Implementation of Value Engineering Techniques in Residential Construction Projects - A Case Study

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Abstract:
Value Engineering may be a creative, organized effort, that analyzes the necessities of a project for the aim of achieving the essential functions at rock bottom total prices over the lifetime of the project. Through a bunch investigation, mistreatment experienced, multidisciplinary teams, value and economy are improved through the study of alternate style concepts, materials, and ways while not compromising the useful and value objectives of the client. price engineering is that the method of relating the functions, the standard and also the costs of the project within the determination of optimum answers for the project. a cheap solution is achieved by an application of VE principle for completely different parts of the structures relating its quality and quantity. This study in the main focuses on new techniques, ways and materials which will be adopted in construction industry, in that, its cost, quality, method time and practicableness are considered. price Engineering focuses on accomplishing the desired functions at rock bottom overall cost. It helps in eliminating or minimizing wastage of material, time, and reserve cost, which improves value to the customer.

Keywords: Value Engineering, Value Engineering Job Plan Techniques, Cost, Quality, Value Analysis
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1. Introduction

The engineers have constantly attempted to lessen the price of production with out affecting the excellent and the useful software, but their method become primarily based totally specifically at the beyond experience. Keeping the expenses low with conventional price control has been a generally carried out degree to enhance competitiveness. However, maintaining price down alone isn't enough, there's an growing want for enhance in agenda in addition to performance and effectiveness. Saving cash on the identical time, imparting higher price is a idea that everybody emphasizes. Value Engineering is a demonstrated control approach that

may make treasured contributions to price enhancement and price discount of the production industry. With the development of technological know-how and technology, it have become relatively clean to lessen the production price, however the idea of useful software become now no longer given due attention. Reliability and sturdiness have been of little significance. Now a day's Engineers and Architects have commenced taking Into attention those vital elements i.e. reliability and sturdiness with useful software to optimize the price. This situation has were given emphasize in previous couple of years whose item is to impact economy, withinside the price of production of project. Value Engineering is an organized, innovative and price seek approach for studying the characteristic of any product, service, or machine with the reason of attaining the specified capabilities at the bottom usual price consistent with all of the necessities that include its price, inclusive of performance, excellent, reliability and appearance. Value Engineering makes use of the great mixture of any demonstrated equipment and strategies in control process. Value engineering is as a consequence arguably of more significance than price control efforts.

Both price engineering and fee discount purpose at lowering cost however there may be a fundamental distinction among these strategies. Value Engineering is practical orientated where in as Cost Reduction is manufacturing orientated. Value Engineering targets at practical fee effectiveness via way of means of averting useless cost; it entails multi field team effort, and applies modern and innovative strategies to maximize price. On the opposite hand Cost Reduction targets at converting the approach of manufacturing to lessen the manufacturing fee of an item, it entails typically an person effort and usually its emphasis is on evaluation of the beyond practices and procedures to lessen cost.

2. Literature Review: -

War War May Phyo1 , Aye Mya Cho2 - The purpose of the research emphasis to investigate the information about the current degree of understanding and usage of Value Engineering in Myanmar construction industry but not to add to theories of Value Engineering per session. The theories of Society of American Value Engineers (SAVE) International are referred to study in this research. Respondents are requested to indicate on a scale from 1 to 5 whether they agreed with each of the statements by using Likert Scale. It is conducted by using questionnaire survey. For analyzing data by ordinary scale, average index method is used. As a result, the awareness of Value Engineering in Myanmar construction industry is average. But the misunderstanding and false perceptions still persist in the mind of the respondents. And the practice of VE

development in Myanmar construction is very slow and very few constructions professional have involved in VE study. Moreover, the SAVE international standard does not match with the application of Value Engineering in the Myanmar construction industry.

Resi Bismantaraa, Dwi Dinarianab, Arman Jayadyc, Fitri Suryanid, Hari Nugrahae- The current condition of the Construction Center of the Ministry of Defense of the Republic of Indonesia (Construction Center) has not implemented value engineering in the implementation of construction development. The research is intended to determine how much influence the application of value engineering methods has in increasing value and how ready the institution is to apply the value engineering method. To achieve these two objectives, the researcher uses the method of applying 6 stages of value engineering studies, Life-Cycle Cost Analysis, frequency distribution analysis, multiple linear regression analysis and correlation analysis. The results of the value engineering study on the construction of the Belawan Hospital in Medan resulted in savings of Rp. 3,592.415,520.0 or 5.05 percent of the value of the building, increasing the value in terms of environmentally friendly functions, durability of walls, preventing excessive humidity in the room and saving time for plastering implementation as much as 6373 peopleday. The research also proves that the Construction Center is not yet fully ready to implement value engineering studies where the relationship between the readiness to apply the VE study at the Construction Center (Y) as the dependent variable, and the availability of defense secrecy regulations, the availability of VE study regulations, the availability of detailed guidance on VE and the availability of service provider support (X1,X2,X3 and X4 respectively as independent variables) is described in the equation Y = - 0.959 + 0.284 X1 + 0.457 X2 + 0.239 X3 + 0.217 X4 Chougule Mahadeo Annappa , Dr. Kallurkar Shrikant Panditrao-Value engineering is a tried-and-true management method that can significantly improve value and save costs in the furniture sector. In a case study of the furniture industry, the product's material size was altered using the value engineering process. Gayatri Industries, M/s, of Sangli (Maharashtra) has been producing various furniture items and providing them to regional retailers and clients directly. The use of Value Engineering ideas and techniques is discussed in this study. Value Any product can use engineering, with its various phases, to lower costs. The substance is picked out in a that the price is lowered without compromising the worth of the product or the quality of its design. To choose the best possible replacement based on the options Hossam El-Din Helal, Ibrahim Hassan Hashim,Ahmed Ebrahim Abu El-Maaty- Value Engineering (VE) is the systematic evaluation of a project, product, or manner to enhance performance, high-satisfactory, and/or life-cycle value with the aid of using an unbiased multidisciplinary team of specialists. Its

focusing at the features that the project, product, or manner have to carry out units it aside from other high- satisfactory development or value-discount techniques. This paper affords the historical past and records of VE, key terminology, definitions and techniques to VM in production. It also demonstrates the amassed revel in of VE associated to transportation area and the way VE may be applied in highway initiatives in each clinical studies and production fields.

3. Research Methodology

The main aim of this research is to improve the building construction process by assessing the effectiveness of the application of Value Engineering principles. The framework planned aims to address the research objectives and to achieve specific improvement in the construction projects. The following sub-sections review currently accepted research methods.

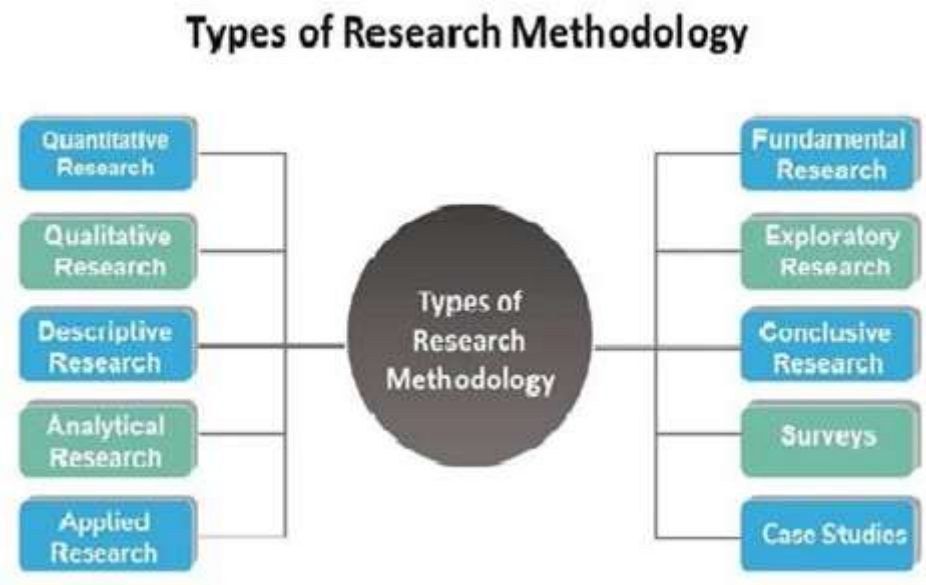


Fig 1: - Methodology StagesSource: - Author

This phase explains how exactly our investigations are carried out. Addressing studies, the usage of this logical and methodology plan is important. To ensure that our findings might be correct and valid, in addition to that they may be in line with our goal and objectives, we offer an outline of our method for carrying out these studies in the form of a technique. It takes under consideration the manner in which the records are being amassed and processed, in addition to the records that we plan to collect and the supply from which they will originate.

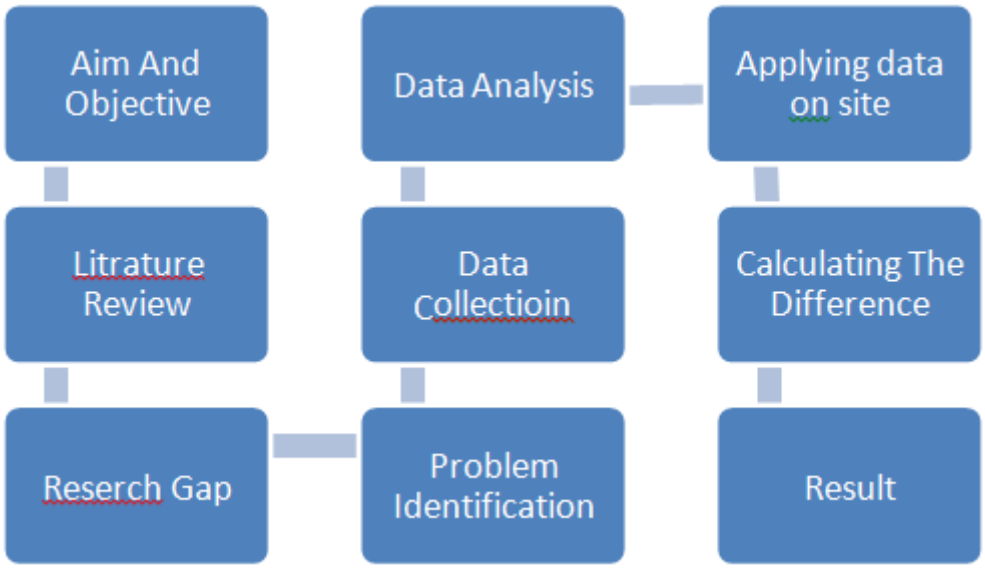


Fig 2: - Research Stages Source: - Author

Case Study:-

Details-

Location- Khanpur gav behind sai Sudha lawn sevasi Vadodara Area – 100002 foot

Project value – 45 cr

Scope of work – reinforcement work

Applying value engineering in construction of residential building in Vadodara.

Stage 1 – All necessary data was collected on site by me and the data includes financial and technical aspects of the projects. it was collected on daily bases along with noticing the time period

Stage 2 – as the observation was made on site the most time-consuming work was of shuttering and reinforcement and they my also have a significant amount of cost to them so the changes was brought to them such as,

I. In shuttering tie rod and anchor nut was introduced to reduce the consumption of timing and cost while working in the with shuttering.

II. So instead in using full iron reinforcement in the beam we used PT cable

III. Second thing which is done is to use multicover instead of normal cover.

IV. In reinforcement couplers were used instead of lapping to reduce cost and time consumption of the project.

V. In the shuttering work of slab instead of wooden key we used mettle channel.

Stage 3- in this phase the observation was noted based on the effect of the above techniques along with time and cost is consumed buy it

4. Data Analysis for first slab

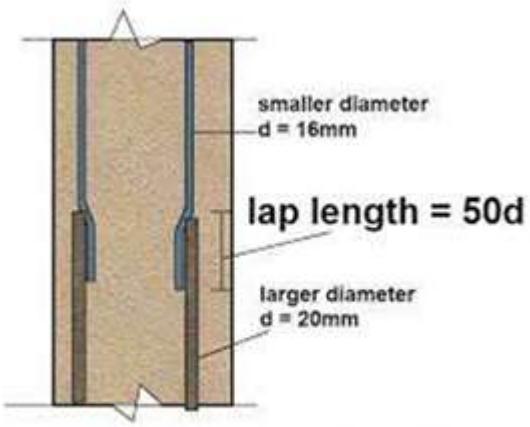
1 re-baring couples

Total no of columns -10 in which

4 columns are of size 7x1.5 foot = 70 laps 4 columns are of 5x1.5 foot = 60 laps

2 columns are 4.5 x1.5 foot = 55 laps Total no of laps are = 185

All above column use 25mm bars



Lap length

couple

- So the lap length will be 4 foot for 25mm bar
- So the steel weight per lap will be 1.174 kg
- And the cost of steel is 74 rs per kg
- So the cost of per lap of one foot will be 86.87rs
- Cost of 185 laps of 4 foot will be

64,288Rs per slab

Unit Weight of Steel		
Size	Kg/m	Kg/feet
6 mm	0.222 kg	0.067 kg
8 mm	0.395 kg	0.120 kg
10 mm	0.617 kg	0.188 kg
12 mm	0.89 kg	0.270 kg
16 mm	1.58 kg	0.480 kg
20 mm	2.47 kg	0.751 kg
25 mm	3.86 kg	1.174 kg
32 mm	6.32 kg	1.925 kg

Unit weight

- But with coupler method there is a issue at initial stage which is its hard for labour to adopt and which results in delay of reinforcement in work but the time is actually covered when there is no bending done for lap in it
- And the cost of couple is 78 rs for one couple and thread 22 per side
- So 185 x122 = 22570 rs
- And addition of miscellaneous cost of 40 thousand

2 PTC (Post tensioncable)

so the biggest positive side of this method is that it reduce the number of column and beam required for the slab

The slab which is consider as case study is 145x95 ft

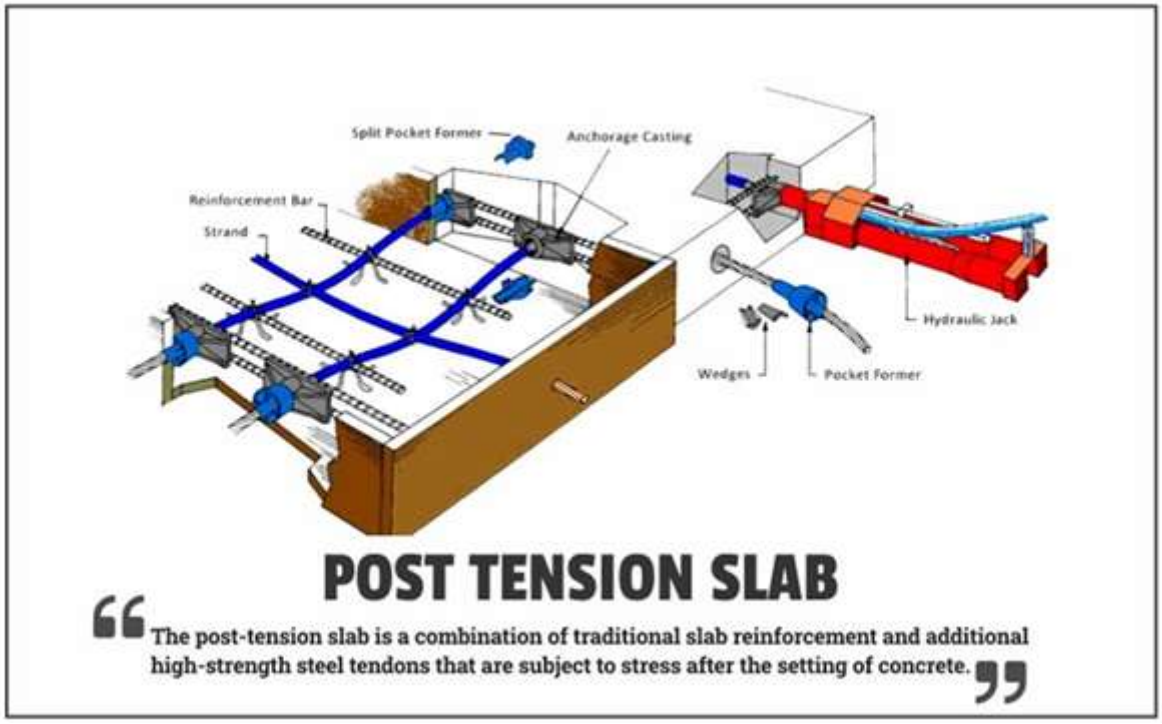
So the total cost for reinforcement is required is 30 ton which is equilivent to 2,220,000Rs and the concrete required for that slab will be around 350 mcube and cost of one mcube is 5500 rs so the cost of total concrete is 1,925,000

- The total cost of reinforcement and concrete is = 4,145,000
- The cost reduces because of using the PTC is 20 % which is 829,000
- The cost of pt cable per foot is 70 rs
- Number of cables

1. PTB1 is 48
2. PTB2 is 20
3. PTB3 is 4

Which is total 72 number

The running foot of cable is 65 feet



PTS

- So the total running foot for PT Cable is 72x65 = 4680
- Cost of PT cable is 70x4680= 372600 rs
- And addition of miscellaneous expense of 20 thousand Total cost of PT cable is 392600

3tie rod and anchor bar

One anchor bar cost 250 rs and 2 are used with one tie rod which costs 450 rs

So for 60 foot of shuttering of retaining wall we will need 90 tie rod and 180 anchor bar

Cost for 60 foot shuttering will be Tie rod – 40500

Anchor bar – 45000

Tie rod – 40500 Anchor bar - 45000

Total cost for 60 foot of work will be 85500

So the days of shuttering in average reduce to 2.5 days which was previously 5 days

For work of 250 running foot which was done in 21 days can be done in 11 days in which 12 labours are used

couple & anchor bar

Data Analysis for Second slab 1 re-baring couples

Total no of columns -10 in which

4 columns are of size 7x1.5 foot = 70 laps 4 columns are of 5x1.5 foot = 60 laps

2 columns are 4.5 x1.5 foot = 55 laps Total no of laps are = 185

All above column use 25mm bars

So the lap length will be 4 foot for 25mm bar

Couple 2

So the steel weight per lap will be 1.174 And the cost of steel is 74 rs per kg

So the cost of per lap of one foot will be 86.87rs Cost of 185 laps of 4 foot will be

64,288Rs per slab

- Now this time when the labour was able to adopt this process the delay in work was reduced as compared before and along with that there is time saving in the bending of reinforcement
- And the cost of couple is 78 rs for one couple and thread 22 per side
- So 185 x122 = 22570 rs

And addition of miscellaneous cost of 40 thousand

2 PTC (Post tension cable)

- So the biggest positive side of this method is that it reduce the number of column and beam required for the slab
- The slab which is consider as case study is 145x95 ft
- So the total cost for reinforcement is required is 30 ton which is equilivent to 2,220,000Rs and the concrete required for that slab will be around 350 mcube and cost of one mcube is 5500 so the cost of total concrete is 1,925,000
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Cost for 60 foot shuttering will be Tie rod – 40500

Anchor bar - 45000

Tie rod – 40500 Anchor bar - 45000

Total cost for 60 foot of work will be 85500

But while this time there was damage in the material which was equivalent to 10 thousand

So the days of shuttering in average reduce to 2.5 days which was previously 5 days

For work of 250 running foot which was done in 21 days can be done in 11 days in which 12 labours are used

5. Result:-

For Slab 1

Item	Time (Days)	Labour (No)	Cost (Rs)
Re-Baring couple	-1	4	24288
PTC (Post tensioncable)	-2	24	436400
Third tie rod and anchor bar	+11	12	-85500
total	+8	40	375188

6.1 Result FS

So for the first slab the days were saved was 8 number of labour was 40 and the amount saved was 375188 Rs

For Slab 2

Item	Time (Days)	Labour (No)	Cost (Rs)
Re-Baring couple	-1	4	24288
PTC (Post tensioncable)	-2	14	436400
Third tie rod and anchor bar	+14	12	-10000
total	+11	30	450688

6.1 Result SS

So for the second slab the days were saved was 11 number of labour was 30 and the amount saved was 375188 Rs

6. Conclusion:-

In the first slab it is observed that the cost is reduced by 375188 in all the three processes and there is 8 day saved and labour used was 40 But In the second slab it is observed that the cost is reduced by 450688with save of 11 days and the labour used was 30 only compare to first slab

Future Directions

i. More methods for replacement in residential construction can be done

ii. There can be advance method instead of normal methods

iii. More ways to reduce the cost and replacement in the process of construction can be done

iv. Along with methods the time taken to the labor adaptability and the time to adjust to work done should be notice

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