

# Redevelopment of Structure with the Help of Building Information Modeling and Rectify with Fuzzy Logic (For Aurangabad Bus Depot)

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**ABSTRACT:** The public transport system is in constant development. Leading to redevelopment of bus terminal land. The project work is about redevelopment of Aurangabad bus depot with the help of building information modeling(BIM) providing a linkage between important cities and terminal such as jalna,beed,jalgaon etc. When transits infrastructure is designed to enhance passenger experience, its attractiveness is ensured making it viable alternative to private motorized transport. BIM technique render all project participant to obtain proper information at due time as necessary assist project understanding, reduce common mistake and support project related decision. CIDCO bus-stand project is presented as a redevelopment land to realize the actual use and benefit of BIM. Cost control plays a major role for being competitive while maintaining high quality levels. The aim of this paper is to propose a model for predicting cost overrun in building construction projects using fuzzy logic.

**Key Words:** Infrastructure, Building Information Modeling(BIM), REVIT, Microsoft Excel, Fuzzy Logic.

## I. INTRODUCTION

Public transport holds center stage in the urban transport agenda. A well-functioning and sustainable city cannot be achieved without strengthening its public transport system. Infrastructure plays a vital role in the operation of an efficient, convenient and safe transit system. When transit infrastructure is designed to enhance passenger experience, its attractiveness is ensured, making it a viable alternative to private motorized transport. The National Urban Transport Policy (NUTP) recognizes that city dwellers are of utmost importance and that all plans must be centered on their common benefit. With reference to a focus on public transportation, the NUTP document emphasizes the following means:

Building capacity (institutional and manpower) to plan for sustainable urban transport, and establishing knowledge management system that would service the needs of all urban transport professionals, such as planners, re-searchers, teachers, students etc.

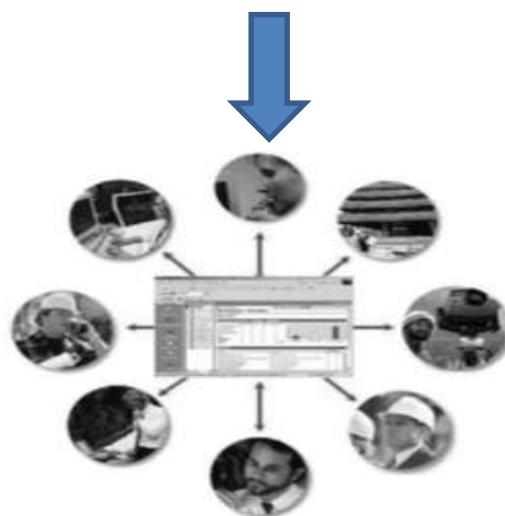
In this project, the uses of BIM which include visualization, 3D coordination, construction planning, cost estimation, scheduling were discussed in detail. CIDCO bus-stand project was presented as a redevelopment land to understand the actual uses and benefits of BIM. For BIM tools were further analyzed by developing a 3D, 4D, 5D bus depot model. Furthermore, BIM as the main generator or 4D scheduling were analysed and we try to verify these 3D, 4D and 5D by using fuzzy logic. The research concluded that although BIM tools have ability to solve construction related issues, the use of BIM is very beneficial to the construction managers.

In the age of fast development of digitization, it is required to create a new technology to construction of building industry. BIM technique is new technique, brings technological revolution throughout whole building life cycle including investment, construction and maintenance[2]. BIM has potential use at all stages of the project life cycle it can be used by the owner to understand project needs, by the design team to analyse, design, develop the project, by contractor to manage the construction of project [3].

Risk is common in all project work and it cannot be completely removed, but proper management can affect the risk in project. Risk management includes tools and techniques that help project manager to maximize chances of positive event and minimizing the fear of adverse event[4]. Due to the limited availability of information during the early stages of a project, construction managers typically leverage their knowledge, experience and standard estimators to estimate project costs. As such, intuition plays a significant role in decision making. Researchers have worked to develop cost estimators that maximize the practical value of limited information in order to improve the accuracy and reliability of cost estimation work and thus enhance the suitability of resultant designs and project execution work



Traditional project management



Modern project management

Chart 1: Difference between traditional and modern project management (Martinez-Moyano 2006).

### 1.1 OBJECTIVES

The objective of this project are as follow:

- To study redevelopment of structure ,building information modeling
- To collect data for case study and analyze it with different parameters.
- Rectify result with fuzzy logic
- To discuss recommend the suggestion and conclusion.

## II. LITERATURE REVIEW

[1] Latif Mazharpoor and Farzad Hatami explain that Fuzzy logic plays a key role as the converter of natural verbal human thoughts to computational comprehensive intervals. Fuzzy logic and fuzzy set theory have been used as the foundation of this new methodology. Fuzzy intervals were used for input data in order to create more realistic assumptions than those derived from a set of crisp numbers; this leads to better results, fewer failures, and a lower tolerance for risk in construction project planning. Enables project characteristics and risk events to be assessed subjectively, as is usually the case in practice. The output of the calculations can be presented both numerically and linguistically, providing the decision maker with a wide, useful, and realistic guide to the most severe risks in the projects.

[2] Pingyu YAN<sup>1</sup>, Xifeng XIE<sup>2</sup> and Yan MENG<sup>3</sup> explains in this paper, With fast development of modern science and technology, informatization level of all industries is improving continuously and building industry, a kind of traditional industry applies increasingly informatization method to reinforce management and improve economic performance. BIM technique, a new carrier of project information, runs through all stages of construction process throughout the life cycle of project, which renders all project participants to obtain proper information at due time as necessary, assists project understanding, reduces common mistakes and supports project related decision.

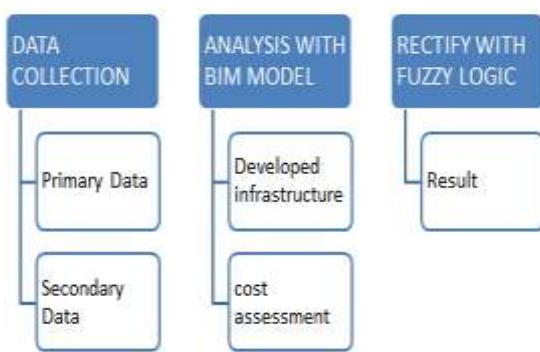
[3] J.Gomez-Romro,F.Bobiloo,M.Ros,M.Molina-Solana,M.D.Ruiz,M.j.Martin-Bautista(2015) present a fuzzy logic based extension of such semantic BIM that provide support for imprecise knowledge representation. They explain how to use a fuzzy ontology reasoner to check the resulting fuzzy semantic BIM for practical purpose and also discuss advantages of using fuzzy ontologies over non fuzzy representation in the scope of linked building data research area.

[4] N Shanmuganathan.N 2.Dr.Baskar.G explain in this paper that now a day's many factors which affect the productivity in construction project. Due to this delay factors time and cost overrun in a project. This research helps to identify the most important factors that affect the productivity and form a modelling using fuzzy logic. The data's were collected through questionnaire survey from engineers, contractors and clients worked within the various construction industries. The collected data's were analysed using relative importance index (RII) and ranking the factors based on percentage of relative importance and also this paper presents an application of fuzzy logic for developing delay factors causes cost overrun model using Fuzzy toolbox of MATLAB Program software. The results can facilitate the construction

industry to take measures the delay factors causes cost overrun in construction projects.

[5] Su-Ling Fan, Chen-Hua Wu and Chien-Chun Hun(2015) this paper deals with study of proposed model for linkage of cost and schedule to BIM element. They study on seven storied building .researcher develop object-oriented model that links BIM elements to cost item and schedule item. They use Autodesk Revit software for preparation of 3D model and at finally system is implemented using MS Visual.

### III. RESEARCH METHODOLOGY



#### 3.1 General

Using REVIT software estimating and scheduling of construction are to be done. Scheduling is sharing of resources. These Resources in conceptual sense are time & energy, but in practical sense are time, space, equipment and effort applied to material. This phase presents the method of the study on comparison of construction using building information modeling with conventional construction. A staff quarter apartment building is taken for comparing and it includes the preparation of plan, data collection from certain authority, estimation of quantities, and determination of project duration, cost analysis are done.

#### 3.2 Plan Preparation

Plan preparation is done for apartment building to estimate the quantities and scheduling of constructions project. Three storey building is taken to estimate the quantities.

#### 3.3 Estimation of Quantities

Estimation is used to find out the requirement of the materials for the constructions. The details of the materials which are used in the construction were collected. By getting these details we can estimate the quantities of the materials. Estimation is done using MS Excel

#### 3.4 Cost Analysis

This is the main factor which is considered in the project is to find out the comparison of cost analysis of three storey building for the unconventional construction and conventional construction

After estimation for checking the result with fuzzy logic

1)Identification and Ranking of cost affecting Factors In this research, 6 factors responsible for cost overrun in construction projects are identified through literature survey. From A Questionnaire survey rating was given to Factor which causes cost overrun

The relative importance index (RII) is calculated by using the relation given below:

$$RII = W/AXN$$

Where

W is the weighting given to each factor by the respondent (Ranging from 0 to 10),

A is the highest weight and N is the total number of respondent.

e.g. Considering factor Escalation of material prices,

$$RII = 97/10 \times 15 = 0.85$$

Table 1: List of identified cost affecting factor with RII and Rank

Sr.no	Cost Overrun Factor	RII	Rank
1	Escalation of material prices	0.85	1
2	Inaccurate investigation	0.82	2
3	Incorrect planning and scheduling	0.80	3
4	Improper construction method	0.79	4
5	Poor communication between labour	0.77	5
6	Inadequate labour productivity	0.75	6
7	Late delivery of material	0.72	7
8	Weather	0.68	8
9	Material Availability	0.66	9
10	Mistake In Design	0.63	10

After rescaling the parameters range while taking expert's advice, we have produced results which can be interpreted and can be understood well with the real world. From the defuzzification process the results we have are very appealing. It can be observed that if the situations prevailing in the project surrounding were improved to higher standards, then the outcome would have been different in terms of cost of project.

#### a) Fuzzy Inference Editor

In this step input and output parameter are fixed. We have consider two input and two output system so from edit option ,two input are added. Thereafter, file is saved by exporting it to workspace .in this way, FIS editing is completed.Mamdami and sugeno are two types of inference system used. Madami type of system is used here.

#### b) Membership Function Editor

The difference between traditional set and fuzzy set theory lies in the degree of membership which elements may possess in a set. Traditional set theory dictates that an element is either a member of a set or it is not; Its membership values are defined as 1 or 0. In fuzzy set theory this membership value can take any real value from 0 to 1 and this value defines the degree of membership of a given set. A membership function is a curve that defines how each point in the input space is mapped to a membership value (or degree of membership) between 0 and 1. The only condition a membership function must really satisfy is that it must very between 0 and 1

Here, are some images shown to present the membership function editor to for every Input factor and Output factor. Every input and output has a range from [0 1]. Which are divided into 5 different categories as mentioned in earlier section, then the effect of these three qualitative factors are shown using rule viewer in later section.

Fuzzy toolbox in MATLAB is preloaded with 11 different types of functions which have their own specialties and simplicities.

1. Triangular membership function.
2. Trapezoidal membership function.
3. Gaussian membership function.
4. Sigmoidal, two sigmoidal and product of two sigmoidal.
5. Z shaped, Pi shaped, S shaped

The Membership Function Editor is the tool that lets you display and edit all of the membership function associated with all of input and output variable for the entire fuzzy

inference system. Membership Function Editor from fuzzy toolbox shown in this figure

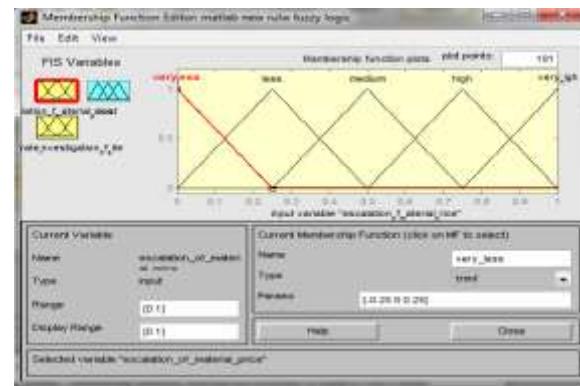


Figure 1: Membership Function Editor

#### c) Rule Editor

At this point the fuzzy inference system has been completely define, in that the variable , membership function, and rule are necessary to analyse cost overrun .total 15 rule are created using all two input variable factor and one output factor .

sample rule are given below

- 1.If Inaccurate site investigation is less then cost is less (0.821)
2. If Inaccurate site investigation is medium then cost is medium(0.821)
3. If Inaccurate site investigation is high then cost is high (0.821)
- 4.if escalation of material price is less then cost is reduce(0.85)
- 5.If escalation of material prices is medium then cost is medium(0.85)
- 6.if escalation of material price is high then cost is increase(0.85)
- 7.if inaccurate\_investigation\_of\_site is very\_low then cost is reduce(0.821)
- 8.if inaccurate\_investigation\_of\_site is low then cost is average(0.821)
- 9.if inaccurate\_investigation\_of\_site is medium then cost is medium(0.821)
- 10.if inaccurate\_investigation\_of\_site is high then cost is increase(0.821)
- 11.if inaccurate\_investigation\_of\_site is very\_high then cost is very\_high(0.821)
- 12.if inaccurate\_investigation\_of\_site is high then cost is increase(0.821)
- 13.if inaccurate\_investigation\_of\_site is very\_low then cost is reduce(0.821)
- 14.if inaccurate\_investigation\_of\_site is low then cost is average(0.821)
- 15.if inaccurate\_investigation\_of\_site is medium then cost is medium(0.821)

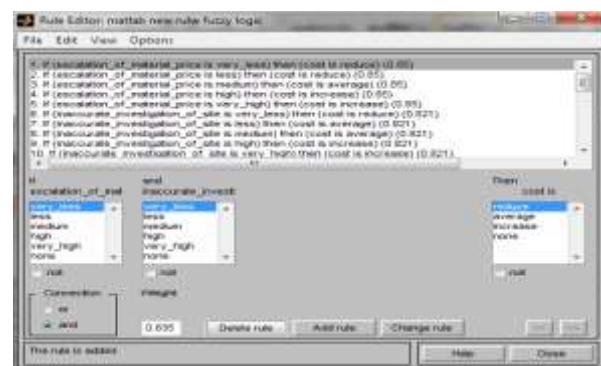


Figure 2: Rule Editor

d) Rule viewer shows the how the shape of certain membership function influences the overall result

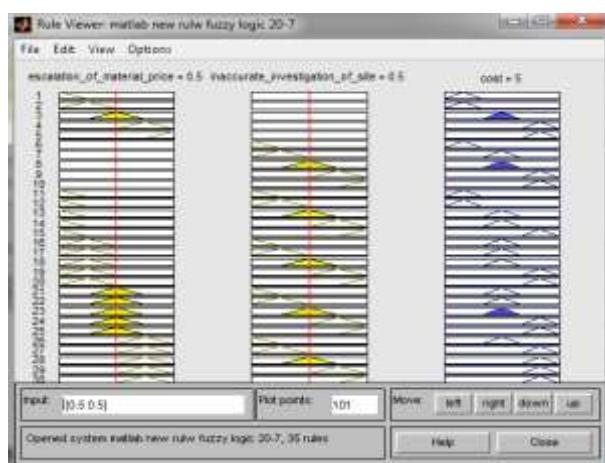


Figure 3:Rule viewer

e)surface viewer

in surface viewer, we can see variation of two cost overrun factor acting in combination with respect to cost overrun

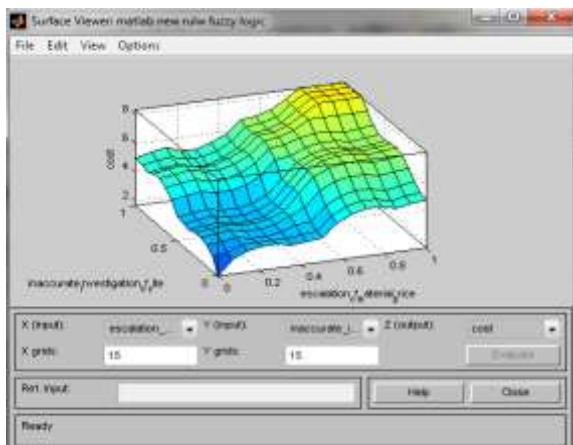


Figure 4:surface viewer

At final total increase in cost in percentage is 5% due to two factor affect cost overrun

#### IV. RESULT

Results obtained by fuzzy logic implemented in BIM estimated of project work

In table, all the information regarding project such as

Estimated and final cost of the project, cost overrun

Estimated percentage by the application of developed model to the mentioned building project

Table 2: Final results of a case study of project

Building structure	Apartment
Name of project	Aurangabad bus depot (building structure)
Total cost of building (Estimated)	7122027
Increase in cost in percentage	5%
Total cost of building increases	356101.35
Total cost of building	7478128.35

#### CONCLUSION

This project discusses the establishment of structure. As a contribution to urban study, the research seeks a greater understanding about the importance of a bus depot development. The purpose of this project is to describe the characteristics of an optimal bus depot with the help of BIM, better planning BIM not only adds value to the technology but also changes the process of designing and building. BIM technology creates new opportunities for getting information on building, this allow easy and quick access to all characteristics of component, building geometry[8]. 3D model Improved visualization of the project and reduce rework ,4D model give construction site planning related activities i.e.scheduling of project done in 4D modeling and 5D model gives budget tracking and cost analysis in short it give estimate of proposed building[8].Cost overrun phenomenon is very common in building construction project. Only some projects are completed within the budget. To avoid construction cost overrun, there is need to develop a cost overrun prediction/assessment model as a decision support tool for the project managers, cost estimators for the construction projects before bidding stage. Different software use in this project are Revit, Microsoft Excel, Microsoft Project, Matlab.

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