ABSTRACT

The current construction practices require a great effort to balance the factors such as money, time and quality. Comparing with other industries it seemed that construction industry remains the toughest one to deal with. It is proven that certain modern techniques can be easily adapted to the project to balance the factors above said. Value engineering is an efficient tool among them for fostering the construction quality with an aim of low cost and high services. The value engineering study is carried out with analysis of basic functions of the project and based on that analysis unwanted elements in the project are scrutinized and eliminated. The function analysis is carried out with the help of FAST tool and the projects study deals with a step by step process. This thesis deals with implementing the value engineering concepts in a residential building project in order to reach out better quality with lower cost.

Index Terms: Fast Technique, Functional Analysis, Job Plan, Value Engineering.

I. INTRODUCTION

Value engineering is defined by the Society of American Value Engineers as: the systematic application of recognized techniques which identify the function of a product or service, established a value for that function and provide the necessary function reliably at the lowest overall cost. In all instance the required function should be achieved at the lowest possible life cycle cost consistent with requirements for performance, maintainability, safety, and aesthetics. Value engineering isn’t a typical cost reduction and it does not “cheapen” the service.

Keeping costs low with traditional methods has been a common practice to improve competitiveness. Saving money at the same time, providing better value is a concept that everyone emphasizes. Value engineering is a practice whose goal is, always, to achieve value for money. Value engineering aims to value improvements through cost reduction and or improve quality and enhance design features for the customer. These disciplines cannot be ignored if a company is to continue meeting the rising expectations of its customer, who will always take their business to where they can get the quality at the lowest possible price.

Value engineering was developed at General Electric Corporation during World War II and is widely used in industry and government, particularly in areas such as defenses, transportation,
construction and manufacturing. The Value Engineering technique directed toward analyzing the functions of an item or process to determine best value or the best relationship between worth and cost. Best value is represented by an item or process that performs the required basic function and has the lowest life cycle cost. In this context, the application of value engineering yields a better value when construction is approached in a manner that incorporates environmentally-sound and energy-efficient practices and materials. However, the real objective of value engineering is value improvement and that may not result in an immediate reduction in cost. Value engineering can be used for the following benefits.

- Cost reduction
- Time savings
- Quality improvement
- Isolation of design deficiencies

Value engineering is thus not simply a cost cutting method but improving value for service by modifying and enhancing functions. Value, as defined, is the ratio of function to cost. Value can therefore be increased by either improving the function or reducing the cost.

Reasons for poor value can be that, lack of information, decisions based on wrong beliefs, habitual thinking, negative attitudes, and reluctance to seek advice, shortage of time, changing technology, and lack of yardstick to measure value, old specifications and poor human relations.

Value engineering gets closer to cost control because it looks at ways to reduce cost on specific items or activities. However, it does not look at the total project picture or check the daily performance of the service. It focuses only on specific items in the designs, procurement, or construction area.

### II. VALUE ENGINEERING JOB PLAN

In all the projects, application of value analysis on different stages of the construction project like design stage, architectural design stage, structural design stage, execution stage, and so on.

Application of value engineering/analysis is done by using job plan which is a systematic and organized approach. VA job plan is the key of success for a value management exercise. It is through this plan that the already identified areas of value study are subjected to in-depth application to seek new and creative alternatives. The job plan required the formation of a multidisciplinary team representing a cross section of technical field to conduct the program. A multi-disciplinary approach generates more and better ideas gives greater impact of decisions and costs on all services, and develops better communication among the members of team. There are different job plan existing and are selected as per suitability of the project and requirement which are entitled as

- Five phase job plan
- Six phase job plan
- Seven phase job plan
- Eight phase job plan

Job plan mentioned above comprises of the selected set of phases as mentioned below, which are identified from various literatures;

- Information phase
- Investigation phase

- Creative phase
- Analytical phase
- Judgment phase
- Development phase
- Recommendation phase
- Presentation phase
- Implementation phase
- Follow-up phase

Out of which most commonly used phases for above completed projects in India, which is considered as five phase job plan also known as standard job plan and most suitable in Indian context are described below

A. Information phase

In this phase maximum information regarding problem is collected from various aspects of the project to clearly identify the problem to be solved and gather information on the background, function and requirements of the project. The importance of this phase lies in collection of as much possible information collection for understanding and assisting the problem

B. Creative phase

The value engineering team lists creative ideas generated from its review of the project with the aim of obtaining a large number of ideas through brainstorming and association of creative proposals. The VE team is looking for the greatest quantity of ideas, which will subsequently be screened, in the next phase of the study. This issue is one of the most challenging for VE team members and participants. Many of the ideas brought forth in the creative phase are a result of work done in the

C. Judgment phase

Creative ideas are analyzed, and the team selects the best ideas for further development. The VE team evaluates the ideas developed during the creative phase. The VE team ranks the ideas. Ideas found to be irrelevant or not worthy of additional study are disregarded; those ideas that represent the greatest potential for cost savings and improvements are selected for development are selected for the further development.

D. Development Phase

The team prepares alternative designs with capital and/or life cycle cost comparisons of original designs and proposed alternatives. All recommendations are supplemented with written descriptions, sketches, basic design concepts, technical information and cost summaries. The selected ideas are developed into proposals that are clearly written so that the owner and other project stakeholders understand the intent of the proposal and how it benefits the project, and also to identify any potential negative factors associated with the proposal.

E. Recommendation Phase

The recommendation phase is important, as the selected alternatives are presented to top management with the full comparative position of costs as well as technical ranking. The major changes in design are also described briefly with sketches, drawings or models as appropriate.
III. VALUE ENGINEERING IN CONSTRUCTION

Value engineering is being a very effective approach, must be appreciated and understood at all level of the project management and must be accepted worldwide. This is one of the tools available for the engineer, and its application on projects and products guides the engineer’s imagination, creativity, and synthesis of knowledge such that whole-life value is achieved for the project or product. Essentially, the project or product is viewed from its purpose and functions through to its conception, actualization or manufacture and usage. And simultaneously in a reverse order from its usage back to its purpose and functions. Although value engineering has its origin in the manufacturing industry, its methodology has been well developed for use in the construction industry. The realization of whole-life value for a building project involves finding optimum combinations of initial project costs, maintenance cost, and cost associated with the time for completion of the project. Value engineering is technique directed towards analyzing the functions of an item or process to determine “best value” or the best relation between the cost and value.

IV. CASE STUDY ON A RESIDENTIAL BUILDING PROJECT

A. Optimal Building Project

The goal of any construction project is to obtain an optimal solution to the design problem. The factors that determine building project and its cost are as follows;

- The purpose and functions for which the building is intended.
- A clear concept about the owner’s total needs.
- The aesthetic appeal of the building to the public and the public’s perception of the value in the building.
- The architectural system and finishes specified for the building, and the need of these systems and finishes to perform under all expected loading conditions.
- The structural form and materials.
- The heating, ventilating, air conditioning, and public health systems specified for the building and the need to provide a comfortable environment to building users under operational conditions.
- The lighting, electric power and telecommunication systems specified for the building and its need to provide reliable and adequate services under operational conditions.
- The method of construction, the ease of construction and the time for completion of construction.
- The ease of maintenance, the replacement cycle of components, and maintenance requirements.

The value engineering proved that it can deliver optimal construction and also it identifies a level of quality for the project. This is done by representing the functional relationships in a FAST diagram and there analysed to get the cost of individual functions in the FAST diagram.

B. Study Area Selection

Since the study aims at an optimal construction practice for residential building an individual housing construction project has chosen. The objective of the study over this housing project is to find a maximum value to the end user for the cost he spends on it.

C. Data Collection

The data collection is done by following the philosophies of information phase which is the first phase of VE job plan. Aim of the data collection is to know the problem well. Data gathered from interviewing and collecting project related materials from owner, contractor and designer.

concerned with the project undertaken. The collected data will be the base for the further progress of the study.

The information collected in the first phase of the study is as follows;

✓ Owners requirements
✓ Basic site and building details
✓ Drawings
✓ Activities to be carried out
✓ Estimation details
✓ Current price of various materials.
✓ Problems involved

All the collected data are tabulated for the easy access and usage. Any additional data which is collected further should be added to the existing collection.

D. Owners Requirements

The owner processes vital role in completing the construction task in desired way. Owner’s expectation, requirements and participation will direct the mode of construction because the end user of the facility that to be constructed is the owner. The owner will feel the value of the facility that he has spend on if only his desires and expectation are accomplished in the project. So in order to get a better understanding regarding owner’s views and desires on the facility, a direct interview has conducted and the data has been tabulated

E. Problems Identified

<table>
<thead>
<tr>
<th>SL. No.</th>
<th>Problems to be Solved and Optimised</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>While demolishing the existing building debris disposal and environmental factors</td>
</tr>
<tr>
<td>2</td>
<td>Laterite usage for walls</td>
</tr>
<tr>
<td>3</td>
<td>High expenditure for wooden works for door, window and ventilators</td>
</tr>
<tr>
<td>4</td>
<td>Compound wall construction with gate</td>
</tr>
<tr>
<td>5</td>
<td>Hand rail material</td>
</tr>
<tr>
<td>6</td>
<td>Roofing type above slab and material</td>
</tr>
<tr>
<td>7</td>
<td>Make place for water tank without affecting cost and appearance</td>
</tr>
<tr>
<td>9</td>
<td>Find the most aesthetic and economical material for parapet wall</td>
</tr>
<tr>
<td>10</td>
<td>Reduce the wall capturing area between living and dining areas</td>
</tr>
<tr>
<td>11</td>
<td>Make effective usage of the portion beneath stair</td>
</tr>
<tr>
<td>12</td>
<td>Evaluate the possibility of making wooden sealing using the material from existing old building</td>
</tr>
<tr>
<td>13</td>
<td>Effective workforce resource for excavation foundation (men or machine)</td>
</tr>
<tr>
<td>14</td>
<td>Correct the stair dimensions and style</td>
</tr>
<tr>
<td>15</td>
<td>Safety to stair case users</td>
</tr>
<tr>
<td>16</td>
<td>Use of aesthetically pleasing and more durable materials without increasing cost</td>
</tr>
<tr>
<td>17</td>
<td>Energy efficiency in electric lightings</td>
</tr>
</tbody>
</table>
F. Alternate Ideas Generated

For each problem a number of alternate ideas has been generated and are their functions are noted with classification according to their necessity as either basic function or secondary function. The basic functions were notated as ‘B’ and secondary functions were notated as ‘S’. Then the ideas were made into a spreadsheet template and are ranked according to their practical implementation possibility.

V. CONCLUSION

By carrying out the value engineering job plan, the project related information were scrutinized and examined and following points were concluded;

- The information phase, have much importance to know the problem well
- The idea generation will be easier if the information are wide and plenty
- Decisions on idea selection may vary upon the relevancy of the information collected.
- For getting a better out for value engineering implementation in a house building the following data are essential while information phase.

✓ Detailed Estimation
✓ Current resource price in market
✓ Basic building and site data
✓ Owner’s requirements
✓ Activities involved
✓ Collection and study of drawings
✓ Problems involved
✓ Miscellaneous data

ACKNOLEDGEMENT

Our gratitude to Almighty, family members, friends, etc, and also acknowledge the support and help of all others who all concerned about this thesis.

REFERENCES


BIOGRAPHY

NAYANA TOM Student, pursuing master of engineering in construction engineering and management from EBET group of institution Erode, Tamilnad, India (DOB: 16-03-1991) she is born in Kerala, India. She has pursued her Bachelor of Engineering from Vickram Collage of Engineering Sivagangai, India. She is currently doing her PG thesis on value engineering in construction industry.

V. GOWRISANKAR Currently working as Assistant Professor in department of Civil Engineering, EBET Group of Institutions Erode, Tamilnadu, India. (DOB: 26-07-1987) He is born in Erode, Tamilnadu, India. Pursued his Bachelor of Engineering from Kongu College of Engineering Erode, India and Master of Engineering from Bennari Amman Institute of Technology, Sathyamangalam, India. He is specialized in Structural engineering. He has an experience of 1 year in teaching profession and 3 years of industrial service.