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PERFORMANCE EVALUATION OF RESIDENTIAL BUILDING USING PROJECT MANAGEMENT TECHNIQUES

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Abstract - *The present scenario of construction industry is growing at faster rate. The rapid development in procuring of material in construction industry and at the same time the depletion in the resource resulted in many challenges that made to use unsustainable materials causing harmful and imbalance environment. This gave a rise to sustainable green materials.*

To compare the material performance a case study of an apartment has been considered and evaluated with its design, cost and duration for both conventional and alternative material. To analyses the structural stability by change in material, design and analysis is carried out in ETABS. For economical parameter, cost indicator is considered and detailed estimation is carried out for both proposals. As application of project management technique scheduling is carried for both proposals and durations is compared.

Key Words: Estimation, Microsoft project, Extended three dimensional analysis of building system, time and cost overrun.

1. INTRODUCTION

1.1 BACKGROUND

In recent days green materials are in demand by many builders and homeowners looking for new and different methods of construction which is ecological friendly and energy saving. Usually alternative materials are manufactured using natural materials, while some others are manufactured using lower energy costs and even less maintenance the cost and quality of the materials is inter-related. Paying low for reduction of overall cost can harm the overall quality of the project that leads to surplus in cost of the project and often gives a negative impact on clients.

Construction industry has special features and runs in unique pattern then all other manufacturing and agriculture sectors. The complexity and other parameter of construction changes as project changes, in this cost and time are two critical parameters that are considered the most during the execution. The success of the project for clients or owner will be managing time, cost, if this overruns it leads time and cost overruns

1.2 SIGNIFICANCE AND PURPOSE OF THE RESEARCH

The main aim of construction industry is to avoid cost and time overrun within the specified objectives of the construction industry. It is a complicated task carried by the project managers in practice, which comprises continuously monitoring of progress, evaluating plans; and taking proper actions & control when needed.

In the last few decades, several project control methods, such as Gantt Bar Chart, Program Evaluation and Review Technique (PERT) and Critical Path Method (CPM), have been developed. A range of software tool has been offered to support the application of these project control methods, a few of these software are Microsoft Project, Candy, BIM, Primavera, Asta Power Project etc. Inspite of the wide range of application available for control and monitoring of project, still construction projects come across through cost and time overrun problem

1.3 OBJECTIVE OF THE STUDY

- To plan, analyze and design a residential building (G+3) using ETABS with conventional building materials and to estimate its total cost and compare the cost difference using alternate materials.
- To plan and schedule the different activities for building construction using Microsoft Project to obtain total duration and compare the same for construction of building using alternate materials.

2. LITRATURE REWIEW

2.1 GENERAL

The following are the past research survey based on the identification of construction risks at every stage.

1.Abhay Guleria et al (May 2014)

The paper emphasizes on structural behavior of multi-storey building for different plan configurations. The structure is being analyzed for four different shape configuration. (rectangular shape, C shape, L shape, I shape).

The maximum bending moments were found in I shape building whereas the least bending moments were found in rectangular building. In shear force aspects the maximum shear force occurred at C shape and least shear force took place in I shape building. Roof displacements increases with increase in height of building but found least in rectangular building. Storey drift displacement increase with increase in height up to 6^{th} floor and then start decreasing. After studying of various shapes it is been concluded that asymmetrical plan undergoes more deformation than that of the symmetrical ones.

2.Ragy Jose et al (June 2017)

In this paper the author addresses the application of ETABS to analyses and design a commercial building (G+3). To compare the results between manual method and ETABS software were been discussed

Both methods almost gave the nearly same results, and the time required for carrying out this task by help of the software is considerably reduced.

3. RESEARCH METHODOLOGY

3.1 GENERAL

In this study the main objective is to compare the overall performance of the building constructed using convectional building materials with one to be constructed using alternate building. To accomplish these two proposals are made:

3.2 RESEARCH STAGES

To accomplish these two proposals are made:

Proposal 1 (Conventional material used):
Planning, analyzing, designing and scheduling of G+3 residential building using convectional building material.

Proposal 2 (Alternative material used):

Planning, analyzing, designing and scheduling of G+3 residential building using alternate building material

Alternative material used AAC blocks and terrazzo tiles.

This study is being carried out as per the following steps:

3.2.1 Data collection at initial stage

3.2.2 .Planning

3.2.3 Analyzing and design using ETABS for Proposal 1 and Proposal 2

3.2.4 Planning and scheduling using Microsoft Project for Proposal 1 and Proposal 2

3.2.1 Objective and scope of project

The study is carried with the following objectives:

- To understand the performance of building using alternate materials

- To minimize the duration of completion of the project using project management techniques that is by employing Microsoft Project

3.2.1 Data collection at initial stage

Surveying is the essential tool for any civil engineering projects. The details like wind directions, existing surrounding buildings in locality, and access to road, drainage and water facilities are identified and considered for the further planning of building. Before commencement of project the surveying is performed and SBC of soil is being collected.

3.2.2 Planning

After the site survey, rough plan is being prepared and further modification has been done, finally the architectural have been prepared. For the architectural plan, structural design like column, beam, slab and footing are being carried out. Beam and column position along with orientation are been assigned according to structural need.

3.2.3 Analyzing and design using ETABS for Proposal 1 and Proposal 2

3.2.4 Planning and scheduling using Microsoft Project for Proposal 1 and Proposal 2

Using Microsoft project tracking of the project schedule get easy. As there are many more features in Microsoft project which helps the executor to carry out the work efficiently. Microsoft gives more advanced features for large and complex project. There are four important features of Microsoft project.

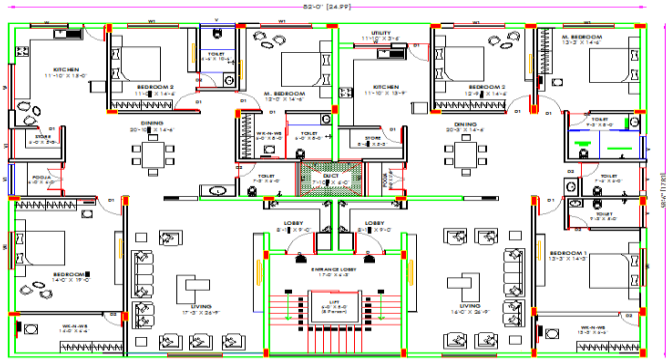
1 **Creating the task**: Represents the steps to complete the project.

2 **Assign resources**: Resources like materials, people, and equipment.

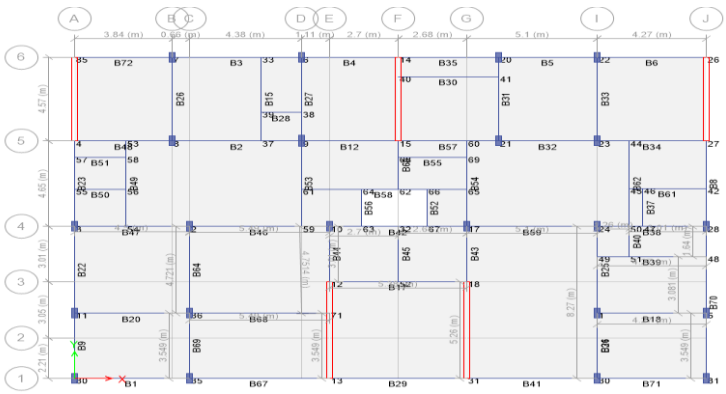
3 **Track project performance**: Compares the present performance of the project and prepare baseline plan

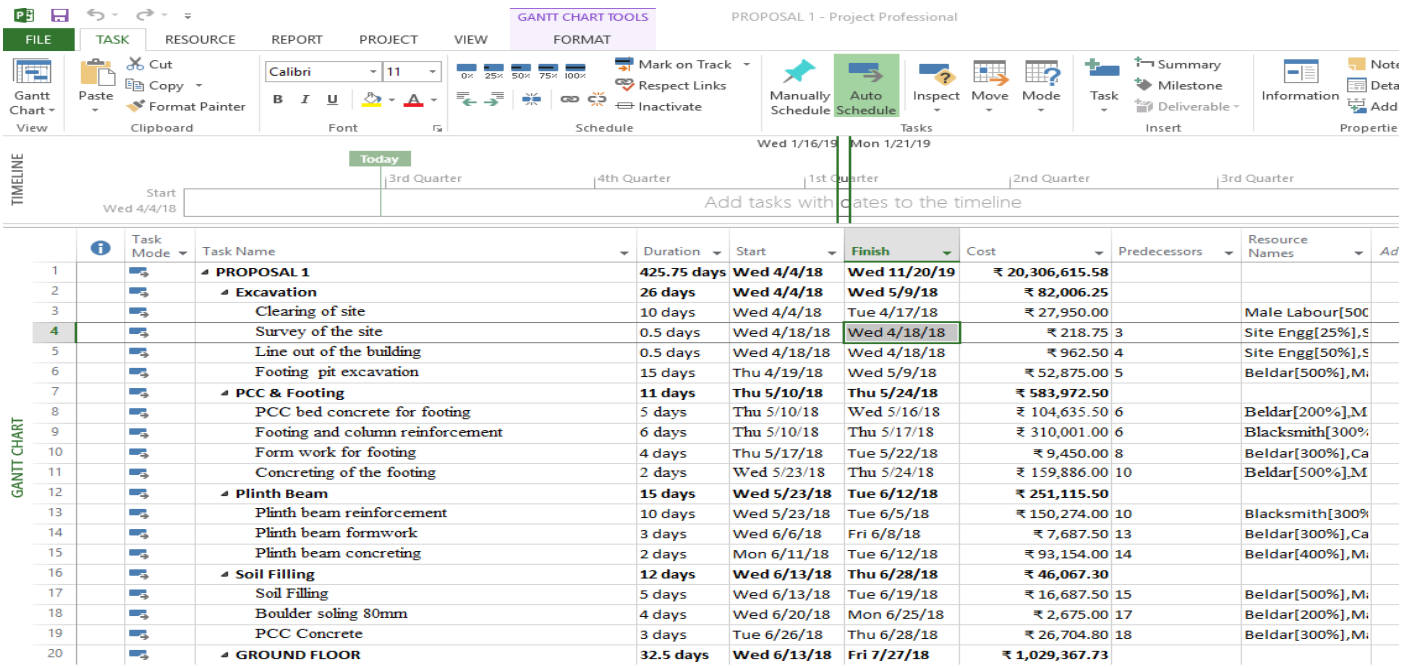
4 **Create report:** reports are being produced which should be shared with team members, stake holders etc.

PROPOSED PLAN



ETABS PLAN



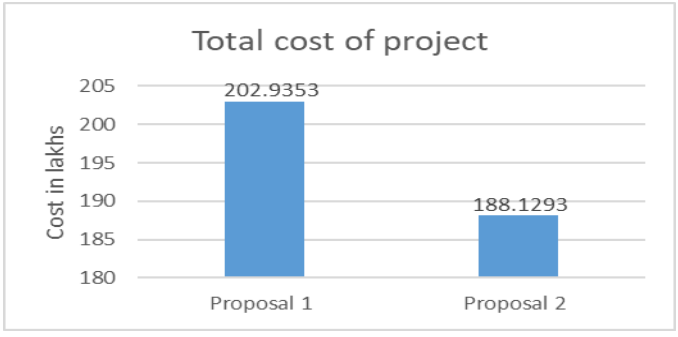


	Task Mode	Task Name	Duration	Start	Finish	Cost	Predecessors	Resource Names
1		**PROPOSAL 1**	**425.75 days**	**Wed 4/4/18**	**Wed 11/20/19**	**₹ 20,306,615.58**		
2		**Excavation**	**26 days**	**Wed 4/4/18**	**Wed 5/9/18**	**₹ 82,006.25**		
3		Clearing of site	10 days	Wed 4/4/18	Tue 4/17/18	₹ 27,950.00		Male Labour[50(
4		Survey of the site	0.5 days	Wed 4/18/18	Wed 4/18/18	₹ 218.75	3	Site Engg[25%],S
5		Line out of the building	0.5 days	Wed 4/18/18	Wed 4/18/18	₹ 962.50	4	Site Engg[50%],S
6		Footing pit excavation	15 days	Thu 4/19/18	Wed 5/9/18	₹ 52,875.00	5	Beldar[500%],M
7		**PCC & Footing**	**11 days**	**Thu 5/10/18**	**Thu 5/24/18**	**₹ 583,972.50**		
8		PCC bed concrete for footing	5 days	Thu 5/10/18	Wed 5/16/18	₹ 104,635.50	6	Beldar[200%],M
9		Footing and column reinforcement	6 days	Thu 5/10/18	Thu 5/17/18	₹ 310,001.00	6	Blacksmith[300%
10		Form work for footing	4 days	Thu 5/17/18	Tue 5/22/18	₹ 9,450.00	8	Beldar[300%],Ca
11		Concreting of the footing	2 days	Wed 5/23/18	Thu 5/24/18	₹ 159,886.00	10	Beldar[500%],M
12		**Plinth Beam**	**15 days**	**Wed 5/23/18**	**Tue 6/12/18**	**₹ 251,115.50**		
13		Plinth beam reinforcement	10 days	Wed 5/23/18	Tue 6/5/18	₹ 150,274.00	10	Blacksmith[300%
14		Plinth beam formwork	3 days	Wed 6/6/18	Fri 6/8/18	₹ 7,687.50	13	Beldar[300%],Ca
15		Plinth beam concreting	2 days	Mon 6/11/18	Tue 6/12/18	₹ 93,154.00	14	Beldar[400%],M
16		**Soil Filling**	**12 days**	**Wed 6/13/18**	**Thu 6/28/18**	**₹ 46,067.30**		
17		Soil Filling	5 days	Wed 6/13/18	Tue 6/19/18	₹ 16,687.50	15	Beldar[500%],M
18		Boulder soling 80mm	4 days	Wed 6/20/18	Mon 6/25/18	₹ 2,675.00	17	Beldar[200%],M
19		PCC Concrete	3 days	Tue 6/26/18	Thu 6/28/18	₹ 26,704.80	18	Beldar[300%],M
20		**GROUND FLOOR**	**32.5 days**	**Wed 6/13/18**	**Fri 7/27/18**	**₹ 1,029,367.73**		

4. RESULTS AND DISCUSSIONS

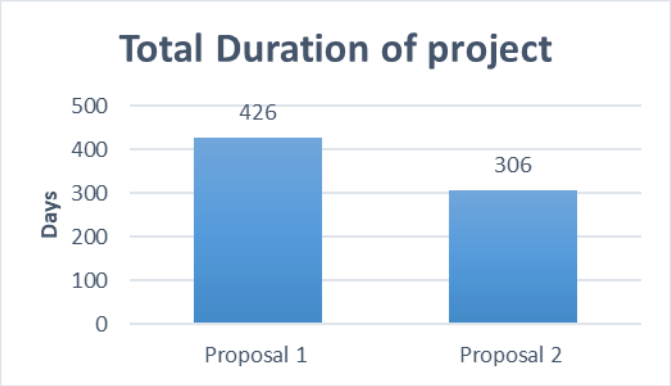
COMPARISON OF PROPOSAL 1 WITH PROPOSAL 2

SL NO.	DESCRIPTION	TOTAL AMOUNT
1	Proposal 1	₹ 20293529.64
2	Proposal 2	₹ 18812928.67



DURATION COMPARISON

SL NO.	DESCRIPTION	TOTAL DURATION IN DAYS
1	Proposal 1	426
2	Proposal 2	306



5. Conclusion:

Considering the above benefits, we can conclude that using of alternate materials in construction will be cost effective, gives faster construction speed and consumes less embodied energy comparatively. Due to increase pollution use of alternative Green material for construction becomes the need of the hour.

Cost parameter

Total Cost of Proposal 1 is **7.87 %** higher than that of the Proposal 2, which is **14,80,600**

Duration parameter

Duration of Proposal 1 is **28.3%** higher than that of Proposal 2, which is **120days.**

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BIOGRAPHIES

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