purposes for example, or not being modeled the way projects are actually constructed. A prime objective of this report will be to find out why models are not "suitable" whilst also investigating the level of any actual BIM briefings carried out. Many BIM guidance publications refer to aspects such as Level of Development (LOD) for models at various project stages but this report adopts a more "first principles" approach asking simply what users would like to get from the digital models they encounter.

## **RESEARCH METHODOLOGY**

Professionals across various construction disciplines were interviewed from industry and tertiary education to ascertain the information individuals really needed from BIM models, and to seek possible reasons for some alleged model inadequacy noted to date. Interviews were felt to be the best way of identifying BIM use levels within the local construction sector whilst also permitting first hand discussion on what participants sought from models. A questionnaire was developed with core questions for all on general information such as background and experience. Certain specific questions however were put only to those who actually generated models using software. Participants who did not author BIM models were asked instead the core questions plus others mindful of their roles. An objective here was to identify any briefings modelers had received and compare them with the non-modeler's BIM requirements. Another aim was to assess overall BIM knowledge and awareness of terms to determine whether this impacted communication of an effective brief. The 21 participants were chosen to achieve a purposive industry and education cross section with approximately 50% from each. The sample was very experienced overall and included traditional construction disciplines and more recent roles such as Fire Engineers and Design Managers. These two roles were included as recent additions to the traditional project team whose use of digital models could benefit their future collaboration contributions. Fire Engineers employ digital models to test things like smoke and gas movement through building spaces and Design Managers will increasingly become model monitors if not complete Model Managers, another newly emergent job title in a somewhat fluid space in the construction industry.

## **LITERATURE REVIEW**

This report's primary purpose was to examine the extent and awareness of BIM briefing in New Zealand within the workplace and academia. To this end, no specific literature was found that targeted this very specific area of study and information was sought from more general BIM publications both books and magazines, selected for their availability and perceived relevance. The main text referenced was the NZ BIM handbook whose production by local stakeholders is intended to encourage and assist with BIM implementation by participants across the whole construction sector. This

recent BIM guidance publication documents much information relevant to this paper's aims including a BIM Brief Definition, a BIM Execution Plan and highlights the distinction between models used for Design, Construction or possibly both. Appendix D of this NZ handbook was most useful providing a table of BIM uses that would be a helpful checklist for any BIM briefing. The accompanying detailed descriptions would enable clients and consultants to better articulate their aims and compare them to what is actually feasible. Some literature contradictions were noted as in MacGairbheith stating that best practice would require a single model whilst the BD magazine White Paper argues that the actual single model is only a dream! Lane's series of magazine articles for Building Magazine UK were found to be extremely interesting and of immense relevance. Studying as they did a live project through from inception to completion enabled the final project's BIM process and built reality to be assessed against its' conceptual targets. Many germane points on briefing are raised such as clients knowing and communicating exactly what they want from models and people not stating clearly or early enough objectives related to Facilities Management operations. FM was a common theme in the article series and prominent also in the White paper published by the same magazine. The articles also highlight comments from architects involved now being more aware of the role of temporary site works than before. Others wonder whether designers should produce data in a different way if it is to be used for future cost planning. If this does occur who will brief designers adequately on how to model the project? Notable also was the expressed need for different models for different project phases, Design, Construction, Operation and the correlation with this researcher's particular interest in models for Academia. Important points noted across much of the literature involved common names, terms and language to improve interoperability between separate discipline models and their actual navigation and use. The BD white paper notes that it is very possible to have too much information in a model. Surely an effective briefing can help prevent this happening and is some justification for this research.

## **MAIN DISCUSSION**

**Q1. What is the extent of your BIM experience and usage to date?** Almost all participants claimed some basic BIM use with only one claiming no prior practice. A Fire Engineer described their interaction as low level but further discussion identified model generation in proprietary software assessing sophisticated mathematical data. Others almost had to be convinced that they were performing primitive construction programming analysis (4D BIM) illustrating again unfamiliarity with BIM language. Common BIM terms were not widely understood despite this primary necessity for clear communication and successful BIM implementation. Literature stresses the need for clear, consistent collaboration, where using a common language is vital and an aspect of BIM explicitly introduced in the NZ BIM handbook foreword. The following questions highlight the unfamiliarity noted with typical BIM terminology and results show that this is an area where work is necessary if we are to achieve and more importantly understand "the common language" the NZ BIM handbook seeks.

**Q2. Are you familiar with the term Level of Detail and how this may relate to digital models?** The term LOD (Level of Development) though better known by industry participants was overall unfamiliar perhaps due to LOD having referred to both "level of detail" and "level of development" in the past. In the UK the RIBA Plan of Work was redrafted to help integrate practice and aid collaboration reflecting LOD stages. An interesting development possibly helping people adapt to new ways

of working rather than shoehorning BIM methods into traditional workflows. “rather than change practices to make use of BIM’s potential” (Rogers,2013)

**Q3. Have you ever heard of the term “deliverables” and do you know what is meant by this?** Whilst encountered by many pre-BIM who could derive a possible meaning the term in the BIM context was not well understood however. This is revealing as Deliverables should be important aspects of any BIM briefing.

**PROJECT DELIVERABLES**

In this section, list the BIM deliverables for the project and the format in which the i

BIM Use	Approximate due date/stage	Format
Cost Estimation	Concept design/preliminary design/developed design/detailed design/construction design	.xyz/IFC
Design Authoring	Preliminary design/developed design/detailed design/construction design	.xyz/IFC
Record Modelling	Handover	IFC
3D Co-ordination	Preliminary design/developed design/detailed design/construction design	.xyz/IFC

Fig 1. NZ BIM handbook Appendix E. p6 table excerpt.

” The new deliverables...a drawing is no longer sufficient for us” (BD White Paper 2012). The NZ BIM Handbook, Appendix E has a Project BIM Brief example illustrating how deliverables are linked to the Schedule of BIM uses found in its’ Appendix D. (Fig 1)

**Q4. Have you ever heard of 3D, 4D, 5D and 6D BIM and do you know what these mean?** Participants understood fairly well the BIM terms 3D, 4D, 5D and 6D with only a few from industry not confident. Most confusion centered around 4D, 5D and 6D BIM with one experienced quantity surveyor upon being told that 4D was time not cost exclaiming “ *ah but time is money!*”

**Q5. Have you ever heard of the term IFC and if so, do you know what IFC is used for?** The term IFC (Industry Foundation Class) was fairly familiar to participants though some had no understanding or at best only had a vague idea. This file format despite some issues is widely seen as offering the best future collaboration options and therefore an area where knowledge acquisition may yield future benefits.

**Q6. Have you ever heard of the term Federated model and if so do you understand what it means?** Half the interviewees had not heard of the term Federated model where separate discipline models are combined. Even less knew its’ meaning and many had no real understanding at all. One participant claiming ignorance was actually found to be extensively using at least partially federated structural and architectural models.

**Q7, Q8. Have you ever heard of the term “ Clash detection “ and are you aware of any type of Model Checking Software packages and their capabilities?** Clash detection was well known with only one industry respondent unaware. The various clash detection software was fairly familiar but only a few 4/21 had good knowledge of some of the currently available package’s capabilities.

A quantity surveyor recognizing one package’s ability to make his workflow more efficient stated however the need for interoperability affairs being resolved early in the project to aid access and navigation of files provided to them. Surely the briefing stage is the ideal time to discuss such protocol issues.

**Q9. Are there any other points that have not been addressed or discussed so far that you think are relevant and important?** This was an open question where interviewees were invited to raise any points they felt had not been addressed. Staged information delivery between consultants was widely raised and possibly in the future could relate to stated LOD stages such as those in appendix C of the NZ BIM Handbook. Only one Fire Engineer participant wanted comprehensive data immediately but conceded this could actually be at a fairly basic level of development. Others noted practical issues with receiving information other than by stages. *“delivering the right information to the right people at the right time”* (BD White Paper 2012)

**Q10. Could you brief a BIM model author on what you need in the model at stages such as Developed design and Detailed Design? If so, can you list some of those requirements please?** This question on the actual briefing process was put to the non-modeler participants requesting the prioritized data they required from BIM models to optimize their use, and additionally whether they felt capable of briefing model authors. All confidently provided direction and responses generating a 37 item wish list suggests providing detailed briefings should not be onerous. This original list was analyzed to identify similar items reducing the number to 24, then compared to the NZ BIM handbook Appendix D BIM use schedules to see if items could be classified using those descriptions. A subjective process based on the researcher's opinions, but the mapping exercise logic is justifiable despite others possibly classifying items under different appendix headings. The intention was to test if Appendix D of the handbook could be used to inform the briefing process and this research would suggest that it would be valuable despite some issues over direct correlation.

**Q11. Are you aware of the recently published New Zealand BIM handbook?** All participants were quizzed regarding their awareness of the NZ BIM handbook or similar guidance documents in their country of work and the majority said they were aware of such publications.

**Q12. Can you briefly state how you have made use of this document?** Very few 2/21 had fully read the document and only 2 industry participants were actually making use of the published guidance. Strangely, some people actually involved in the handbook's development still didn't employ it as a rule. The fact that the BIM handbook had only been publicly available for a few months could explain in part why it was not used more widely. However, that no interviewee brought this up as an explanation is interesting and could indicate unawareness of important milestones in this document's development such as its' publication date.

**Q13. What BIM software if any have you ever used and for what purpose?**

Numerous BIM applications were employed including basic use of model checkers Navisworks and Solibri. Archicad and Revit were most common for model authoring with many using Sketchup, a package used also by one quantity surveyor. One industry consultant used Solibri frequently and another Navisworks. Specialist software used by the Fire engineers interviewed generated debate on model duplication. Reducing waste and increasing efficiency are stated aspirations of BIM so if a briefing process addressing interoperability avoids unnecessary duplication of

information then surely it is a work stage worthy of some focus. *“make increased use of BIM processes to aid efficiency and meet cost targets”*( MacGairbhieth,2014)

Certain questions were posed only to model authors regarding BIM experience, software use and the degree of BIM briefings they had received if any.

**Q14. What authoring software package do you personally use?**

Analyzing the BIM experience of the 9 model authors revealed 5 claiming detailed use of BIM. Some inconsistencies arose however due to variations noted across individual BIM definitions. For example generating databases from 2D Autocad without 3D models was practiced by one but is this actually BIM? Providing an initial description of BIM expressed in simple terms would perhaps have clarified matters here but risked putting words in people’s mouths.

**Q15. What products of the various authoring packages have you engaged with in your projects eg from surveyors, structural engineers or services engineers?**

One modeler interviewed had not received what he considered BIM model data of any kind from consulting colleagues whereas the majority employed 2D outputs regularly from surveyors. 2 participants had received 3D output in IFC model form or similar and another considered he had received detailed BIM data. These respondents were all from industry. Most model authors had not briefed consulting colleagues on what they required from BIM models whether due to unfamiliarity with product and process or because their small-scale residential work did not require it. Briefing for detailed 2D outputs was common but not for digital models. All modelers were able to state content desired in other consultant’s BIM models. Lists were compiled relating to structural and services models based on responses. The lists were filtered to omit duplicate requests and then compared with the Appendix D schedule of BIM uses as before. This process was to ascertain whether the stated practical requirements could be reconciled with published guidance to help rationalise future briefing practice. This revealed an apparent gap between what model authors state as necessary and what is described in the NZ BIM handbook. Mapping their needs onto the appendix D matrices was not straightforward in part due to the way the document is written. The process began to feel contrived and detached from real world practice explaining in part perhaps why one interviewee found the NZ BIM handbook *“ off – putting”*

**Q16. To what extent have you been briefed by anyone whether a client or a design team colleague on what they would like to be included in your BIM models at any stage of a project?**

None of the modelers could recall receiving a formal brief to deliver a BIM model though some from industry had discussed matters in some detail.(Fig2)

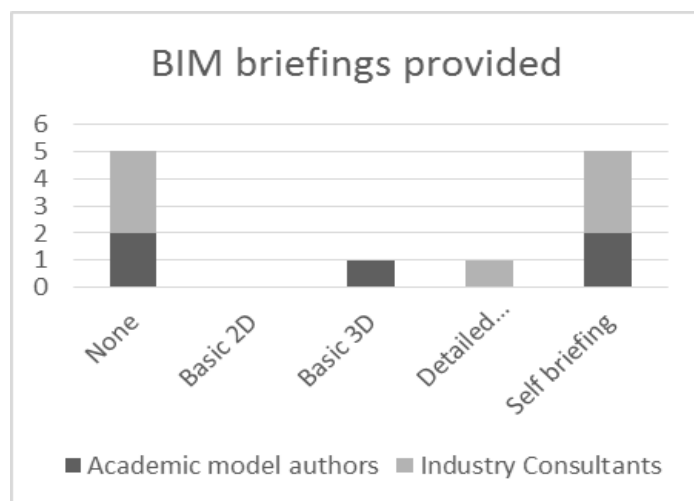


Fig 2. Briefings to model authors.



One academic had however prepared a model for colleagues which evolved from fairly detailed informal discussions. This model subsequently turned out to be very effective and fit for purpose even without a structured briefing. Some modelers thought clients had only a blind understanding of BIM and therefore incapable of providing a detailed BIM brief whereas another yearned for “intelligent clients”.

*“ asking for the BIM model but not always knowing what they’re going to do with it”*  
(BD White Paper 2012)

An interesting concept of “ Self Briefing “ was noted where designers modelled only those building elements they thought important or required traditionally as opposed to responding to a prescribed brief from a client or colleague.

## **CONCLUSIONS AND RECOMMENDATIONS**

This research indicates that there is very little formal briefing in BIM terms being carried out at the moment around Auckland whether within industry or academia. Educators could argue that embedding BIM into programme delivery is still something institutes are grappling with, but industry itself has had more time to respond. BIM has been around for a relatively long time but as in the UK and other countries, NZ construction has been quite tardy in adopting and exploiting the new technologies. Practitioners across the sector are not making sufficient use of the guidance within the NZ BIM handbook despite some apparently being involved in its’ development. Reasons given included that it was found to be off-putting and that it did not provide detailed information on items such as modeling processes and protocols. The handbook however is intended as a framework document avoiding specifics, possibly because they could quickly become outdated in a rapidly evolving BIM landscape. Appendices provide detail but here the language can seem at times detached from the common mentioned in its’ own foreword. Ease of use is something that should be considered in future iterations. Despite the above, briefing should still be attempted. All participants were able to articulate well their desired model contents, some lucidly so. However, thus far these have not been effectively or formally communicated to colleagues, thereby reducing the value of a crucially important project stage.

*“we didn’t articulate our objectives clearly enough”*(Lane2012)

Some interviewees using BIM extensively, surprisingly did not know that merged files they were mining for data were defined as “federated models”. Improving familiarity with BIM vocabulary, and clarifying terms such as IFC and Federated models should become future priorities to help achieve the communication and collaboration deemed so vital to successful BIM implementation.

*“ ensuring collaboration, one of the bugbears of the construction industry”*( BD White Paper 2012).

Despite software preferences, developments such as IFC should mean the “software neutral” stance of countries such as the US and UK can work in New Zealand too. Already two large Auckland firms using diverse software are collaborating by exchanging IFC data on a multi-million dollar project, demonstrating interoperability challenges can be addressed if considered at initial briefings. Other matters raised concerned items such as names, labels and referencing, all points conceivably

addressed at briefing stage under drawing protocols. Lack of formal briefing has led in some cases to a form of “self briefing“ where model authors have made assumptions about the data models should contain. The stated lack of “suitable models“ especially in Academia would indicate that the present system should be revised to a more formal process stating clearly BIM model requirements.

The UK government set up hubs to encourage uptake of BIM there and this approach may have value in New Zealand too where utilizing academia as such hubs could augment industrial links between institutes and industry to mutual benefit.

The BIM process is a new way of working whose milestones may not align precisely with traditional project stages therefore updates to existing texts such as the NZ equivalent of the RIBA Plan of Work should consider outlining project phases expressed in BIM terms such as LOD 200, 300 etc, which at present do not appear to be widely enough understood or used.

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