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The BIM Balancing Act: Tilt the Scales in Your Favor

Feature

Comprehensive International BIM With Full Owner Involvement

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INTRODUCTION

Owners have sometimes appeared to be "silent partners" in current BIM implementations, a legacy of their traditionally limited role in the creation and use of project documentation. While owners have a vested stake in the content of this information—and the underlying processes of project design and execution—their relationships to this information have historically focussed on managing oversight, approval and, of course, financial responsbility. Until recently, developers of BIM technologies have concnetrated primarily on parties that develop project documentation (architects, engineers, and consultants), and to some degree on contractors and subcontractors who process the documents for construction. Where owners have been considered in the development of BIM tools, it has largely been towards its use in facilities management applications.

Many (but by no means all) owners have so far taken a hands-off approach to the development of the BIM data and supporting process changes. There remains the perception, and potentially the reality, of shifts in risk associated with owners taking a strong leadership role in the working methods of the building team. There is the sense that some efficiencies and increased control may be enjoyed by the project participants in leveraging shared BIM data, resulting in a better overall building. However, there is also the perception that these benefits are unlikely to translate measurably into lower project costs for the project team - relative to the additional risks and responsibilities brought about by the owner imposing process change.

Owners have the most to gain from the benefits of BIM, as the ultimate beneficiaries of improved building performance and project delivery efficiencies. As project stakeholders, the owners are also best placed to impose the necessary enabling structure of information development, distribution and organizational processes.

Providing owners with direct added value from the BIM dataset is an important advancement that is required to drive adoption. However, this owner-driven approach to BIM implicitly requires new practices by owners that drive a need for improved access to the project information. Benefits are now beginning to occur through providing owners direct visibility and control of the project BIM, and by integrating BIM further into financial aspects of building ownership.

Gehry Technologies has participated in a number of projects that point to methodologies that can bring owners into the BIM conversation as more active participants, by identifying and providing new values to owners beyond those traditionally associated with project information.

A. Case Study: Swire Properties' One Island East

Swire Properties Limited is a substantial developer of commercial, retail and residential properties throughout the world, who has made a significant investment to develop owner-driven BIM methodologies for many of its new projects.

The One Island East project in Hong Kong, a 70 storey, 1.4 million square foot office tower, was the first Swire Properties BIM driven project to be completed. The owner retained Gehry Technologies (GT) as the BIM Consultant for the project, to assist in the implementation of BIM practices and supporting technologies. The owner's objective was to achieve a higher quality design while saving money and improving construction time by using collaborative, collocated work methods and integrated 3D modeling tools. The initial objective was to save 10 percent on the cost and reduce construction time.

B. Team setup and implementation

GT was brought in during Design Development, after preliminary 2D drawings had been completed. GT produced the initial BIM model from the 2D Design drawings, and then transferred the BIM to the project team. Formal management of the model was then adopted by the owner, with the BIM Consultant providing the Model Manager for this role.

During the design phase, the owner provided a co-location office space for the project BIM team near the building site. Each of the key consultants provided a project team of BIM staff, who were responsible for developing and coordinating their components of the design and associated modeling. The owner provided a server, a web portal and associated IT infrastructure for the team. Workstations and software were also acquired by the owner, who sponsored the BIM training and technical support for the design phase team. The owner provided an active, senior project management team that managed the process. The BIM Consultant worked as a member of the project team to develop and implement the BIM methodology, providing database architecture, information development and control processes, BIM trainers, technical support and supplementary BIM modeling staff. A model manager led the coordination and management of BIM information developed by the team for the duration of the pre-tender phase. The team developed virtually all of the project 3D data on a common software platform, Digital Project. Internet-based vaulting, and versioning databasing technology was used to coordinate the parallel collaborative working processes of the 30 person team.

MEP modeling has proven to be one of the most significant contributing factors to the success of the integrated BIM value

delivery. The OIE model included all major MEP elements. Clash detection was used extensively and continuously both to identify interferences associated with these items and to manage the construction of correct openings in structure and architecture. This process enabled the design team to identify and resolve over 2000 conflicts before tendering. Later, during construction, the contractor used the same technology and working methods to identify and manage hundreds of clashes and coordination issues.

drawings—including all MEP shop drawings—were reviewed against the design intent as indicated in the BIM model and then incorporated into it. Any requirements for revisions that were identified in this shop drawing process were returned to the relevant sub-contractor for incorporation into revised shop drawings. The construction BIM model became the main visualization tool for coordinating the many elements of the project prior to construction.

4D simulation was employed extensively

completed ahead of time and 90 percent rented at completion.

Tranferring the entire BIM process from design to construction teams was essential to realizing the maximum potential value during construction. This was achieved by making it a contractual obligation that the contractors adopt, and continue to develop the BIM model and technology implementation as part of the creation of the construction information.

Providing all of the bidders with the

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The owner procured the project using a traditional tender process; a number of qualified main contractors were invited to bid for the project. GT trained a number of the potential main contractors in the use of quantity extraction and measurement from the BIM model. The BIM model provided an enhanced quantity take-off capability that improved the speed and accuracy of the management of quantities before and after tender. Lower, more accurate tender pricing resulted from better identification and management of the contractors' unknowns earlier on. Four contractors submitted competing bids that were closer to each other than would have been expected. While the BIM model did not form part of the legal contract documents, it was appended to the contract as reference information, and the quantities from the model were used as the basis for the bill of quantities.

Subsequent to contract award, the winning contractor, Gammon Construction Limited of Hong Kong, assumed full responsibility for the tender BIM model and began to develop it into a highly accurate and detailed 3D construction BIM model. Gammon and MEP subcontractor Balfour Beatty continually kept the progress of the One Island East (OIE) BIM model ahead of construction site activities. After being trained by GT, the main contractor maintained a team of 8 full time modelers who helped to identify and manage clashes and coordination issues, incorporating the resulting design solutions back into the model.

A number of sub-contractors—including the cladding contractor, Gartner, also modeled their elements of the works. All shop

to help to optimize the construction sequence and manage risk. In addition to "conventional" 4D modeling, construction process simulations were produced for Gammon by the Virtual Prototyping Laboratory at the Hong Kong Polytechnic University, in cooperation with the BIM Consultant, and using process simulation tools developed in the manufacturing industry for assembly line simulation and control. These simulations were produced using the actual BIM elements aggregated by the project team. The contractor's team conducted detailed construction sequence optimization exercises before the actual construction. A number of sequencing problems and clashes were identified—particularly in critical risk areas such as the 4 day floor construction cycle and the erection of the outrigger floors. Job safety aspects were also vetted and communicated to construction personnel through the construction simulation process.

C. Results and lessons learned

Gammon Construction has reported that Construction Process Modeling saved the project at least 20 days. Across the construction industry, it is thought that geometric coordination of the design prior to construction yields at least a 10 percent overall cost saving, and that construction process modeling can contribute an additional 20 percent cost saving. Order of magnitude reductions of contractor Requests For Information (RFIs), and significant reductions of claims on site resulting from incomplete design coordination were experienced on this project. The project was

pre-tender 3D BIM model helped them to evaluate the level of risk and resulted in lower tender returns than in a traditional 2D-based tender. After completion, the contractor adopted Digtial Project and 3D BIM and created a permanent inhouse construction BIM team.

Throughout the design and construction phase, the BIM was used to monitor cost in real time. The technology can produce vast, detailed and appropriately formatted quantity take off information in real time. This helps the entire project team to manage cost more effectively throughout the project. Ongoing 4D analysis and Construction Process Simulation were used extensively to optimize the construction process.

On One Island East, the owners's leadership of the BIM process was fundamental to the success of the project. This direct, top down approach provided a coordinated vision for the project goals and provided an effective structure for delivering the results.

Since beginning owner driven BIM practices on One Island East, Swire has subsequently deployed these practices on a number of large new evelopments in Hong Kong and China. The owner has continued to retain Gehry Technologies for assistance in transitioning the methods initially developed on One Island East to other projects in his portfolio.

The One Island East team was honored to receive the 2008 AIA TAP BIM Award for Process Innovation on this project.

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