Using BIM to reduce time-related risks

Haitham E. Khaireldin

1. What is BIM?

"Digital representation of physical and functional characteristics of a facility creating a shared knowledge resource for information about it forming reliable basis for decisions during its life cycle, from earliest conception to demolition" as defined by the Construction Project Information Committee and supported by RIBA.

The building information modelling (BIM) term is used simultaneously to refer to the model itself or to the whole process. The model is the visual representation of the facility based on which users can view and extract specific-tailored data and the process is the act of collaboration between the parties involved in a project at different stages that requires their input in the BIM.

Greenwald (2013) stated that BIM has several levels of development that are related to the model content and to the purpose of use, the first three levels provide increasing degree of details in areas such as 3D visualization and systems integration and furthermore, added that a BIM model essentially contains detailed information about the project structure and its components and accordingly, terms like 4D and 5D refer to additional levels of model development.

A 4D model is essentially a 3D CAD model attached to the fourth dimension of time via a construction schedule as illustrated in Fig.1 and 5D model is linking both schedule and estimates to a 3D model.

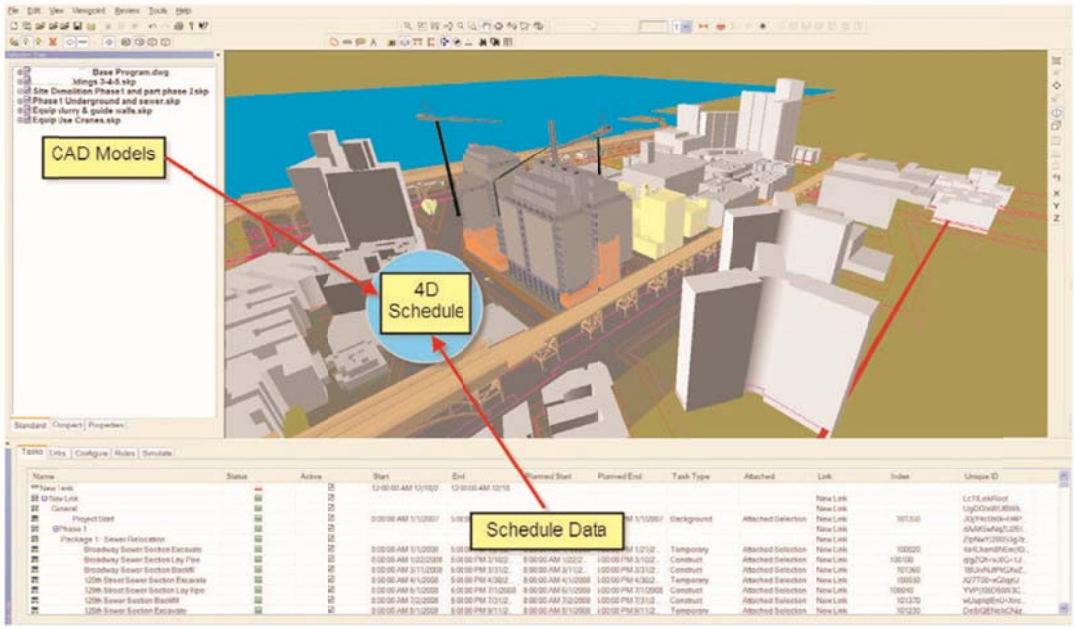

Fig.1

2. *Why BIM?*

Newbery (2012) stated that the current trend adopting BIM is driven mainly by the urge of possessing a clear and a fully searchable description of a facility during and after construction and added that a shared BIM model enforce coordination and minimizing the occurrence of unforeseen clashes.

High-level objectives of a construction project are essentially time, cost and quality. Initial appropriate planning can take time but this early effort ensures that time and cost are under control and thus, risks are minimized.

Utilizing BIM technologies such as 4D modelling and automated activity monitoring system (See Fig.2), can eventually fortify the role of the project schedule as a pivotal tool by enhancing the ability of validating schedule duration, sequencing and examining the critical path, which is achieved by providing better vision of parameters not accessible via conventional Gantt chart.

Coyne (2008) stated that adopting 4D modelling resulted in tangible added value during the pre-construction phase as well as construction phase, such as optimization of the project schedule and increasing its reliability, optimization of site use and safety, ensuring constructability, improving coordination and communication and better resources allocation.

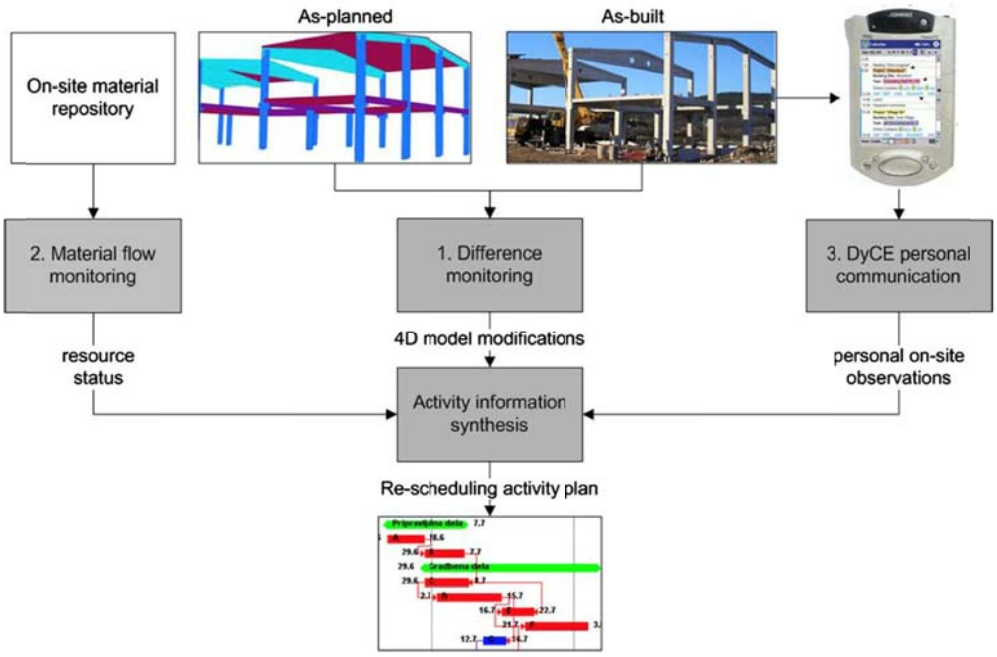

Fig.2

It is also worth mentioning that 4D modelling can be used as a powerful tool in construction delay analysis. There are some examples where 4D modelling has been used in prospective type of delay analysis, such as Time Impact Analysis (TIA) as well as retrospective analysis, such as As-Planned versus As-Built, which ultimately means that it can play a major role in resolving disputes throughout

the project lifecycle. Below in Fig.3, an illustration of 4D modelling application in TIA type of delay analysis.

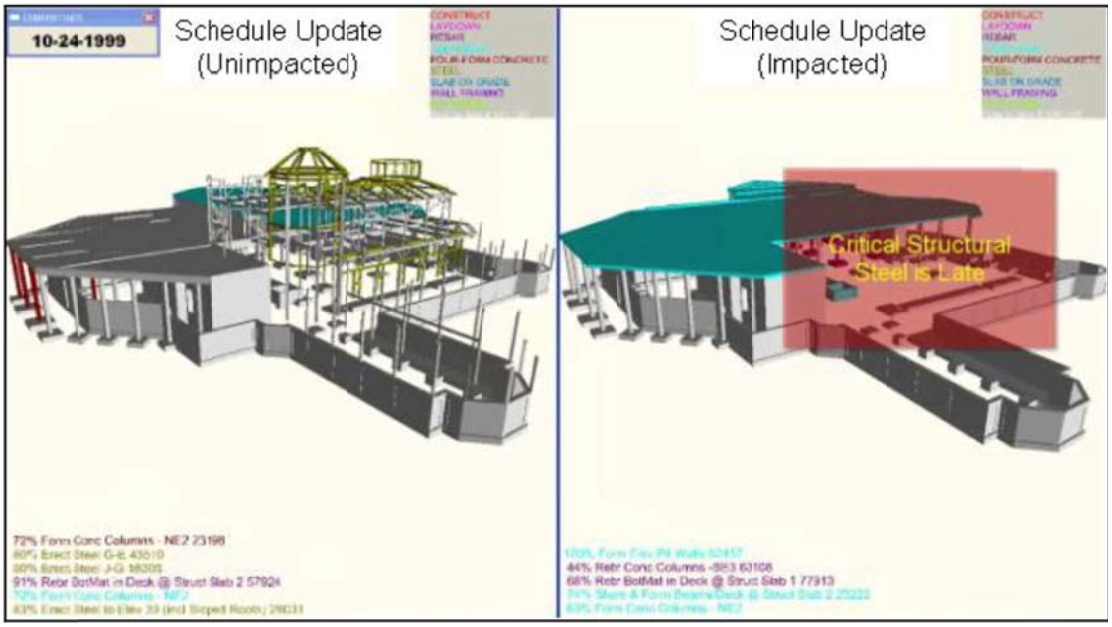

Fig.3 TIA Comparative 4D Model

3. Challenges

There is a wide consensus on the benefits of utilizing BIM in the construction industry and there are available technologies to match. Nonetheless, the implementation of BIM is relatively slow. The two main reasons for that slow behaviour of implementation are technical and managerial, the technical reasons revolve around the need to eliminate data interoperability issues and the need to well-developed practical strategies and on the other hand, the managerial reasons are mainly due to the absence of consensus on how to implement BIM.

Furthermore, the findings of the ICLC (2008) conference has identified some major barriers to BIM, which are mainly the absence of standard contract documents that hinders the development of BIM and legal concerns from the way the technology is used in regard to data misuse, intellectual property, loss of data, the legal status of the model, allocation of risks and standard of care. Fenwick Elliott (2012) concluded that the full legal implications of BIM are yet to be explored and will be clearer once level 3 of BIM becomes widespread.

4. Conclusion

In light of the literature review, it is evident that BIM has the potential to reach prominent success when it comes to closing the gaps and avoiding the pitfalls of the fragmented practices that the construction industry is infamous for.

However, it is important to note that it is an emerging approach that did not reach full maturity yet and hence, it is wise to fulfil the prerequisites prior proceeding with full implementation in full throttle pace.

BIM is proving day in day out that it can eventually improve the construction industry position in terms of productivity, profitability, value and frequency of conflicts and disputes by promoting the collaborative work environment, better allocation of obligations and liabilities and clear visual status of the facility that will eventually lead to pinpointing issues whenever they arise.

There are a lot of challenges confronting the implementation of BIM to the fullest potential and the first challenge is the mind-set of the parties involved in the construction industry. If these parties are not willing to coordinate and communicate effectively, BIM would be just conventional CAD software and nothing more.

BIM future is both promising and challenging at the same time. While, BIM is expected to enhance the quality of the construction industry, allocation of obligations and liabilities is still a challenge within the BIM framework because parties have to undertake detailed risk analysis and allocation before entering any contract.

Certain issues have to be considered when drafting a contract for a project utilizing BIM. These issues are essentially the purpose, the deliverables, users' privileges, how the model will be managed and level of reliance on modelled information.

5. Bibliography

Basu, A. (2007). 4D Scheduling – A Case Study. *AACE International Transactions.*

Coyne, K. (2008). Leveraging the Power of 4D Models for Analyzing and Presenting CPM Schedule Delay Analysis. *AACE International Transactions.*

Fenwick Elliott (2012) *Demystifying BIM* [online]. Available from: http://www.fenwickelliott.com/files/insight_issue_7.pdf (Accessed 22 March 2013)

Fryer, B., Egbu, C., Ellis, R. and Gorse, C., 2004. *The Practice of Construction Management*. 4th ed. Blackwell Publishing.

Forth Construction, *Achieving Excellence in Construction Procurement Guide – OGC 3* [online]. Available from: http://www.forthconstruction.co.uk/downloads/achieving-excellence-guide-3.pdf (Accessed 19 November 2012)

Gibson, R., 2008. *Construction Delays: Extensions of Time and Prolongation Claims*. Taylor & Francis e-Library: Taylor & Francis.

Greenwald, N. (2013). A Creative Proposal for Dispute Systems Design for Construction Projects Employing BIM. *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction* 5:pp. 2-5.

Hall, J. and Folk & Associates (2012), *Ineffective Communication: Common Cause of Construction Disputes* [online]. Available from: http://www.azbuilders.org/main/MainSubPages/legal/LegalNotes/ineffective%20communication.PDF (Accessed 22 March 2013)

Hurtado, K. and O'Connor, P. (2008), *Contract Issues In The Use of Construction Building Information Modelling* [online]. Available from: http://www.acecmn.org/contents/file/195 (Accessed 25 March 2013)

Harris, M. (2010). 'Measure Twice, Cut Once'. *Building Magazine* [online], 17 December, Available from: http://webcache.googleusercontent.com/search?q=cache:3cXzozc6h6QJ:www.building.co.uk/professional/legal/the-legal-implications-of-using-building-information-modelling/5009554.article+&cd=3&hl=en&ct=clnk&gl=ae (Accessed 22 March 2013)

ICLC (2008) conference on building information modeling: a framework for collaboration. London, 6-7 October, 2008.

Khosrowshahi, F. and Arayici, Y. (2012). Roadmap for implementation of BIM in the UK construction industry. *Journal of Engineering, Construction and Architectural Management* 19(6):pp. 610-635.

MISBE (2011) Proceedings of the international Conference on Management and Innovation for a Sustainable Built Environment. Amsterdam, The Netherlands, 19-23 June, 2011.

Mitchell, B. and Trebes, B., 2012. *Managing Reality, Book3: Managing the Contract*. 2nd ed. London: ICE Publishing.

Newbery, F. (2012). BIM and architects' professional risk. *Construction Law Journal* 28(3):pp. 272-274.

Rebolj, D., Babicˇ, N., Magdicˇ, A., Podbreznik, P. and Pšunder, M. (2008). Automated construction activity monitoring system. *Advanced Engineering Informatics* 22:pp. 493-503.

Semple, C., Hartman, F. and Jergeas, G. (1994). Construction Claims and Disputes: Causes and Cost/Time Overruns. *Journal of Construction Engineering and Management* 120(4):pp. 785-795.

Sinclair, S. and Elliot, F. (2012). *Building information modeling and English law.* Available from:http://www.fenwickelliott.com/files/stacy_sinclair_-_building_information_modelling__english_law.pdf (Accessed 20 March 2013)

Thompson, R., Vorster, M., and Groton, J. (2000). Innovations to Manage Disputes: DRB and NEC. *Journal of Management in Engineering* 16:pp. 51-59.

Zaneldin, E. (2006). Construction claims in United Arab Emirates: Types, causes, and frequency. *International Journal of Project Management* 24:pp. 453-459.