

Development of 4D BIM cost model

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Abstract- Building Information Modeling (BIM) is the process of creating and managing 3D building data during its development. This study was conducted on a residential-commercial building which was situated in Nashik. The study aims to develop a 4D BIM cost model and to understand the different aspects of 4D BIM technologies. A thorough literature review was conducted and a case study was taken to develop a 4D BIM cost model using MS Excel. For the development of 4D BIM cost model, several research papers have been studied. From that Autodesk Revit software is used in conjunction with Autodesk AutoCAD for preparation of 3D BIM model. With the help of MS Excel cost model is prepared which is adaptive to ever changing price of raw material. The study indicated that MS Excel can be a promising tool for efficient for developing a cost model. The most significant benefit of MS Excel for development of cost model is that it can be manipulated according to different material selection and the ever-changing market price of it.

Keywords - BIM, BIM cost model.

1. INTRODUCTION

Building information modelling (BIM) is a process involving the generation and management of digital representations of physical and functional characteristics of places. When preparing their cost estimates, estimators typically begin by digitizing the architect's paper drawings, or importing their CAD drawings into a cost estimating package, or doing manual take offs from their drawings[1]. All of these methods introduce the potential for human error and propagate any inaccuracies there may be in the original drawings.

By using a building information model instead of drawings, the take offs, counts, and measurements can be generated directly from the underlying model[2]. Therefore, the information is always consistent with the design. And when a change is made in the design – a smaller window size, for example – the change automatically ripples to all related construction documentation and schedules, as well as all the take offs, counts, and measurements that are used by the estimator.

2. METHODOLOGY

- (1) Collection of necessary drawings from architect & structural designer.
- (2) Development of 3D BIM of the model in Autodesk Revit.
- (3) Collection of the necessary information for the development of cost model from a case study.
- (4) Development of cost model in MS Excel.

3. CASE STUDY IN NASHIK

3.1. Devkinandan Buildcon – morya parashare Heights

Location of building: - “Morya Parashare Heights”, P no 62 +57 S.no 891 at Chetana Nagar, Rane Nagar,

near Guru Gobind Singh college, Nashik- 422009, Maharashtra, India.



Fig. 1. Snapshot of google maps location of the site

- (1) Residential & Commercial project.
- (2) 2BHK & 3BHK luxurious flat.
- (3) Basement + ground floor + 7 floor building.
- (4)

4. DATA COLLECTION AND DATA ANALYSIS

4.1. Data collection

From the case study chosen following information is collected.

Table 1 material cost table

Material type	Cost	Unit
Cement	285	Bag
20 mm aggregate	2400	Brass
Steel	48.5	Kg
Wash sand	4400	Brass
Crush sand	3100	Brass
Natural sand	8000	Brass

4" red brick	4.5	Piece
6" red brick	7.3	Piece
600X600 vitrified Tile	40	Sq.ft
Neru	80	Bag
Saint Gobain gypsum	250	Bag
W window	310	Sq.ft
W1 window	310	Sq.ft
V window	310	Sq.ft
FD door	160	Sq.ft
FD1 door	160	Sq.ft
FD2 door	160	Sq.ft
FD3 door	160	Sq.ft
D door	1500	Nos
D1 door	1500	Nos
D2 door	1500	Nos

Table 2 labor cost table

Labour type	Cost	Unit
RCC labour	125	Sq.ft
Brick & plaster labour	110	Sq.ft
Tile labour	40	Sq.ft

Table 3 with material cost table

With material	Cost	Unit
Paint labour	110	Sq.ft
Plumbing labour	54	Sq.ft
Electrical work labour	80	Sq.ft
Supervision charges	14	Sq.ft

4.2. Data analysis

4.2.1 Preparation of 3D BIM model

The 2D Architectural drawings and RCC Drawings help for Preparation of 3D BIM is in Autodesk Revit. The 3D model is made in the Revit by constructing 3D element in the Revit like Column, Wall, slab Beam etc.



Fig.2. Snapshot of Autodesk Revit BIM model

4.2.2 Preparation of programable Excel sheets.

The cost model is developed using MS Excel, in which unit cost of each family in the 3D model is computed using MS Excel and then this Cost data is used to develop cost model in the Autodesk Revit.

As the cost of material is fluctuating through the year, so considering this single a programable sheet is developed for each family in the 3D model which can be tweaked easily just by updating new cost of raw materials in the Excel sheet.

Input table					Total quantity		Total Cost
unit cost table & mix design details					cost of wall	6450	INR 4,626,337.32
layer	item	unit	cost/unit	Quantity per 100 Sq.ft			
External Finish layer	cemet 1	bag	INR 280.00	3.5			
	Fine Aggregate 1	CFT	INR 4,400.00	0.27			
Middle Layer	cemet 1	bag	INR 280.00	1.5			
	Fine Aggregate 1	CFT	INR 4,400.00	0.12			
	Brick	per piece	INR 4.50	500			
Internal Layer	cemet 1	bag	INR 280.00	2			
	Fine Aggregate 1	CFT	INR 4,400.00	0.15			
	neru	bag	INR 80.00	1			

Fig. 3. Snapshot of brick cost estimation in MS Excel

Input table				Auto calculation table		
unit cost table & mix design details				item	cost in Rs	unit
item	unit	cost per unit	Quantity per unit	concrete	1181173	meter cube
concrete	meter cube	4150	284.62			
reinforcement	kg	50	34119.42103			

Fig.4. Snapshot of RCC cost estimation in MS Excel

5. CONCLUSION

By using above tool total estimated cost found to be INR 3,78,85,566.

Table 4 Total cost table

Item	Cost
Brick	INR 4,626,337.32
Tile	INR 3,571,943.40
Ceiling finish	INR 2,778,178.20
Door	INR 243,782.59
Folding sliding door	INR 718,588.95
Window	INR 473,571.81
Concrete	INR 4,137,173.00
Reinforcement	INR 4,081,341.45
Paint (labor + material)	INR 3,195,500.00
Plumbing (labor + material)	INR 1,568,700.00
Electrical (labor + material)	INR 2,324,000.00
RCC labor	INR 4,945,750.00
Brick & plaster labor	INR 3,652,000.00
Tile labor	INR 1,162,000.00
Supervision charges	INR 406,700.00
Total	INR 3,78,85,566.

BIM is very useful from designing to execution of any project and quantifying total project cost is very difficult considering designs changes and changes in market price of raw materials. With the help of BIM software quantity estimation with respect to design changes is very seamless & With the help of MS Excel unit price of raw materials can be easily manipulated according to market rate and total cost of building can be automatically quantified with it.

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