IMPLEMENTATION OF VALUE ENGINEERING FOR RESIDENTIAL AND COMMERCIAL BUILDINGS

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ABSTRACT

Value engineering, is a subject about technology and economy helps to improve the function of product or system, sometimes to reduce the cost of both, by following different methods and techniques to meet customer's requirement about function. The application of value engineering focuses on the design phase of the research of development of the product, which is an important characteristic of value engineering. Infrastructure development in construction industry is a key driver in socio economic development of the country, so it is in need to have proper construction techniques which are cost effective and feasible to meet customer's requirement. In this research we studied various cost effective construction techniques such as "Gypsum Plastering", "CLC brick work" and use of modern precast elements of buildings for residential and commercial buildings, It also includes comparison of various design approaches like "mivan shuttering", and "conventional techniques", study of alternative materials to minimize cost and specially time of project and simultaneously to improve value of project.

Keyword : - *value engineering, alternative materials, precast elements, mivan shuttering*

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1. INTRODUCTION

Value engineering is a systematic application of recognized techniques which identify and establish the worth functions of the product or service, and provide the necessary functions to meet the customer's Requirement required at the lowest cost, Value engineering concentrates on the effectiveness through stating functions, goals, needs, requirements and desires.

Value (V) = Function (F)/Cost (C)

Where, V is Value, F is sum of total function performance and C represents cost paid for it. The relation of F and C shows that lower the cost for optimum function, better the value.

1.1 History of Value Engineering

Value engineering concept was first applied by Mr. Lawrence D. Miles during world war of 1940's.He find out alternative material useful for B24 bomb production company,which can perform the same function at lowest cost and helped to achieve production and reduce the production time also, later this concept is continuously in use to improve the product value and now known as "Value Engineering".

1.2 Value Engineering Education Source in India

Now in India the best and most convenient way to learn the technique of Value Engineering and its application, is by becoming a member of Indian Value Engineering Society (INVEST)-1977, which helps to study, improve and implement "Value Engineering Techniques".

1.3 Aim of Study

- To study the performance of value engineering applied for residential and commercial building for cost reduction and time effectiveness.

1.4 Objective of Study

- To study value engineering and its implementation in construction industry.
- To compare projects cost and schedule after application of value engineering

2. METHODOLOGY

2.1 Value Engineering Stages

Value engineering is often done by systematically in any stage of project work for number of time also. Early construction stage planning of value engineering implementation can helps to achieve the desired result in a systematic manner which can also reduce work complexity.
So following are different standard stages applied in this study of value engineering

2.1.1. Information phase

in this phase maximum information is collected regarding the project including background information, its possibility of complexity, cost overrun parameters and time overrun parameters. Basic Flow chart preparation after studied available data can help us to find out a systematic technique to control cost overrun and timely project completion .In our case study we have gathered all detailed drawings it's, budgeting and commercial including BOQ of project.

2.1.2. Design Phase

After collecting all the information regarding project, In this phase we need to finalize the appropriate and effective techniques to control cost overrun and time overrun of project. In our case study we find out some design alternatives to achieve timely project completion and alternative material and its sources to reduce the material cost. According to previous project studies mivan shuttering instead of conventional shuttering proved as a best alternative to achieve quality, timely completion and to reduce material wastage while construction.

2.1.3. Development Phase

In the final stage, each recommendation is presented with description, sketches, basic design concepts, technical information and cost summaries.

2.1.4. Presentation Phase

In this phase presentation of recommendation is prepared in the form of a report. The team for presentation consists of client, consultants and other stakeholder representatives. The VE team members describe the recommendations and basis that went during development phase.VE report is shared with client and designers. This begins the evaluation by the client and designer of the VE report. After incorporating client's comments a preliminary proposal implementation action plan is prepared.

2.2 Applied Functions

To evaluate study we defined some functions to categorized Value engineering Implementation, Following are the functions proposed for implementation of value engineering in residential and commercial project.

2.2.1. Alternate Design Method

In this function we focused on comparison of MIVAN technology and PEB structure with RCC formwork..In Mivan shuttering the walls, columns and slab are casted by continuous pour on concrete. Early removal of forms can be achieved by the air curing/ curing compounds. These forms are made strong and sturdy, fabricated with accuracy and easy to handle. The components are made out of aluminum and hence are very light weight. IT can provide number of repetitions (around 250). The re-propping is easy hence it can reduce time. It provides good finish which reduces plastering cost of construction. A Pre-engineered Building (PEB) is steel structure of built up section which fabricated at factory according to customer's requirement, transported and assembled at site, which

reduces time, labor work, rework and masonry cost also. We conducted a case study for commercial PEB structure and compared it with RCC structure by standard assumptions of proportionate size of building elements.

2.2.2 Planning and Scheduling With Implementation of VE

In a construction projects proper planning and scheduling in detail is necessary for eliminating unnecessary delay of the project. Improper planning of a project, leads to wastage of amount of time, money and resources. In this case, we have studied same residential project scheduling by using some material alternative with respect to its estimated quantity ,time and cost .The main objective of this study is to plan, schedule and track a residential building project with the use of MSP 2013 software, analyzing the result and which method is suitable for residential building project is determined and measure are recommended to the organization for enhancing their project planning skills.

2.2.3 Alternative Material Uses

2.2.3.1. CLC Brickwork

Here we have conducted a case study for the same residential building project by calculating wall area of plan and states the comparison of CLC block wall and Conventional Fly Ash Brick wall with respect to their basic properties, estimated quantity and cost.

We can replace CLC bricks with conventional for following reasons

- it reduces overall weight of building by 20% due to lower density
- its size is 40% higher than conventional bricks hence it increase the speed of masonry work

2.2.3.2. Gypsum Punning

Conventional mortar plastering leads to material and time wastage which proved costly in every construction, we compared Gypsum Punning and Conventional mortar plastering.

3. RESULT AND ANALYSIS

3.1 Case Study

We have conducted case studies for implementation of Value engineering based on various functions, So that we would know how these going to be beneficial to construction industry. at first we conducted case study for a large residential project, due to vast construction, even with a proper planning they were facing material shortage issue, time overrun issues which was eventually increased the labour cost and daily resources cost, after gathering information we decided to conduct a study for such large type of project by applying value engineering for item whose total annual cost consumption is high which was shuttering & labour work. Firstly we done the comparative study of mivan shuttering Vs conventional shuttering and CLC block Vs Fly Ash Bricks with respect to estimated cost comparison and time comparison.

Project Details

- Project: Residential
- Design Team : JW consultancy
- No. of Towers: 6, Towers No. of Floors: 14 Floors

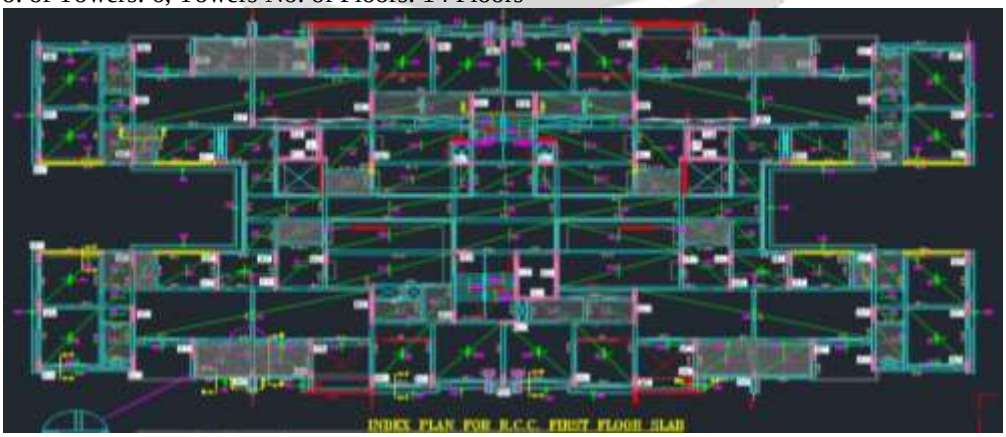


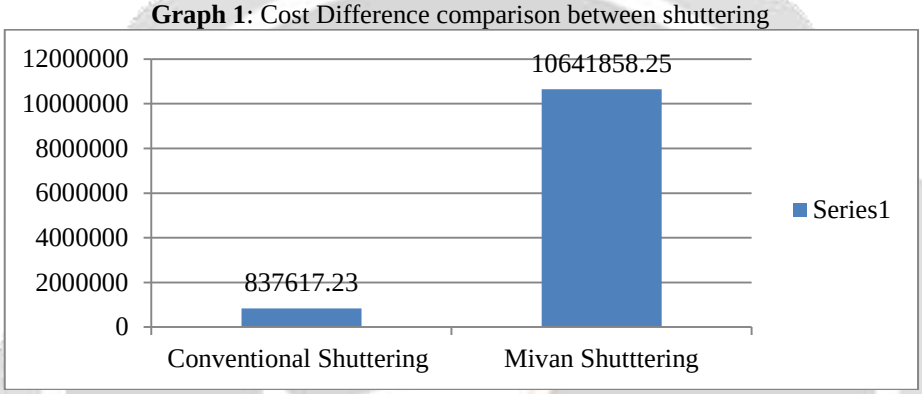
Fig 1: Typical First Floor Plan of a Tower

3.1.1. Cost and Time Comparison

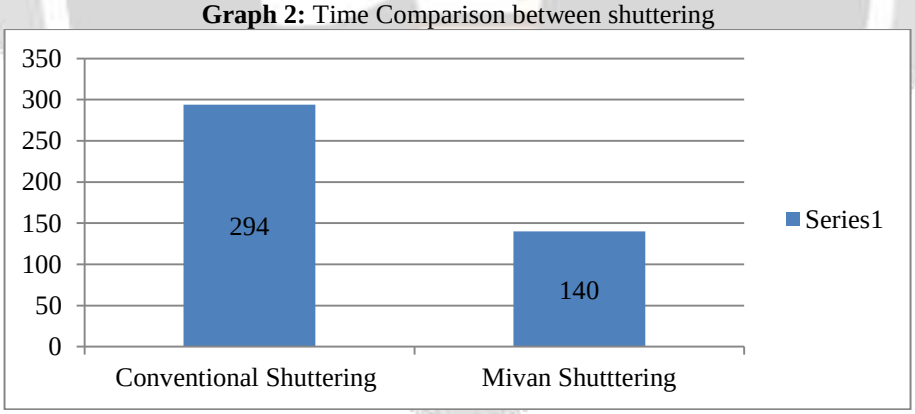
Table 1: Result Comparison of Mivan shuttering And Conventional shuttering

Sr No	Particulars	Unit	Conventional Shuttering	Mivan Shutttering
1	Material cost+Labour Cost	Sqmtr	610	7750
3	Number of repetitions		15-20Times	200-300Times
4	Minimum duration of slab cycle	Days	21	10
5	Total Cost Per Slab =Shuttering Area*Rate	Rs.	837617.23	10641858.25
6	No of days to complete one tower	Days	294	140

Graph 1: Cost Difference comparison between shuttering



Graph 2: Time Comparison between shuttering



In this method the conventional shuttering is replaced by Mivan shuttering for present case study, It observed that cost of project increased by 2.5 times but the time reduced by 62%. It determined that Mivan technology is suitable for large scale building projects and they can be reused for about 200-300 times. Even though the initial investment of Mivan technology is high, it provides cost efficiency for large project and eliminated the need of plastering work, as it gives a good surface finish compared to conventional type of formwork.

There is a drawback for this alternative that, we cannot provide a design changes for single building unit only, as it can repetitively use for similar floors only.

3.1.2. CLC Brick as an Alternate Material

Table 2: Result Comparison of CLC Blocks And Conventional Fly Ash Bricks(4")

Brick Type	Qty	Rate	Amount	14 Floors
4" Bricks	64348	8.5	546958	7657412
CLC Bricks	7831	72	563832	7893648

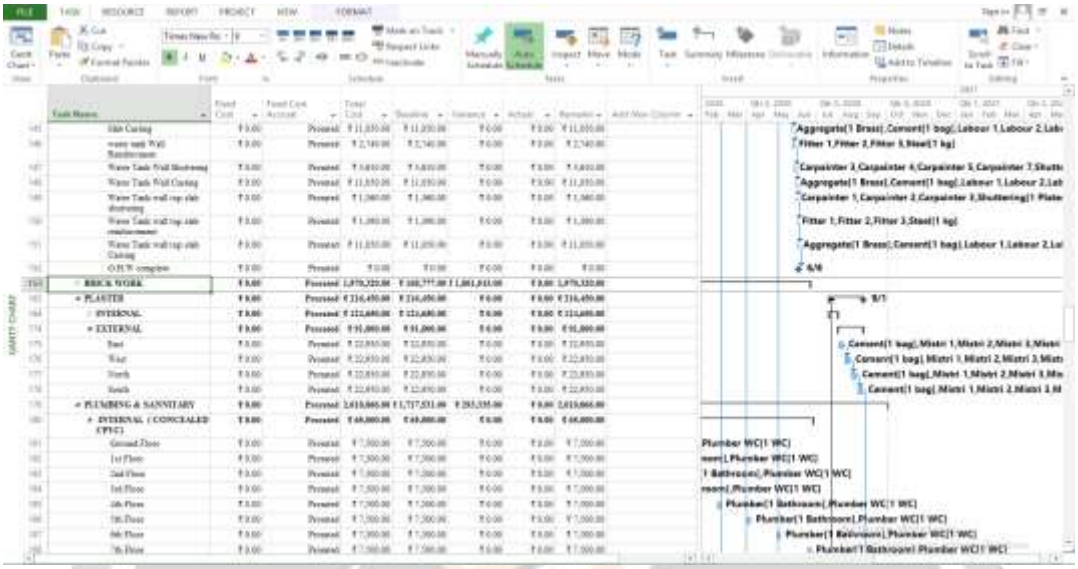


Fig 2: (Conventional) 4"Brick Work takes less Cost but take more Duration

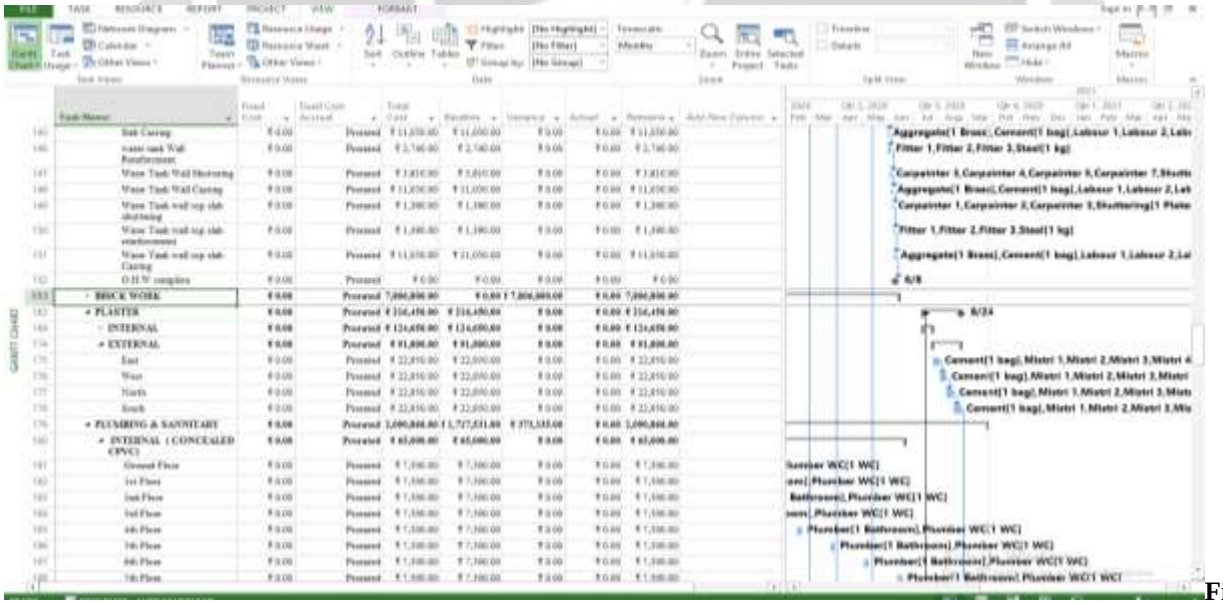


Fig 3: CLC Brick Work takes more Cost but less duration

In Above the MSP Scheduling we have use CLC Bricks to reduce time and cost of the project as compare to Mivan Technology in Mivan we can reduce brick work time but it take more cost than brickwork. Due to its 20% lower density than conventional brick it reduces overall weight of masonry also.

3.2 Case Study

We have a conducted a commercial case study for PEB structure and compared it with RCC structure with respect to estimated cost.

Project Details-

- Project: commercial
- Structure Type-PEB
- No. of floor- G + 1

Table 3: Conventional steel Amount

Conventional Steel amount	
8 mm	1118602.424
12mm	965229.9414
16mm	5823701.011
20mm	498059.7082
Total	8405593.085

Table 4: PEB Amount

PEB Framed Costing	
Framed Structure	6914800
Deck sheet	1610400
Total	8525200

Though Cost of raw conventional steel is lesser than PEB for this project ,but conventional steel will consume shuttering cost, labor cost, masonry cost to provide complete RCC structure as compared to this PEB provides readymade Framed structure, ready for Installation only which reduce the time construction. We can provide extension to existing structure and Can easily, which proves flexibility of this structure over conventional one.

3.3 Gypsum Punning

Table 5: Comparison of Gypsum Punning & Conventional Plastering

Sr No	Particulars	Mortar Plastering	Gypsum Punning
1	Material Wastage	More	Negligible
2	Levelled surface	Require skilled labor for leveled surface	Applied within level strips which ensure leveled surface.
3	Curing Period	8 days	Not required
4	Shrinkage Cracks	Appearance	No cracks
5	Thickness	Up to 30mm	15-20mm
6	Final Finishing	Sometimes it required Gypsum finish	Provide Finished surface
7	Strength	Can achieved after complete curing	Ready to use

4. CONCLUSION

- Even though the initial investment of Mivan technology is high, for large project, it provides cost efficient project and reduce the project Time 52% than conventional shuttering, save daily labour and daily resources which eventually reduce project cost
- CLC block use reduces the building weight due to lower density and larger in size reduces the construction time.
- Gypsum Punning proved as a cost and time beneficial than conventional mortar plastering.
- PEB structure saves the concrete & shuttering work cost and gives finished, quality structure in lesser time.

5. REFRENCES

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