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Research Article

AN APPLICATION OF VALUE ENGINEERING TO INDUSTRIAL PROJECT

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ABSTRACT

Value engineering is a technique which is considered a boon for the project management sector. It is very important to analyze all functions for all projects as there can be many substitute alternatives which can be considered for a project which will help us to have a better management of the construction projects. In this paper we analyzed an industrial project by dividing all the various activities of the projects into their respective functions. Further we analyzed the percentage total cost of the project with respect to their sub functions and total functions. Secondly by selecting critical elements we carried value engineering relative to their function. The project concluded by achieving 15% cost reduction and thereafter we analyzed their effects with the help of Interaction matrix. Finally by comparison of the interaction matrixes we could provide relative correlation between impact factor and cost reduction.

INTRODUCTION

Value engineering (VE) is always a structured & also an analytical process that mainly seeks to achieve the value for the money by always providing with all necessary functions that are available at the possible lowest cost always consistent with the required levels of quality & also the performance of the function. VE which has been from long time widely used in many of the developed countries from several decades is now a useful tool which is capable of helping the industry to meet the challenges ahead. On one aspect, the major reason for choosing VE, accordingly are with a view of achieving cost saving, also for establishing a clear project objective & also for providing a creative thinking for the function of design improvement. This target is very difficult to be met unless it is possible for us to have a clear picture of what the actual situation of the projects is in terms of three aspects i.e. time, cost & the quality which are considered to be crucial cause and if of major concern in Value engineering process. Also, for getting to assess the process of value engineering, it is considered necessary therefore to implement the feedback system which is to be used during the execution of the project.

On the other aspect, as a matter of the fact, we can consider that the construction projects are always subjected to changes so that there is always a requirement of this current issues to have the updated feedback through the whole process involved in the construction projects. Getting timely & targeted feedback can mainly able the project management concerned to identify the problems as early as possible and thus make adjustments which help to keep the projects on time & in budget. Earned Value engineering has thus proven itself to be one of the best effective ways of performance measurement & also considered as a best feedback tools for managing the projects which has a close relation with all the concerns of value. It would therefore be found to be helpful to find a way so that we can make the process on a more efficient & an effective so that we can decrease the cost of undertaking VE.

VE has been always used to improve the value of projects in all the government, the private, & also the manufacturing & construction industries/sectors & also the value concepts have been spread worldwide. Concurrent to this fast growth, a number of many other value improvement tools, techniques & also processes which has emerged, out of which many of them were considered to be complementary and also were integrating with the value concepts.

There are numerous angles which can confer poor value to the project. (1) Proper data is not considered as there is time lack. (2) Whenever there is an issue a few changes are done and the issues are attempted to be settled which does not have the quality. (3) Sometimes the necessities and requirements of the client are not thought about and after the finishing of the

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projects it does not have its capacities for which it was intended to be. (4) No legitimate correspondence is been done and couple of perspectives are misconstrued.

Value engineering can be connected for different perspectives. Few of the utilizations are: (1) it can be utilized for lessening of superfluous cost on existing task. (2) It can help in deciding the conceivable choices which is best for the project. (3) The timetable of the project which was deferred because of unverifiable circumstances can be made strides. (4) Whenever there is danger for chance in extend Value building can help in decreasing danger. (5) It is granted for better quality, unwavering quality and fulfillment of the considerable number of requirements of client. (6) The performance of association can likewise be enhanced to a superior degree.

LITERATURE REVIEW

Review of Technical papers

Hongping Wang and Xuwei Li. "The application of value engineering in project decision-making" (2013)

1. The main objective of the research is to show how to utilize the value engineering methods to make a good scientific & decisions which are sound so that we can achieve better benefits in a construction project for effective investment decision making.
2. Firstly defining the function is an important aspect and basically it is divided in to five categories: social, technical, suitable, physical and aesthetic functions.
3. Then calculating imp function factor and finally we calculate the function coefficient of each program and also the value coefficient of each function. By comparing both we can analyze the best alternative to be selected.
4. The author concluded that the project decision-making is the significant factor as it can make functions more reasonable.

Li Ning "Cost Control Application Research of Value Engineering in the Design phase of Construction project" (2015)

1. The main objective of this research paper is to tell us the importance of enhancing Value engineering in the most productive phase of Value engineering-Design phase.
2. The methodology which was adopted was firstly to find an appropriate project. Further we had to analyze the functional importance coefficient on the basis of the ratings given by user, designers and construction unit.
3. Then we need to do value engineering on with the best possible alternatives practical. Lastly we needed to find the technical and economical index.
4. The alternative with the greater geometric average was to be selected as the best option. This paper tells us that at the design stage by applying it makes it better and viable.

Nimitha Vijayaraghavan and A S Wayal "Effects of Manufacturing sand on compressive strength and workability of concrete" (2013)

1. The main objective of this research paper is to compare between the compressive strength and workability of concrete with the use of manufactured and natural sand.
2. The methodology was to do an experiment of making concrete cubes on varying proportions of natural and manufactured sand. Then the casted cubes were to be tested for 7 and 28 days.
3. Also the workability of the concrete was tested. Further the comparison between the results was to be done.
4. The comparison showed that the mix with complete manufactured sand was having higher compressive strength as compared to other mixes.

A Singh R, Himanshu S.K, Bhalla N, "Reinforcement Couplers as an Alternative to Lap Splices: A Case study" (2013)

1. The main objective of this research paper is to check the use of couplers in the reinforcement steel and thus how cost effective is this method in comparison with other conventional methods.
2. There was a case study which was considered on a under construction site where the couplers was used. An estimation of the cost of couplers was been done. Also the cost of use of steel lapping was also calculated.
3. Further a comparison was done to check the difference of cost in lapping and use of couplers.
4. The results showed that the use of reinforcement couplers significantly reduced the consumption of both time and reinforcing steel cost. It also increases overall reliability of reinforcement splices.

Amit Sharma and Harshit Srivastava. "A Case study analysis through the implementation of Value engineering" (2011)

1. The paper tells us about the basic fundamental values of VE and its different phases which can be implemented in a project.
2. In this paper we see that initially the functional analysis worksheet is prepared on basis of their respective function as basic and secondary function. Then the functional evaluation is carried on basis of the weight age basis and the percentage of cost is identified.
3. Later the function cost matrix is formed in which we find the relationship between the weight and function of product.
4. The author concluded that the VE should be well understood by all levels of organization and an effective team is required for the best implementation of value engineering.

DATA COLLECTION

General Detail of case study

Name of Site: Mahasainik Industrial Estate
Name of Group: MESCO (Maharashtra Ex-Servicemen Cooperation Ltd)
Site Location: Plot No 153/1, “T” Block, Pimpri Industrial Area, Bhosari MIDC, Pune-411026.
Total Area: 2.5 Acre
Cost of Project: 22 Crore

Background of the project

“Mahasainik Industrial Estate”, a prestigious project undertaken by MESCO (Maharashtra Ex-Servicemen Cooperation Ltd.) which consists of a Main workshop building having 120 flatted industrial shops with floor areas ranging from 500 to 1000Sqft and an Administrative and Amenity Building in a 2.5acre of land. This project is been undertaken in

Bhosari MIDC Area which is an industrial area where many micro medium and macro industries are there. The project cost is about 22crores.

The Mahasainik Industrial Estate is the first unique project in the country to promote employment generation for technically qualified, adequately experienced and well disciplined Ex-

METHODODLOGY

STEP 1
- Collection of all data and categorising it into groups based on its functionality

STEP 2
- Calculating percentage value of the elements and then finding for the key elements for consideration of value engineering

STEP 3
- Apply value engineering to find best possible alternatives for the critical elements and estimating the new cost

STEP 4
- To find relationship between the function & effects of found alternative and the project using Interaction matrix

STEP 5
- Finally by applying Tabulated comparison between the interaction matrix we find the best possible combination to be implemented for achieving cost reduction.

Fig 1 MSIE Layout

The project mission is as follows: 1) to establish high-tech industrial estate for manufacturing of Components/Assemblies of Engineering, Automobile categories & also for manufacturing Fabricated Items / Assemblies. 2) To generate direct and indirect job opportunities for about 2450 persons, for executing this project. The job opportunities will be available to Ex-Servicemen, their wards, disabled soldiers; war disabled soldiers and war widows.

These are the first generation entrepreneurs. MESCO will establish 120 micro industries and will implement the industrial project efficiently with effective management by the technically expert, retired defense officers of MESCO. The estate will have RCC workshop construction, in flatted factory complex having 120 industrial flats, all for micro industries, in order to manufacture components and assemblies of engineering and automobile categories and fabricated items and assemblies.

Analysis of Data

Functional Classification

Firstly in the analysis part of the data we need to classify the various activities available in the different sub functions into their respective functions. For classifying it was necessary to analyze the data and think about various functions which possibly we could select for the classification.

Following were the classifications considered:

Table 1 Functional classification

Sr No	Function
1	**Substructure (SB)**
2	**Superstructure (SP)**
3	**Structural (S)**
4	**Finishing (F)**
5	**Mechanical Electrical Plumbing (MEP)**
6	**Fire fighting (FF)**
7	**Miscellaneous (M)**

Percentage Value of functions

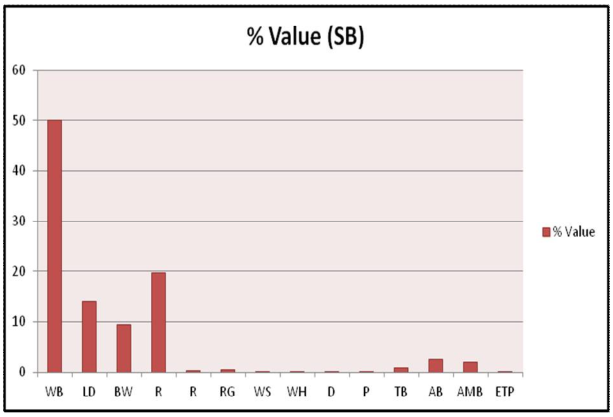
After classification of all activities into various functions the 2nd step is to analyze for the percentage value of each activities. For this purpose we firstly classify all the activities from all buildings into their respective functions and thereafter we analyze the net percentage value and total percentage value. We use the following formulas for analyzing the same:

Net Percentage value= $\frac{\textit{Amount of particular item}}{\textit{Net total of the sub item function}}$x100

Total Percentage value= $\frac{\textit{Net total of the sub item function}}{\textit{Total cost of the entire function}}$x100

After carrying out the percentage values the next step is representing the values with help of a graph so that better understanding is achieved for the further selection of items. Following are the % value graphs of the respective graphs:

% Value (Sub structure)

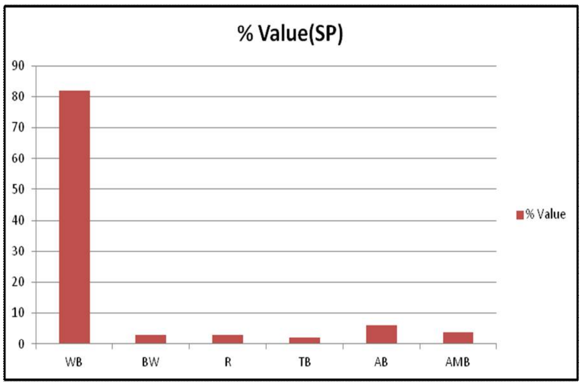


Graph 1 % Value (Sub structure)

Table 2 Sub structure

Sub Structure (SB)			
Sr No	Description	Short form	% Value
1	Workshop building	WB	**50.08**
2	Land development and levelling	LD	**13.97**
3	Boundary wall	BW	**9.46**
4	Roads	R	**19.73**
5	Ramp	R	**0.4**
6	Road side Greenary	RG	**0.59**
7	Water supply	WS	**0.09**
8	Water harvesting	WH	**0.07**
9	Drainage	D	**0.054**
10	Power	P	**0.15**
11	Toilet Building	TB	**0.84**
12	Administrative Building	AB	**2.48**
13	Amenity Building	AMB	**1.98**
14	Effluent Treatment plant	ETP	**0.11**

% Value (Super structure)

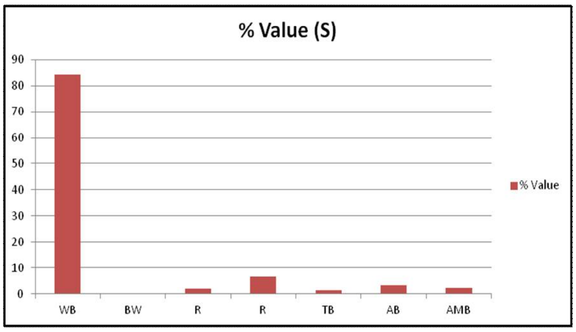


Graph 2 % Value (Super structure)

Table 3 Super structure

Super Structure (SP)			
Sr No	Description	Short form	% Value
1	Workshop building	WB	**82.05**
2	Boundary wall	BW	**2.95**
3	Ramp	R	**3.06**
4	Toilet Building	TB	**2.10**
5	Administrative Building	AB	**5.93**
6	Amenity Building	AMB	**3.91**

% Value (Structural)

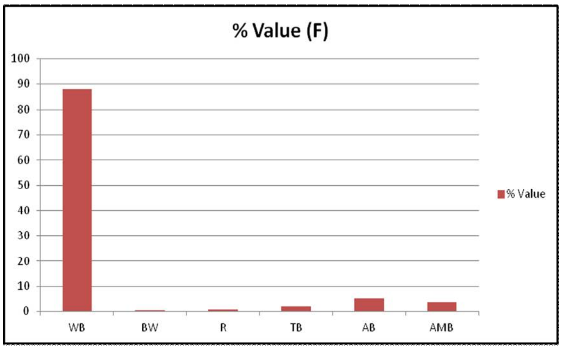


Graph 3 % Value (Structural)

Table 4 Structural

Structural (S)			
Sr No	Description	Short form	% Value
1	Workshop building	WB	**84.06**
2	Boundary wall	BW	**0.08**
3	Roads	R	**2.03**
4	Ramp	R	**6.78**
5	Toilet Building	TB	**1.36**
6	Administrative Building	AB	**3.39**
7	Amenity Building	AMB	**2.30**

% Value (Finishing)

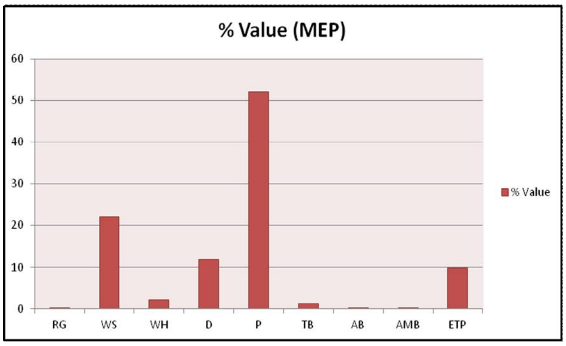


Graph 4 % Value (Finishing)

Table 5 Finishing

Finishing (F)			
Sr No	Description	Short form	% Value
1	Workshop building	WB	**88.13**
2	Boundary wall	BW	**0.19**
3	Ramp	R	**0.78**
4	Toilet Building	TB	**1.91**
5	Administrative Building	AB	**5.36**
6	Amenity Building	AMB	**3.62**

% Value (Mechanical Electrical Plumbing)

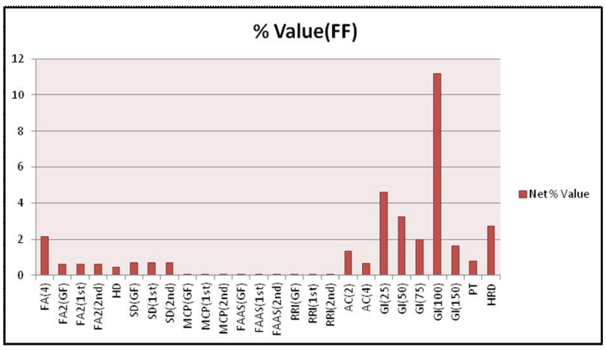


Graph 5 % Value (MEP)

Table 6 MEP

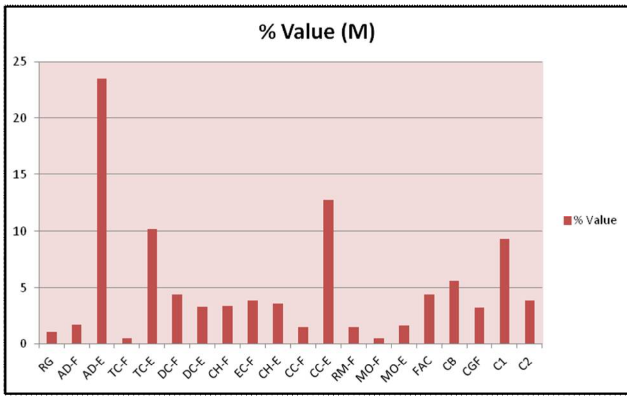
Mechanical Electrical Plumbing (MEP)			
Sr No	Description	Short form	% Value
1	Road side Greenary	RG	**0.15**
2	Water supply	WS	**22**
3	Water harvesting	WH	**2.3**
4	Drainage	D	**11.92**
5	Power	P	**52.1**
6	Toilet Building	TB	**1.27**
7	Administrative Building	AB	**0.24**
8	Amenity Building	AMB	**0.1**
9	Effluent Treatment plant	ETP	**9.92**

% Value (Fire Fighting)



Graph 6 % Value (Firefighting)

% Value (Miscellaneous)



Graph 7 % Value (Firefighting)

Table 7 Firefighting

Miscellaneous (M)			
Sr No	Description	Short form	% Value
1	Road side Greenery	RG	**1.08**
2	ADM Furniture	AD-F	**1.7**
3	ADM Equipments	AD-E	**23.49**
4	Telecommunication centre Furniture	TC-F	**0.52**
5	Telecommunication centre Equipments	TC-E	**10.21**
6	Documentation centre Furniture	DC-F	**4.43**
7	Documentation centre Equipments	DC-E	**3.31**
8	Conference hall Furniture	CH-F	**3.37**
9	Exhibition centre Furniture	EC-F	**3.88**
10	Conference hall/Exhibition centre Equipments	CH-E	**3.59**
11	Cyber centre Furniture	CC-F	**1.51**
12	Cyber centre Equipments	CC-E	**12.78**
13	Raw material storage Furniture	RM-F	**1.51**
14	Marketing outlet Furniture	MO-F	**0.53**
15	Marketing outlet Equipments	MO-E	**1.65**
16	First aid centre	FAC	**4.4**
17	Canteen Facilities-Basement storage	CB	**5.62**
18	Ground floor kitchen	CGF	**3.24**
19	1st floor Dining hall for staff	C1	**9.29**
20	2nd floor dining hall for staff	C2	**3.89**

Value Engineering done

The next step we carried out is selecting of the critical items from the following graphs and tables. We took into consideration 94% of the items in the respective functions for value engineering to be carried out. Only the first **4** functions are taken into consideration as per the requirement of client. The following table shows us the cost reduction achieved in each items and also the % cost reduction with respect to the difference in amount with the previous cost of the respective items.

Table 8 VE(Substructure)

Sub Structure (SB)					
Sr No	Building	Activity	VE Applied	Cost Reduction	% Cost Reduction
1	Workshop Building	PCC	Use of robo sand as substitute to river sand	**Rs. 2,40,800**	**18.52**
		RCC Foundation	Use of robo sand as substitute to river sand	**Rs. 6,57,000**	**10.29**
		RCC Retaining wall	Use of robo sand as substitute to river sand	**Rs. 1,64,250**	**7.15**
2	Boundary wall	PCC	Use of robo sand as substitute to river sand	**Rs. 68,800**	**18.52**
3	Roads	PCC	As Bituminous road does not need PCC	**Rs.15,04,170**	**100**
		RCC road	Bituminous Road	**Rs. 12,01,220**	**34.32**
Total Cost Reduction				**Rs. 40,28,052/-**	

Table 9 VE (Super structure)

Super Structure (SP)					
Sr No	Building	Activity	VE Applied	Cost Reduction	% Cost Reduction
1	Workshop Building	RCC Columns	Use of robo sand as substitute to river sand	**Rs. 2,95,650**	**8.90**
		RCC Floor beams, Staircase cap etc	Use of robo sand as substitute to river sand	**Rs. 11,16,900**	**8.55**
		RCC Lintel beams	Use of robo sand as substitute to river sand	**Rs. 1,97,100**	**8.55**
		RCC Floor slabs, staircase slabs etc	Use of robo sand as substitute to river sand	**Rs. 16,75,350**	**8.33**
		RCC Chajja	Use of robo sand as substitute to river sand	**Rs. 98,550**	**8.33**
		OHWT Slabs	Use of robo sand as substitute to river sand	**Rs. 16,425**	**8.33**
		OHWT Wall	Use of robo sand as substitute to river sand	**Rs. 9,855**	**7.15**
		230mm flyash brickwall	Use of 200mm seeporex	**Rs. 6,92,000**	**28.36**
		18mm thick External plaster	Silpoz sand as substitute	**Rs. 5,07,500**	**38.56**
		12mm thick Internal plaster	Ceiling gypsum plaster	**Rs. 18,14,000**	**23.33**
2	Boundary wall	230mm flyash brickwall	Wall size reduced to 150mm	**Rs. 4,38,400**	**44.92**
3	Ramp	RCC Foundation	Use of robo sand as substitute to river sand	**Rs.16,425**	**10.29**
		RCC Columns	Use of robo sand as substitute to river sand	**Rs. 13,140**	**8.9**
		RCC Beams	Use of robo sand as substitute to river sand	**Rs. 39,420**	**8.55**
		RCC Slabs	Use of robo sand as substitute to river sand	**Rs. 72,270**	**8.33**
4	Toilet Building	230mm flyash brickwall	Wall size reduced to 150mm	**Rs. 1,31,520**	**44.92**
5	ADM Building	RCC Columns	Use of robo sand as substitute to river sand	**Rs. 21,024**	**8.9**
		RCC tie/plinth beams	Use of robo sand as substitute to river sand	**Rs. 6,570**	**8.55**
		RCC Floor beams	Use of robo sand as substitute to river sand	**Rs. 32,850**	**8.55**
		RCC Lintel beams	Use of robo sand as substitute to river sand	**Rs. 6,570**	**8.55**
		RCC Floor slabs	Use of robo sand as substitute to river sand	**Rs. 59,130**	**8.33**
		RCC Chajja	Use of robo sand as substitute to river sand	**Rs. 5,913**	**8.33**
		RCC Retaining wall	Use of robo sand as substitute to river sand	**Rs. 29,565**	**7.15**
		RCC OHWT Slab	Use of robo sand as substitute to river sand	**Rs. 7,884**	**8.33**
		RCC OHWT wall	Use of robo sand as	**Rs. 3,492**	**7.15**

Table 10 VE (Structural)

Structural (S)					
Sr No	Building	Activity	VE Applied	Cost Reduction	% Cost Reduction
1	Workshop Building	Reinforcement steel	Use of tapered thread couplers in place of lap for columns	**Rs. 13,17,528**	**3.82**
2	Ramp	Reinforcement steel	Use of tapered thread couplers in place of lap for columns	**Rs. 1,04,502**	**3.76**
3	ADM Building	Reinforcement steel	Use of tapered thread couplers in place of lap for columns	**Rs. 24,272**	**1.75**
4	Roads	Reinforcement steel	As bituminous road considered no steel needed	**Rs. 8,33,475**	**100**
Total Cost Reduction				**Rs. 22,79,778/-**	

Table 11 VE(Finishing)

Finishing (F)					
Sr No	Building	Activity	VE Applied	Cost Reduction	% Cost Reduction
1	Workshop Building	Aluminium sliding windows	Use of MS Grill windows	**Rs. 1,32,23,000**	**54.93**
		MS Rolling shutter	GI Automated rolling shutter	**Rs. 24,75,000**	**45.83**
		Toilet Granite frame with pvc door	Eureka PVC Door with frame	**Rs. 3,00,000**	**60**
2	Toilet building	Toilet Granite frame with pvc door	Eureka PVC Door with frame	**Rs. 1,20,000**	**60**
3	ADM Building	Aluminium sliding windows	Use of 2 track shutters with design glass	**Rs. 1,48,680**	**36.03**
		Toilet Granite frame with pvc door	Eureka PVC Door with frame	**Rs. 76,500**	**60**
		Green marble-staircase	Glazed ceramic tiles for Riser and skirting	**Rs. 39,700**	**11.94**
		Vitrified tiles	Glazed ceramic tiles	**Rs. 2,90,400**	**33.61**
4	Amenity Building	Aluminium sliding windows	Use of 2 track shutters with design glass	**Rs. 92,925**	**36.03**
		Green marble-staircase	Glazed ceramic tiles for Riser and skirting	**Rs. 43,670**	**12.80**
		Vitrified tiles	Glazed ceramic tiles	**Rs. 1,93,600**	**33.61**
Total Cost Reduction				**Rs. 1,78,53,649/-**	

Now we show the cost reduction table showing the amount of cost savings we achieved in the respective buildings.

Table 12 VE (Finishing)

Cost reduction achieved		
Sr No	Function	Cost savings
1	Sub structure	**Rs. 40,28,052**
2	Super structure	**Rs. 90,63,906**
3	Structural	**Rs. 22,79,778**
2	Finishing	**Rs. 1,78,53,649**
TOTAL SAVINGS		**Rs. 3,32,25,385**
% Cost savings achieved		15.12%

Interaction matrix

The next step is for carrying out interaction matrix and we find the relative relationship between the functions value engineered and their effects to the project. We decide upon weight age criteria which are used for giving weight age to the effects.

Following are the effects considered for the value engineering done:

EFFECTS	**Quality considerations** **Environmental considerations** **Financial impact** **Technical considerations** **Client considerations** **Project considerations**

These are the following weight age criteria considered:

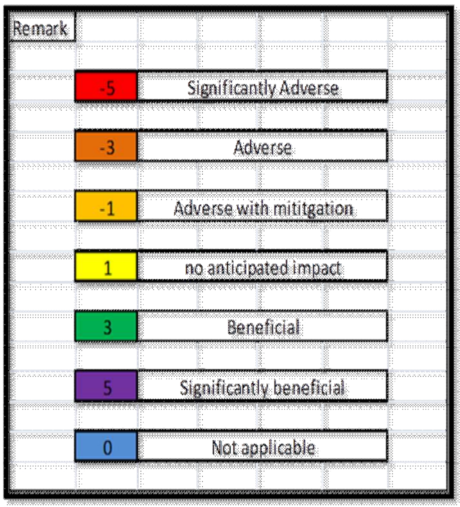


Fig 2- Weight age criteria

Final analysis

Finally we need to carry out the final analysis for the value engineering carried out. After the collection of 4 Interaction matrixes we need to analyze the results. As shown in the table no 13 we can see how the average impact factor is been calculated by the comparison of the interaction matrix. Then further we arranged the value engineered function on the basis of their rank starting from positive impact factor to negative impact factor. Further in table no 14 we see the final analysis showing the correlation between the impact factor and cost reduction achieved.

Table 13 Impact factor comparison

				IMPACT FACTOR					
				Interaction matrix (SGS)	**Interaction matrix (Medayil)**	**Interaction matrix (MESCO)**	**Interaction matrix (LKS)**	**Avg Impact factor**	**Rank**
Function	**Sub structure**	**WB**	**PCC**- Use of robo sand	25	11	9	3	**12**	43
			RCC(F)- Use of robo sand	24	16	13	6	**14.75**	22
			RCC(RW)- Use of robo sand	27	18	11	4	**15**	19
		BW	**PCC**- Use of robo sand	26	11	11	1	**12.25**	42
		RCC road	**PCC**- Use of robo sand	0	0	0	0	**0**	59
			Road- Bituminious road	10	1	16	-14	**3.25**	56
	Super structure	**WB**	**RCC©**- Use of robo sand	25	17	11	3	**14**	32
			RCC(FB)- Use of robo sand	28	16	12	3	**14.75**	23
			RCC(LB)- Use of robo sand	28	16	14	3	**15.25**	14
			RCC(FS)- Use of robo sand	22	19	17	3	**15.25**	15
			RCC(Ch)- Use of robo sand	30	20	11	3	**16**	8
			RCC(TS)- Use of robo sand	22	15	13	3	**13.25**	39
			RCC(TW)- Use of robo sand	28	18	13	3	**15.5**	11
			BW- Use of seeporex	48	37	37	10	**33**	1
			EP- Use of silpoz	22	-3	27	8	**13.5**	35
			IP- Use of ceiling gypsum	49	36	26	17	**32**	2
		BW	**BW**- Wall size reduced	15	18	15	-2	**11.5**	44
		Ramp	**RCC(F)**- Use of robo sand	24	16	13	8	**15.25**	16
			RCC©- Use of robo sand	25	17	11	3	**14**	33
			RCC(FB)- Use of robo sand	28	16	12	3	**14.75**	24
			RCC(FS)- Use of robo sand	22	19	17	1	**14.75**	25
		TB	**BW**- Wall size reduced	15	18	15	-2	**11.5**	45
	Super structure	**ADM Bldg**	**RCC©**- Use of robo sand	25	17	9	3	**13.5**	36
			RCC(PB)- Use of robo sand	28	16	12	3	**14.75**	26
			RCC(FB)- Use of robo sand	28	16	12	3	**14.75**	27
			RCC(LB)- Use of robo sand	28	16	14	3	**15.25**	17
			RCC(FS)- Use of robo sand	22	19	17	1	**14.75**	28
			RCC(Ch)- Use of robo sand	30	20	11	3	**16**	9
			RCC(RW)- Use of robo sand	27	18	11	4	**15**	20
			RCC(TS)- Use of robo sand	22	15	13	3	**13.25**	40
			RCC(TW)- Use of robo sand	28	18	13	3	**15.5**	12

Table 14 Impact factor and cost reduction final analysis

Impact factor and cost reduction final analysis						
	Initial cost		**219682133**			
Sr No	**Functions**		**Average Impact factor**	**Total savings**	**New cost**	**% Cost reduction**
1	**Workshop building**	**BW**- Use of seeporex	**33**	692000	218990133	**0.3150**
2	**Workshop building**	**IP**- Use of ceiling gypsum	**32**	1814000	217176133	**1.1407**
3	**ADM Building**	**IP**- Use of gypsum	**31.5**	245000	216931133	**1.2523**
4	**Amenity building**	**IP**- Use of gypsum	**31.5**	154800	216776333	**1.3227**
5	**Workshop building**	**TD**- Use of PVC frame and door	**18.25**	300000	216476333	**1.4593**
6	**Toilet building**	**TD**- Use of PVC frame and door	**18.25**	120000	216356333	**1.5139**
7	**ADM Building**	**TD**- Use of PVC frame and door	**18.25**	76500	216279833	**1.5487**
8	**Workshop building**	**RCC(Ch)**- Use of robo sand	**16**	98550	216181283	**1.5936**
9	**ADM Building**	**RCC(Ch)**- Use of robo sand	**16**	5913	216175370	**1.5963**
10	**Amenity building**	**RCC(Ch)**- Use of robo sand	**16**	5256	216170114	**1.5987**
11	**Workshop building**	**RCC(TW)**- Use of robo sand	**15.5**	9855	216160259	**1.6032**
12	**ADM Building**	**RCC(TW)**- Use of robo sand	**15.5**	3492	216156767	**1.6048**
13	**Amenity building**	**RCC(TW)**- Use of robo sand	**15.5**	2628	216154139	**1.6060**
14	**Workshop building**	**RCC(LB)**- Use of robo sand	**15.25**	197100	215957039	**1.6957**
15	**Workshop building**	**RCC(FS)**- Use of robo sand	**15.25**	1675350	214281689	**2.4583**
16	**Ramp**	**RCC(F)**- Use of robo sand	**15.25**	16425	214265264	**2.4658**
17	**ADM Building**	**RCC(LB)**- Use of robo sand	**15.25**	6570	214258694	**2.4688**
18	**Amenity building**	**RCC(LB)**- Use of robo sand	**15.25**	5256	214253438	**2.4712**
19	**Workshop building**	**RCC(RW)**- Use of robo sand	**15**	164250	214089188	**2.5459**
20	**ADM Building**	**RCC(RW)**- Use of robo sand	**15**	29565	214059623	**2.5594**
21	**Amenity building**	**RCC(RW)**- Use of robo sand	**15**	16425	214043198	**2.5669**
22	**Workshop building**	**RCC(F)**- Use of robo sand	**14.75**	657000	213386198	**2.8659**
23	**Workshop building**	**RCC(FB)**- Use of robo sand	**14.75**	1116900	212269298	**3.3743**
24	**Ramp**	**RCC(FB)**- Use of robo sand	**14.75**	39420	212229878	**3.3923**

CONCLUSION

The success of the project depends on various factors which are involved in a project such as the methods applied for the projects, the internal and external factors associated with the projects.

accordance to the project and it is necessary as it can directly affect the fund requirements in the execution of project. It is necessary to identify the necessity of VE in any project. The VE can only be applied on projects which can have considerable cost benefit. Hence it is useful if we apply value engineering to a big project where the VE can bring considerable benefit to the organization. Also there should be a proper balance between all the things which are being applied to a project and also the needs of the customer should also be taken into consideration.

In this paper we got to achieve a 15% cost reduction in the total cost of project. After achieving the cost reduction it is very necessary to identify the impact/effects of the value engineered options with the project. The Interaction matrix was very helpful in achieving this relationship and with the comparison of the impact factor of each alternative we got average impact factor and finally we got achieve a relation between the impact factor and the cost reduction achieved which was considered to be the most effective method. Now it was possible to select the alternative which is found to be best as per their requirement.

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