A Statistical Analysis of Building Information Modelling for PSC Bridge

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Abstract – Building Information Modeling (BIM) is nowadays becoming an effective method in the Indian as well worldwide in the sector of construction. Although of its short history, advanced growth took place in last dec-ade in BIM. This happened primarily due to its potential to handle construction projects. BIM creates a common gateway for coordination between various parties involved and system divisions on a particular project so as to shape them into an integrated team. The targets of BIM matches with IDPS (integrated pro-ject delivery system). The different branches are connected by BIM like effective communication, analyzes the project systems for effective implementation in construction, estimation of the cost and time of projects most of the time using quantity take-offs, sketches a gross idea of projects using visualization and building teams executing project. These are the things in different extents most of the times done by a project manager in different stages of the project.

This paper targets to exhibit the suitability of BIM and role of project manager in the majority construction projects. Hence the importance of proper knowledge of BIM and experience of project managers for the success is highlighted. The requirements of thorough knowledge of BIM and valuable experience of project managers are simultaneously concentrated in this paper.

Keywords: Building Information Modelling (BIM), Project Management, Construction and management

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1. INTRODUCTION

1.1. History

A virtual, digital and reliable three dimensional representations of any project to be constructed for use in planning, decision-making for design, scheduling of construction, estimations of different costs and maintenance of projects (Words & Images, 2009) can be the definition of the BIM from its short history. The BIM Handbook (2008) explained that BIM is a computer-operated and aided modelling technology so as to satisfy purpose of managing the information of the construction project focusing on production, communication and analysis of BIMs to bring effectiveness in study and analysis. The concept of BIM theoretically evolved and was developed at Georgia Institute of Technology (GIT) in the late 1970s and grew rapidly after that. It is the result of increasing concentration provided to construction teams and firms that found advantages in using BIM so as to achieve integration in the whole progress of the giant construction projects and managing them.

A user interface for virtual building, as a new software introduced by Graphi Soft in 1986. An effective improvement brought in Computer Aided Drawing programs by ArchiCAD of that time from where Archicad permitted the generation of three dimensional (3D) models of construction projects (Dey, 2010).

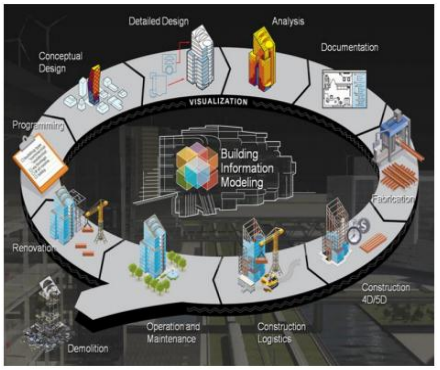

Figure 1 - Building Information Modeling

1.2. Construction Project Management

Construction projects include the main part of all branches projects due to their amount, variety and cost. It is a clear picture that anyone can observe that any size of the construction project requires proper management of functions.

There is requirement that the management team of construction sector projects should have thorough knowledge of modern management along with detailed view of understanding towards all construction processes with the change in technology, organizational arrangement/procedures and new techniques and methodologies, where the management of construction sector projects differs (Hendrickson, 2000).

Construction project management is nothing but a concatenation of activities for determining how, when and by whom the work, including all life cycle activities, will be performed.

The project management planning cost and time management, quality and contract administration including safety practices along with risk dealing is handled by project manager as of PMBOK.

He is also responsible for communication and coordination between all stakeholders involved in the project including owner, designers, engineers, professionals and administrative staffs. Normally, construction project management shares the common and overall characteristics of general projects, therefore, the rules and methods required for general project management applies to this type of projects.

2. BUILDING INFORMATION MODELING ASPECTS

2.1 Clash Detection

The geometrical design inconsistencies are the most common problems among various branches. Reason for it is overlapping of plans of those branches. With BIM we can bring those plans effectively together so as to predict exact points of clashes. This visual checking can also give another outcome of Suggesting changes and modifying the aesthetic problems.

2.2 Constructability

It is easy with BIM to monitor and action the problems of constructability and put forward the issues in RFIs for the teams. Also visual information can be obtained from a vantage to have broad idea of the problems. Hence along with markup and further solutions over the problems with prevention and mitigation of the risks is possible with this visual information.

2.3 Analysis

With processes and advanced analysis, the better decision making abilities along with time efficiency possible with BIM and which is extremely helpful for project managers and Designers, Engineers is another advantage of BIM. Moreover, light, mechanical and acoustics analyses are available be made possible by BIM up to 7D.

2.4 Time & Cost Estimation (4D & 5D)

Any construction project manager to get clear idea of his project at any phase, Time and estimation of the cost is some of other specifications that are generally used. For optimum cost and time, the 4^{th} & 5^{th} dimension called Time and cost estimation, (4D & 5D), can be efficiently used in the initial stages of a project for easement in the process of decision making. Further, with the help of potential of BIM project manager and other body can predict the effects of their decisions on project as well other aspects. Also with the help of BIM, it is possible to suggest multiple alternatives.

2.5 Integration

Sometimes a composite model is prepared from different models generated by different disciplines. In that case a unified model interaction is done by project squads with the help of BIM. With these abilities and multiple project components like other construction activities and design-analysis parts are coordinated by BIM and hence result integrity brings overall improvement in all processes.

2.6 Quantity Take-off

Quantity take-offs gives the clear idea to project squads and managers of multiple alternatives in the phases of design and analysis. Therefore, it creates maximum probability for integration of BIM model and database effectively.

3. ROLE OF BIM IN CONSTRUCTION SECTOR PROJECT MANAGEMENT

3.1 BIM vs. PMBOK Knowledge Areas

It is observation about BIM that it is proving effective and powerful tool of management in sector of construction as the capabilities of PMBOK knowledge areas and potential of BIM are different as nature and role are different.

The prime area which is identical among PMBOK and BIM is integrity management. BIM collectively maintains and improves the documents, plans and efforts of all stakeholders involved on a project. Classification of multiple building elements and broken down under different groups as in management of project scope can also be done by

BIM with another characteristic of managing time and cost or generally called 4D and 5D. In general, what HRM considers Collective efforts and squad building is done by help of BIM. An extraordinary feature of BIM is Communication helps to maintain and improve the professional relationship between all parties including project managers, designing professionals and executing squad engineers on a construction sector project by creating effective and through communication channels.

At the end, procurement management will be possible by quantity takeoffs which are produced by BIM. Additional changes in any item can be easily reflected in cost and time and work needed for its procurement. Although with extensive framework, BIM yet is a main and effective concept over PMBOK knowledge areas.

3.2 BIM Benefits and Advantages

Some major advantages of BIM are as follows:

- improved collective efforts and control among various parties and owners
- Improved or efficient productivity (less repetition of work, clashes and changes in plans)
- Better quality of work on project and enhancing performance
- Speedy project delivery
- Reduction in wastages
- Reduction in cost of construction
- revealed revenue and business opportunities

3.3 BIM Tools available for construction practice

There are lots of Building Information Modeling tools. This section will shortly elaborate some tools. Table and figures given below shows the BIM tools and their base functions. This list consists of MEP, structural, architectural, and also site work 3D modeling softwares. Few of them are potent of project scheduling and estimations of costs.

Table 1 - BIM Tools for construction practice

Product Name	Manufacturer	Primary Function
Cad-pipe HVAC	AEC Design Group	3D HVAC Modeling
Revit Architecture	Autodesk	3D Architectural Modeling & parametric design.
AutoCAD Architecture	Autodesk	3D Architectural Modeling & parametric design.
Revit Structure	Autodesk	3D Structural Modeling & parametric design.
Revit MEP	Autodesk	3D Detailed MEP Modeling

3.4 Case Study: Harris Bridge, Khadaki

Location: Khadaki Pune

Effective span: 80 m

Start date: 18th Nov.2016

Client: PCMC

Contractor: M/S Valecha Engineering Ltd,

Structural consultant: ACME structural consultant

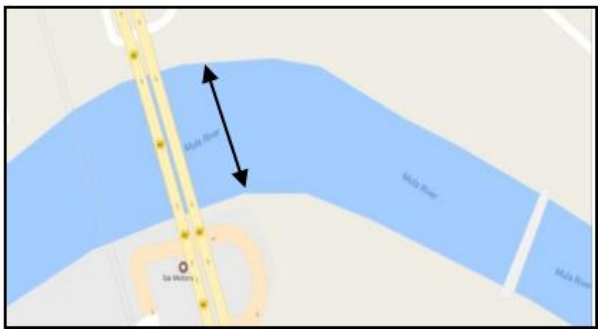

Figure 2 - GPS location of site

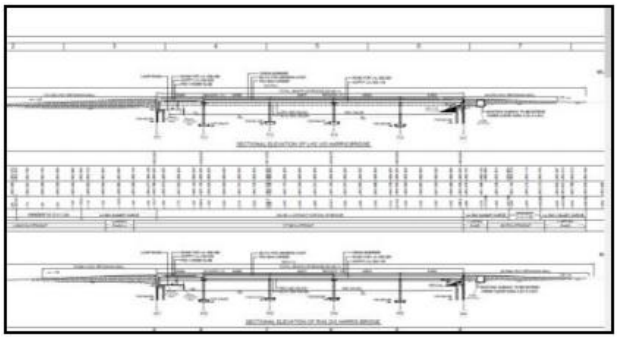

Figure 3 - General Arrangement of drawing 2D

Figure 4 - BIM model in Autodesk Infraworks

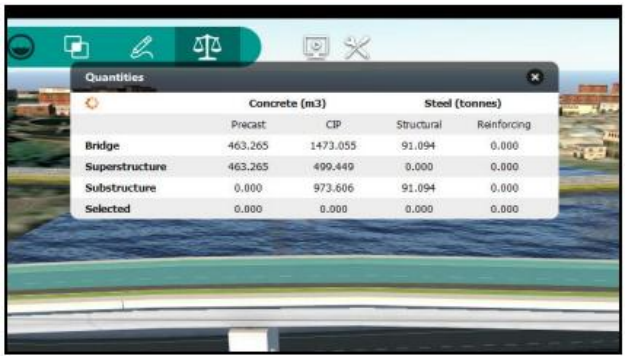

Figure 5 - Quantity Generated from BIM model

Table 2 – Activities and Cost

Type	Activities	Cost
Sub structure	Excavation work for abutment	16256746.4
	Formwork for substructure	
	Abutment work	
	Pile foundation work	
	Footing work	
	Pier work	
	Bearings and replacement	
Super structure	Precast main girder	9179782.64
	Post tension cable and anchorage	
	Deck slab	
	Cross girder work	
	Cable work	
	Kerb	
	Footpath	
	Handrail	
	Wearing coat	
	Form work	

4. QUESTIONNERIES SURVEY CONDUCTION REPORT:

For Indian construction industries BIM still is a new concept. Only few case studies like Trump tower, Koregaon Park Pune, Barclays etc. few case studies are found for BIM.

In this paper questionneries are prepared to study implementation of BIM in Indian construction industry so as to achieve overrunning of costs, effective project management

5. CONCLUSION & RECOMMENDATIONS

This papers studies effectiveness of BIM for effective project management and to achieve reduction in cost overruns. The following conclusion can be worked out after case studies:

- The quantity take-offs can be generated immediately after generation of BIM Model so as to have estimation of the costs of particular project. Also, the 3D coordination helped to detect and remove trade clashes and alternatively resulting conflicts. Accompanied by generation of detailed drawings for the purpose of review and coordinate work between trades.

- The 4D scheduling based on BIM helps to understand the components involved in construction along with schedule of progress resulting in proper construction planning.

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