Value Engineering for Aluminium Formwork and Other techniques for Innovation in Construction

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Abstract: **Infrastructure development in construction industry is a key driver in socio economic development of the country. As construction industry play a vital role in economic growth and development of the country. Globally, the predicted growth in construction industry is 70% more by 2025 it is in need to have proper construction techniques which are value effective. Value engineering is a systematic application of recognized techniques which identify the functions of the product or service, establish the worth of those function and necessary function to meet the required performance at the lowest overall cost. Value engineering concentrates on the effectiveness through stating function, goals, need, required and desires. Value engineering concept was started by Mr. Lawrence D. Miles during 1940`s.He worked for General Electric company (GCE), USA. which faced scarcity of strategic material needed to produce their products during world war-II. Indian Value Engineering Society (INVEST) is a professional society established in October 1977 and dedicated to the advancement of value engineering through education. INVEST is affiliated to the society of American value engineering (SAVE). Various cost reduction technique are as follows- "Thinner walls or single brick thick walls", "Load bearing brick work", "Brick on edge cavity wall", "Precast stone masonry blocks", "Modular brick masonry walls", "hollow clay blocks of shell type houses", "Sundried brick walls with waterproof treatment", "precast hyperbolic shell for roofing". All these techniques come under "Value Engineering"**

Keyword: Value Technology, INVEST, SAVE capital project, scope creep, cost effectiveness

I.INTRODUCTION

A. General

Value engineering is the systematic application of recognized techniques that identify the features of a product or service, determine the value of those features, and provide the necessary functionality to achieve the desired performance at the lowest total cost. Value engineering focuses on efficiency through the determination of functions, goals, needs, requirements, and wants.

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

Where V is the value, F is the sum of the function's total performance, and C is the cost paid for it. The relationship between F and C shows that the lower the cost of the optimal function, the better the value.

B. Value Engineering

VE is the process of finding systems or methods to achieve the same program goals using a different system that do not materially affect the desired outcome.

Some examples might be:

• A look at the cost differences between steel and concrete structural systems.

• Use of different mechanical devices with similar characteristics.

• Reduction of lighting levels due to daylighting; combining office functions into one space.

• Changing the shape of the building to improve the external wall to floor area ratio.

• Reduction of finishing allowances.

Value engineering is usually able to reduce project costs by 5-10%, while more aggressive methods must be used. contingency bids of the project can be used for the required work. Alternatives are often items that may have another source of funding, such as deferred maintenance money, that can be done independently. They may also be areas of planned programmatic growth that will not be needed when the building is completed and may be "merged" for a future project. Alternatives are best applied in the later stages of design, as history has shown that many alternatives at this stage cannot be afforded later in the project, so they de facto become scope reductions.

Scaling is perhaps the most difficult aspect of any project, as it usually involves a permanent reduction in the quantity or quality of the program space.

Downscaling at this point may include:
• Reducing the number or size of rooms
• Removal of special features that would improve the program
• Reduction of space volume
• Elimination of special mechanical systems or elements
• Reduction of impacts on the area of the site.

"There is often a tendency on projects to try to get more space within the budget. This is known as "scope creep" and it is therefore important to verify the proposal against the original program plan on which the budget was based. The first round of scope reduction tends to be areas where the design exceeds the original program plan before moving to other scope reduction areas. Ultimately, most projects are able to break even. If this is not the case, additional funds may be diverted beyond the project's unpredictability, or the overall project budget may need to be increased through a change in the program plan. This requires documentation and submission back at the approval stage, causing a delay of four to six months, so it is important that the project team works diligently to contain project costs. Anyone involved in costing a construction project has heard of value engineering. Is the original vision of the palace building in danger of exceeding the budget? The answer is often, "Let's respect the engineer that "Sometimes value engineering looks like the solution to every budget problem, like a magic wand that cuts costs and balances budgets. But what exactly is it? Is value engineering just a cost-cutting marketer's ploy, a way to settle for the less palatable? If so, the term is being misused. As the federal government defines it, "value engineering attempts to eliminate, without compromising essential functions or characteristics, anything that increases the cost of acquisition, operation, or support." So reducing the size of a building by 10 percent or eliminating a media gallop would reduce costs—but it would not be value engineering.

II. METHODOLOGY

A. CLC bricks

The use of CLC (Siporex) bricks will increase the total construction cost, but reduce the total self-load because they are lighter. At the time of an earthquake, the total load of the structure on the foundation will be less, so the intensity of the earthquake will act to a lesser extent. The time required to build any structure is less, that means the construction is easy and the construction cost and labor cost are also less.

Fig 1:Siporex brick

B. Cavity wall

We use hollow CLC bricks for the hollow wall. This will reduce the overall load on the structure. It will be more beneficial as it provides better insulation resistance. A leak can occur through the outer sheet through the joints between the bricks and the mortar. It prevents the penetration of moisture through the wall.

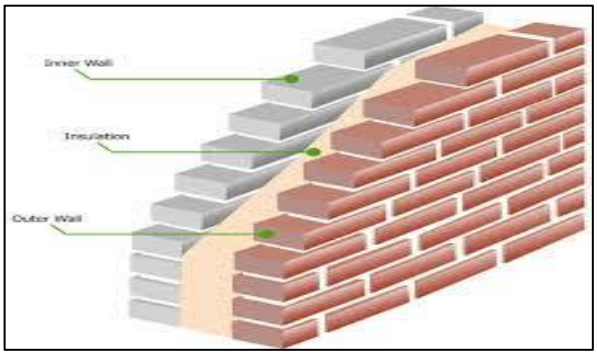


Fig 2: Cavity wall

C. 800 x 800 Vitrified Tiles

Vitrified tiles are igneous rock formed by volcanic activity. Tiles Vitrified tiles remain a popular flooring choice due to their overall durability, strength and abundance of unique color options. Our selection of tiles with a premium surface Vitrified tiles offer more than 50 color patterns. We use 800 x 800 mm sintered tiles for project flooring whether residential or commercial use

D. Mivan Technology

Mivan is essentially an aluminum formwork system. The Mivan system was an invention of a construction company from Europe. In 1990, Mivan from Malaysia started to produce formwork, then named MIVAN. This technology is widely used in Europe, Gulf countries and Asia. Formwork is defined as a temporary structure whose purpose is to support a building structure. The development of formwork at the same distance as the

progress of concrete construction in the 20th century. Nowadays, modern technology must be required as the population increases and the land available for building houses is limited. For a mass housing project, it is essential to know new technology for quick project completion, quality durability and wear resistance. Mivan technology is able to construct a huge no. home in a short time. Mivan formwork can be easily removed. All activities can be arranged in a simple way and the result is a more accurate, well-regulated and high-quality production economically with a shorter time

III. PROBLEM STATEMENT

A. Study Area 1 - Amar Landmark
Site Details:

- Site name :Amar landmark
- Address: Near green park hotel pashan.
- Name of Builder: Amar Builder
- Name Contractor: SJ construction.
- Architecture: MOCO design
- Structural consultant: J+ W
- Total Area:2.8 acres
- Built-up Area:15570sq ft
- Type of building: Residential.

B. Study Area 2 - Devraai Residential Building
Site Information
Name of the site: Devraai Phase-2
Location: Kiwale, Pune
Site Area: 2125 m2
Built up Area: 3103.48 m2
Air-conditioned Area: 0 m2
Non Air-conditioned Area: 3103.48 m2
Typology: Residential apartments
Energy consumption reduction: 84.5% reduction in energy consumption compared to
Energy Performance Index (EPI): 15.5 kWh/m2/year
Renewable Energy: Rated capacity of solar PV installed on site – 3 kW
Solar hot water system met 96% of the conventional energy demand for hot water
Year of Completion: 2017

IV. RESULT

A. Data Analysis Of Case Study – 1

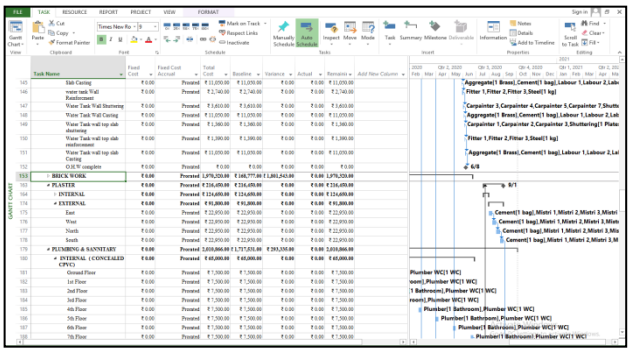


Fig 3 CLC Brick Work takes less Cost but take more Duration

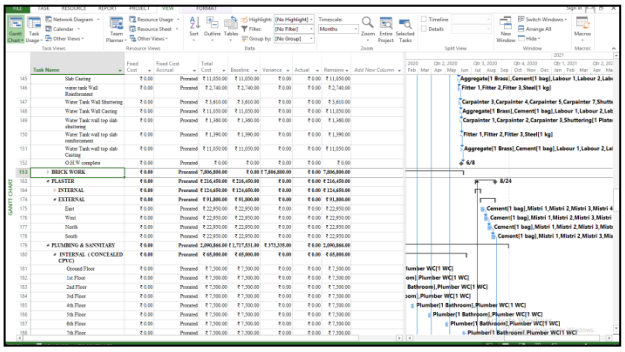


Fig 4 4'' (Conventional) Brick Work takes less Cost but take more Duration

In Above the MSP Scheduling we have use CLC Bricks to reduce time and cost of the project as compare to Conventional Brick Work

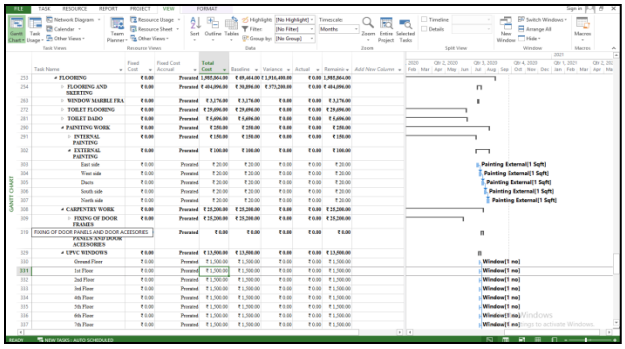


Fig 5 600 x 600 Flooring increase Cost and Duration too

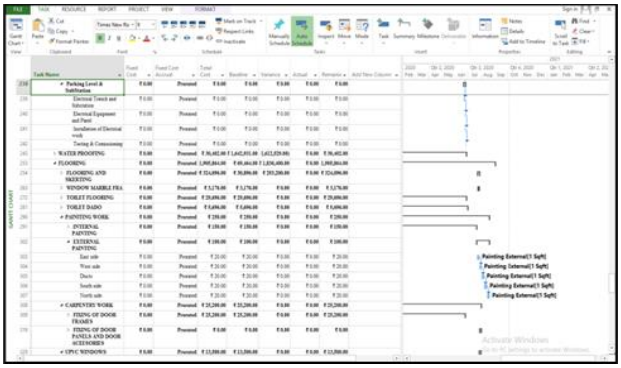
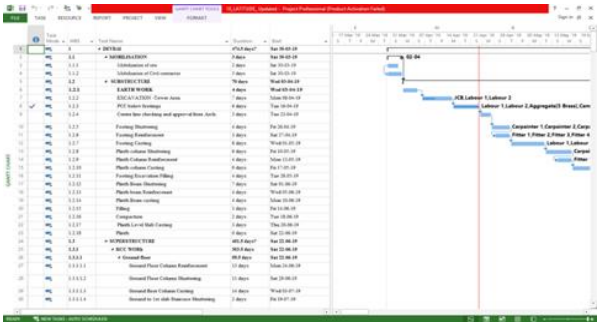
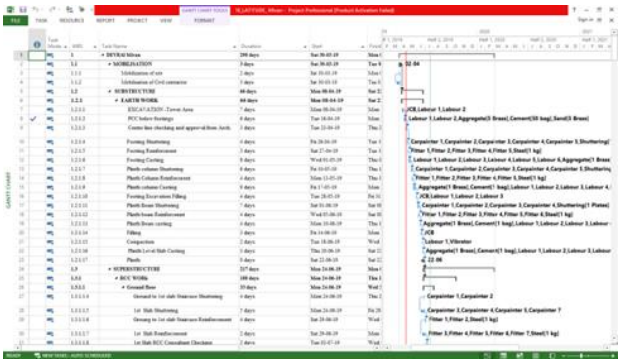


Fig 6 800 x 800 Vitrified Tiles tile use Flooring takes more Cost but less Duration

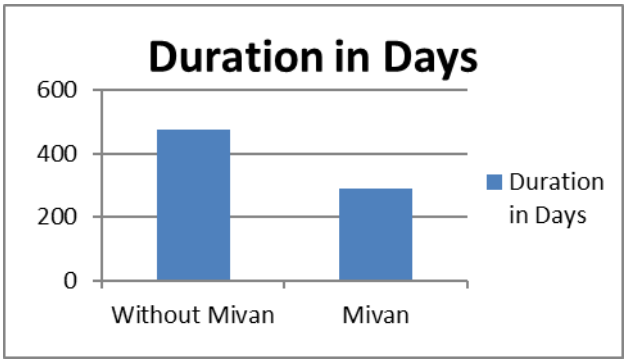
In MSP Planning we have used 800mm X 800mm Vitrified Tiles to reduce the project time compared to 2nd project we are using 600x600 tiles It will reduce cost but it will take more time compared to 1st project.

B. Data Analysis of Case Study – 2

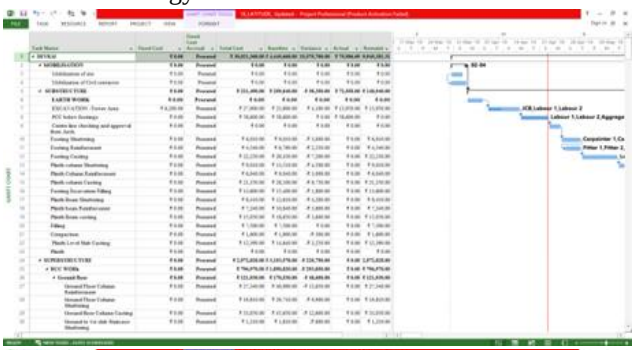


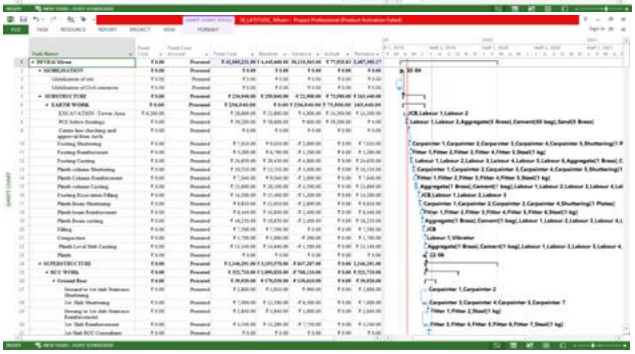


DEVRAI	Duration in Days
Without Mivan	475
Mivan	290

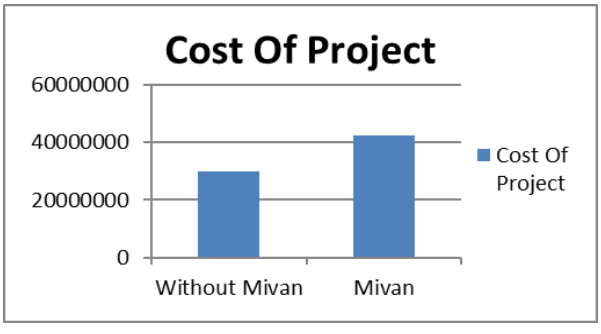


The above graph shows that the required duration of the project without mivan technology is longer than with mivan technology.





DEVRAI	Cost Of Project
Without Mivan	30021368
Mivan	42565231



V. CONCLUSION

- It was discussed that by using value engineering methods by a multidisciplinary team, value and economics will be improved by studying alternative design concepts, materials and construction methods without compromising functional requirements and quality.
- A second look at the design by the architect and engineers ensures that all reasonable alternatives have been explored. It can be seen from the study that different parameters of value engineering alternatives help to find the best solution.
- Value engineering therefore ensures that the best value is achieved during the life cycle of a building or structure. Project success, decisions about where and how the project will be built, completion of the construction according to the desired design and construction quality, within the specified time and cost limits, all this is possible with good estimates and solutions.
- Making correct estimates is closely related to the knowledge level of the team. A value engineer takes on regulatory and analytical responsibilities to increase project value while preventing unnecessary costs.
- It is not possible to apply VE to every project that the company produces. Much more successful value engineering studies can be conducted on complex and large projects that have a high ROI potential.

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