Application of BIM in Different Stage

1 BIM and the Quantity Surveyor

BIM

Should we Participate from Day 1?

A successful BIM model must eventually comprise data like building geometry, spatial relationships, geographic information, quantities and properties of building components. Like all complex databases, however, each piece of data must be multi-encoded manually in order to be retrievable in the future for specific uses. This is a very labor-intensive task and any changes later will incur extensive re-modeling work. As efficient productivity is also one of the goals for using BIM, it is obvious that modeling works should be undertaken in stages to mitigate abortive work by the team. The stages taken may follow the recommendations by the Level of Development (LOD) of American Institute of Architects as follows:

1

LOD 100 – Master Planning Stage

The model at this level should be as simple as possible to give only indicative areas, height, volume, location, orientation and in some instances, functional spaces. Estimating is kept at the appraisal stage, using cost per unit floor area.

LOD 100 - Master Planning Stage

- Master layout comparison
- Development phasing programming
- Zoning of functional areas

2

LOD 200 – Preliminary Design Stage

Floor areas and functions could be given in more detail but estimates are still on a cost-per-floor-area basis. High level quantities such as Construction Floor Area (CFA) and Gross Floor Area (GFA) may be available. But further levels of detail, which are premature to be built into the model, should be supplemented using other media. Conventional tools like material schedules, 2D drawings and sketches may be more appropriate for cost planning purposes.

LOD 200 - Preliminary Design Stage

- Building design comparison
- Key milestone programming
- Floor areas for cost planning

3

LOD 300 – Detailed Design Stage

Designs of building sizes, shapes, facade and functional area mixes are complete and the model can theoretically produce accurate quantities for cost planning purposes, but specifications of components will still not be ready.

LOD 300 - Detailed Design Stage

- Building sizes/shapes well-dimensioned
- Key quantities to cost plan level
- Key activity programming
- For design & build procurement
- Clash analyses among components

Specific functional areas such as water features, external works should also be modeled but at a lower detail. Details at this level would already be good enough for procuring design & build contractors.

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4

LOD 400 - Construction Stage

Details in the model are complete enough and can be issued as tender drawings as well as construction drawings. However, the quantities from the model can be used as a basis for BQ measurement but cannot confidently be directly used as BQ quantities. Quantity surveyors will still have to carry out cross-checks, make adjustments and add sundry items in accordance with prescribed measurement rules. The BQ descriptions will need to be written separately.

LOD 400 - Construction Stage

- For BQ Measurement - subject to cross-check
- BQ description to be written seperately
- As tender and construction drawings
- Detailed construction programming
- Clash analyses among components

It is unlikely that there will be a standard phraseology library built into the model for generating bill pages directly because each model will be unique. Non-standard features will have to be adjusted separately.

5

LOD 500 – Operating Stage

Models detailed to this level have actual dimensions for use as as-built drawings. The model can be used by asset and facilities managers for planning and recording maintenance, alterations and addition of functions, elements and systems of the building.

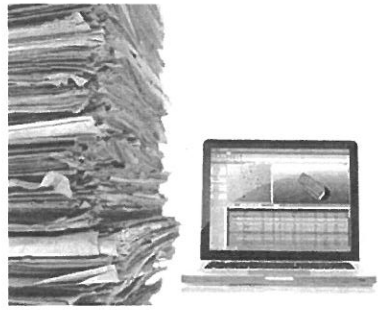
It is also an ideal platform for maintaining building information for life cycle analysis and costing.

LOD 500 - Operating Stage

- As-built drawings of construction works
- Planning and recording building operations, maintenance and asset enhancement
- Life cycle analysis and costing

Benefits

For a project to adopt BIM, there will inevitably be some additional expenditure on computer hardware and software, as well as the extra costs of maintaining a specialized team for the modeling work. However, the productivity thus enhanced throughout the period of development and the savings in waste and abortive works may well pay off. Not to mention the accurate and traceable records that it offers for the life cycle of the building. Many of these are intangible and simply cannot be evaluated in money terms alone.



CONTRACTUAL CHALLENGES MATRIX

A snapshot of the contractual challenges presented is set out in the matrix below.

	Contractual Challenges
Design Responsibility	▪ Acceptance of design responsibility for BIM model which other participants and users have contributed, updated or modified
Discrepancies in Contract Documents	▪ Extent of applicability of current contractual provisions in the resolution of discrepancies when working on a BIM-based project
Defects Liability and Interoperability Issues	▪ Design defects appearing during construction, after handover or emerging as a latent defect caused by software interoperability issues ▪ Response by professional indemnity insurers to design errors arising from interoperability problems
Intellectual Property Rights	▪ Ownership of BIM model and layers of intellectual property rights ▪ Use of BIM model for future refurbishment and extension works by third party design consultants

Table 3. Designers' opinions on BIM (positive issues)

Rank	Statement	Weighted average score
1	I welcome adoption of BIM in my organisation.	4.03
2	BIM checks the potential conflicts during pre-construction stage.	4
3	Adopting BIM enable users to create a model visualizing the real construction process.	3.9
4	BIM increases consistency and accuracy of information used during the whole project.	3.87
5	BIM benefits for better data reuse.	3.82
6	BIM enhances communication among project members.	3.74
7	BIM enhances collaboration among project members.	3.74
8	BIM checks design non-conformities during pre-construction stage.	3.69
9	BIM checks the constructability during pre-construction stage.	3.69
10	BIM is an information centre for the project.	3.62
11	Adopting BIM encourages users to give feedback more frequently than before.	3.36
12	BIM helps tendering.	3.26
13	BIM has a high degree of customisation to meet your requirement.	3.13
14	BIM helps procurement.	3.03
15	BIM reduces the time spent on project documentation and communication.	2.97
16	BIM lowers the project cost.	2.92
17	BIM improves construction safety.	2.87
18	BIM will reduce the amount of staff/workers in your organisation in the long run.	2.72

Table 4. Designers' opinions on BIM (negative issues)

Rank	Statement	Weighted average score
1	The current standard and specification in BIM is not unified in the construction industry.	4.05
2	It does not help if your counter-parties are not using the BIM.	3.95
3	BIM files have compatibility / interoperability problem when transferring to other software.	3.9
4	BIM software is costly.	3.87
5	Initial set up of BIM is difficult.	3.82
6	The model in BIM needs to be manually updated frequently.	3.82
7	Adopting BIM will propagate the error if a mistake is produced.	3.49
8	BIM is not yet mature for adoption in the local construction industry.	3.44
9	BIM is too complex and should be made easier to use.	3.36
10	BIM creates redundant work transforming project data between different parties.	3.26
11	Responsibilities of parties will be unclear after adopting BIM.	3.1

Barrier & Support of BIM

Table 5. Designers' opinions on BIM barriers

Rank	Statement	Weighted average score
1	Lack of qualified in-house staff to carry out the BIM related works.	4.18
2	Lack of training/education.	4.08
3	Lack of standards.	4.03
4	Lack of client demand.	3.92
5	Lack of government's lead/direction.	3.92
6	Lack of incentive to have subcontractors and suppliers (lower part of the supply chain) to adopt BIM.	3.87
7	High cost.	3.77
8	Uncertainties over interoperability of BIM software with other software.	3.77
9	Lack of IT infrastructure.	3.69
10	Uncertainties over ownership of data and responsibilities.	3.54
11	Lack of new and/or amended forms of construction contracts.	3.18
12	Current professional indemnity and insurance terms.	3.08

Table 6. Required support on BIM

	Required	Not Required
Providing guidance on use of BIM	33	6
Defining levels of BIM working for reference in professional services agreements	32	7
Providing training	31	8
Developing data exchange standards	31	8