Implementation of Value Engineering for Residential and Commercial Building

Tejaswini S. Ade[1], Pranav K. Lende[2]

MTech Student, Department of Civil Engineering, GHRU, Amravati, Maharashtra, India.
[2]Assistant Professor, Department of Civil Engineering, GHRU, Amravati, Maharashtra, India.

Abstract - *Value engineering is a methodology used to dissect the function of the goods and services and to gain the needed functions of the user at the lowest total cost without reducing the necessary quality of performance. Numerous a time, Value Engineering (VE) is confused with cost cutting exercises in construction industry. The essential difference between conventional cost cutting and VE is that it involves reducing the cost by perfecting the functionality through lower consumption of energy in terms of force, accoutrements and machines. Structure development in construction industry is a key driver in socio economic development of the country, so it's in need to have proper construction ways which are cost effective and feasible to meet client's demand. It includes comparison of various design approaches like "mivan shuttering", and "conventional techniques", study alternative materials to minimize cost and especially time of design and simultaneously to improve value of design*

Key Words: CLC Bricks1, cavity wall2, mivan framework3, 800x800 granite tiles4, gypsum punning5, etc.

1.INTRODUCTION

Construction industry is an index of growth of a nation. The real estate sector in India has assumed growing significance with the liberalization of the economy. Today, the construction industry is the second largest employing skilled and semiskilled labor after agriculture and plays an important part in nation's economy. Due to increase in business opportunity and migration of labor, the demand for commercial and housing spaces has also increased. According to the tenth five- time plan, the estimate of deficit in urban housing is penetrated to be 8.89 million units. As of now, the housing and construction industry employs 30 million people and about 250 industries are associated with construction industry directly or indirectly. It includes hospitals, school, townships, services, houses and other structures as well as urban structure, roadways, roads, port, railroads, airfields, dams, power plants etc.

1.1 Value Engineering

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.

$$\text{Value (V)} = \text{Function (F)}/\text{Cost (C)}$$

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.

1.2 History of Value Engineering

Value engineering concept was started by Mr. Lawrence D. Miles during 1940's. He worked for General Electric Company (GEC), USA which faced scarcity of strategic material needed to produce their products during world war-II. Mr. Mile was appointed in GEC in purchasing department. At that time there was shortage of steel, copper, bronze and other materials. GEC wanted to expand its production of turbo supercharger for B24 bombers from 50 to 1000 per week. Miles was assigned the task of purchasing material to permit this. Often he was unable to obtain specific material, so he thought to obtain an alternative which can perform the same function. Miles observed that many of substitutes were providing equal and better performance at the lowest cost and from this incident evolved the concept of value engineering.

2. LITERATURE REVIEW

Value engineering is a combination of specialized and profitable subjects. It's committed with the smallest life cycle cost and dependable completion of the functions needed by the user. Value engineering is basically a process which uses function analysis, team- work and creativity to improve value. Value Engineering can be applied during any stage of a design's design development cycle. It has an important influence and function to promote the traditional product value invention, cultivate and develop the enterprise's core competitiveness, and promote public profitable and social sustainable development..

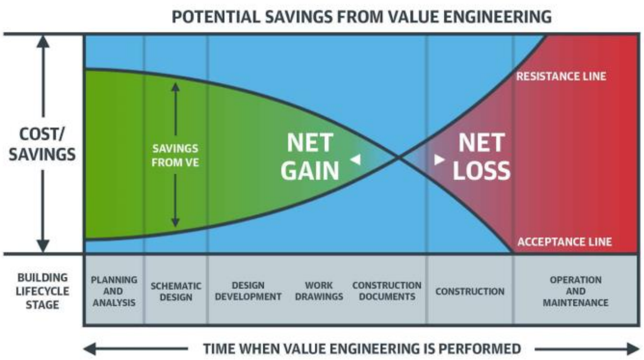


Fig 1 Potential Saving from Value Engineering

3. Advanatges of Value Engineering

Value engineering is characterized by a branch of knowledge and practical styles to break problems for other quality improvement in the following :-

1. Job analysis distinctive way (function analysis).

2. Get appointed a large amount of good ideas that are applicable.

3. The action plan in place which consists of several successive stages of a logical sequence.

4. Multi-disciplinary team working in the studies of collective values.

5. Ensure collaboration between the applicable authorities in the design.

4. METHODOLOGY

Value engineering has a methodical and collaborative medium to assay function and systems with the end of achieving desirable function with the least costs. This study has tried to compactly introduce generalities and administrative process of value engineering in construction systems. Also, the study has tried to probe conventional styles of assessing systems serve and compare them confluence with value engineering to improve systems. Grounded on the exploration findings, it can be set up that if we can anticipate to achieve systems objects by spending the least cost and insure the efficacity of investment in construction systems operation sector as a main challenge of development plans in the third world countries through using engineering in applicable time ages and in different phases.

The value methodology is a methodical process which is applied by a multidisciplinary team to improve the value of a design through the analysis of functions. We're using some indispensable parameter in our case study rather of traditional one in our case study. Now-adays we saw some (2 or 3) of these parameters were enforcing in construction industry but we're going to apply these all parameters in one structure, So that we'd know how these going to be salutary to construction industry.

We are using some alternatives in our case study, they are as follows:

4.1 **CLC bricks**

Use of CLC (Siporex) bricks, will increase the total cost of construction but, it decreases total dead cargo, as they're lighter in weight. At the time of earthquake, total cargo of the structure on the foundation, will be less therefore, the intensity of earthquake would act to a lower extent. Time needed to construct any structure is less i.e., construction is easy & construction cost and labour cost also less.

Fig-3: CLC Brick (Siporex bricks)

4.2 Cavity wall

We're using concave CLC bricks for cavity wall. It'll reducing the overall load of structure. It'll be more suitable because it gives better thermal resistance. Leakage can do through the external leaf through joints between bricks and mortar. It avoids humidity passing through the wall.

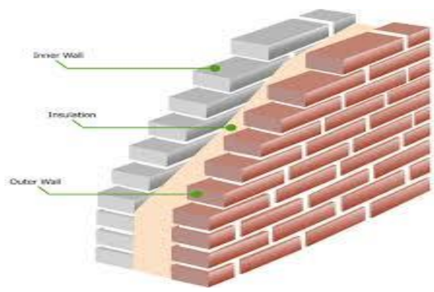


Fig-4: Cavity wall

4.3 800 x 800mm Granite Tile

Granite is an igneous rock formed from volcanic activities. Granite tiles remains a popular flooring choice because of its overall resiliency, strength, and number of unique colour options. Our decoration face granite tiles selection offers over 50 colour patterns. We Are using 800X800mm granite for flooring of design, whether it's for residential or commercial use.

Fig-5: 800x800 Granite Tiles

4.4 Mivan Technology

Mivan is principally Aluminium formwork system. Mivan system was invention by Construction Company from Europe. In 1990, Mivan Company from Malaysia start manufacturing formwork, also later give name MIVAN. This technology is considerably used in Europe, Gulf country and Asia. Formwork is defined as the temporary structure whose purpose to support the structure. The progress of the formwork equidistant with the progress of concrete construction through the 20th century. Modern technology must be needed in this time because of adding the population and land available for constructing houses in limitation. For mass housing design, it's essential to know the new technology for completion of design in fast rate, stand to good quality and suitable to repel wear and tear. Mivan technology is able to constructing a huge number of houses within short period. Mivan formwork is fluently removed. All the activities can arrange in simple manner and get affect more accurate, well regulate and high-quality product at economically with lower period.

Fig-6: Mivan Technology

4.5 Gypsum Punning

Conventional mortar trouncing leads to material and time destruction which proved expensive in every construction, we compared Gypsum Punning and Conventional mortar plastering.

Fig-7: Gypsum Punning

4.6 Software use

Microsoft Project (MSP)

Microsoft Project(or MSP or WinProj) is a design operation software program which is designed to help design directors in developing plans, assigning resources to tasks, tracking progress, managing budgets and assaying workloads. The operation creates critical path schedules, and critical chain and event chain methodology with third-party add- ons. Cost variance and Schedule variance are imaged in a Report

5. Job Plan

Value engineering can be applied during any stage of a design cycle. VE may be applied further than formerly during life cycle of construction design. Early operation of VE helps in further organized implementation of design conditioning, therefore reducing overall cost by avoiding any major changes right in the beginning. If the operation of VE is done in after stages it may affect in advanced design cost

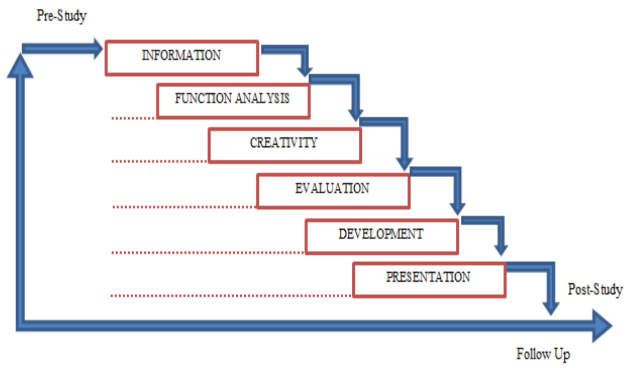


Fig-8: Job Plan

5.1 Information Phase

In this phase maximum information is collected from various aspects of project regarding identification of problems to be answered and gathering of information on background, function and conditions of the design. At the beginning of VE study it's important to:

- Understand the background and opinions that have told the development of design.
- Define owner's objective and criteria governing the design.
- To analyse issues of design
- To discuss design cost and schedule data
- To prepare cost and energy models

VE team recognizes low quality area and high cost area and sets target quality enhancement and cost savings.

5.2 Functions

One of the most unique features of Value Engineering is its use of functions and a function- sense process to describe requirements, purposes, and ramifications. The use of function- sense removes numerous of people's preconceived impulses. The use of two word functions(active verb, measurable- noun descriptors) and their positioning in a decision- sense illustration move people from the" I want" position to a introductory requirements concentrate. It also helps them see how their opinions calculate on critical features, and whether their opinions bear support to apply.(potential value- mismatches, also known as potential value oppottunities).

5.3 Creative Phase:

This phase involves generation of ideas and listing of those creative ideas from review of design. VE team thinks in creative way to give necessary functions within the design. Large number of ideas are attained through creative proposals and brainstorming. In team everyone is encouraged to participate. Evaluation of ideas is banned in this phase. The VE team is looking for quantity and grouping of ideas, which will be screened in the coming phase.

5.4 Evaluation Phase:

In this phase of design, VE team together with customer defines the criteria for evaluation. It involves

- Analysis of ideas performing from creative phase.
- Ranking of ideas by VE team.
- Inapplicable or non-worthy ideas are discarded.
- Selection of ideas which represents top most eventuality for cost saving and advancements.

A weighted evaluation is applied in some of the cases to regard for impacts other than cost similar as quality, safety, trustability, time, constructability, aesthetics, utility, continuity, maintainability, etc.

5.6 Development Phase:

During this phase numerous of ideas are expanded into workable results. It consists of
Preparation of recommended designs and life cycle cost comparison of original and proposed designs. Description of recommended design change.
Each recommendation is presented with description, sketches, basic design concept, technical information and cost summaries.
Selected ideas are developed into proposals so that owner and other design stakeholders understand the intent of offer and benefits to the design.

5.7 Presentation Phase:

In this phase presentation of recommendation is prepared in the form of a report. The team for presentation consists of customer, advisers and other stakeholder representatives. The VE team members describe the recommendations and base that went during development phase. VE report is participated with customer and contrivers. This begins the evaluation by the customer and developer of the VE report. After incorporating customer's commentary a primary offer perpetration action plan is prepared.

6. RESULT AND ANALYSIS

6.1 CLC bricks and partition walls:

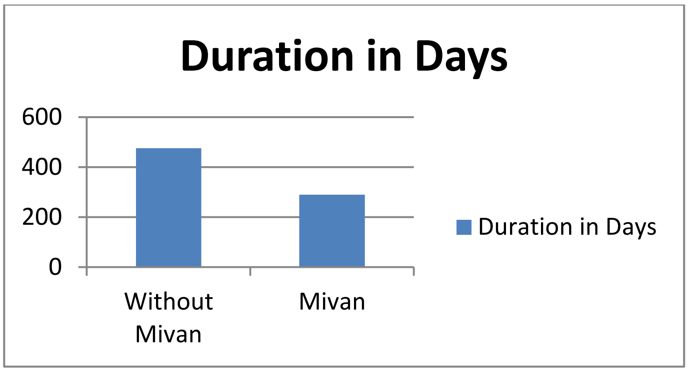
Table 1 Comparison between Burnt Clay Brick and CLC Brick

PARAMETERS	Burnt Clay Brick	CLC Bricks
Basic raw material	Agriculture soil, core or wood for firing	Cement, Sand and Fly ash
Production Process and set up	Process in normal bricks kilns	Can be produce at project site or specially design plant with foam concrete station.
Technological tie up	None	Srees Brickolite-India
Dry density	1800-	450-600,800-

	2000kg/m3	1000kg/m3
Compressive Strength	30-40kg/cm2	4-10,24-35kg/cm2
Applications	Load bearing and non-load bearing	Thermal insulation high rise and low rise, load and non-load bearing.
Cost of Place	Not feasible	Any shape, any size, any density.

6.2 Mivan Technology

Graph 1 Duration of project using Mivan technology



6.3 Gypsum Punning

Table 2 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

7. CONCLUSIONS

7.1 Conclusions

It was discussed that using value engineering methods by multidisciplinary team, value and economy are improved through study of alternative design concepts, material and construction methods without compromising functional requirement and quality.

A second look at the design produced by architect and engineers gives the assurance that all reasonable alternatives have been explored. From study it is seen that different parameters of value engineering alternatives helps to find best solution.

Thus, value engineering assures best value will be obtained over life cycle of the building or structure. Success of a project, deciding on where and how a project will be built, completion of the structure according to desired design and building quality, within determined time and cost limits, are all possible with good estimations and solution.

7.1.1 CLC BRICKS

We Can Replace CLC Bricks With Conventional For Following Reasons

1. It Reduces Overall Weight Of Building By 20% Due To Lower Density

2. Its Size Is 90% Higher Than Conventional Bricks Hence It Increase The Speed Of Masonry Works.

7.1.2 Granite Tiles

We Can Replace Regular Tiles By Granite

1. It Has More Finishing And Strength Than Regular Tiles but its Rate Is Comparatively higher Than Regular Size

2. Its Size Is Larger Than Vitrified Tiles Hence Increase In Speed Of Masonry Work.

7.1.3 MIVAN FORMWORK

1. Conventional formwork system is mostly adopted in the world but it has more consume time and costly in construction project. Conventional formwork not suitable where population is large, less land available and construction project work required in speedy. This all condition satisfies in MIVAN formwork system.

2. Mivan technology gives the better result in Cost effectiveness, Speed of the construction with higher durability of building structure.

3. In Mivan formwork, speed of construction can be achieved by 4 day cycle per floor. Removing of floor

slab forms without removing prop is possible, while in conventional not possible. Displacement of the conventional system is 86% more than that of Mivan structural system.

4. In the present case study the conventional formwork model is replaced by Mivan formwork so it is observed that cost of project is jumped to 30% by using MIVAN formwork. But in terms of value it gives with proper finishing and faster delivery i.e.8 to 9 months can be saved as two slab can be cast at a time.

5. Hence we can conclude that value engineering is just not decreasing cost but delivering better product

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