ANALYSIS OF DOOR SYSTEM BY USING VALUE ENGINEERING TECHNIQUE

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Abstract - Value engineering or value analysis is a proven management technique using a systematized approach to seek out the best functional balance between the cost, reliability and performance of a product, project or process. During past few decades in Maharashtra (India) various types of doors has been applied to buildings. There is no any systematic approach used for evaluation of door system. It is only based on designer’s experience. From that it is observed that more cost is spending on that component which is of least use. Therefore door should perform their function with less cost than existing cost. This paper presents an evaluation and selection technique derived from value engineering principles for door system. The study includes different types of doors, materials used, the weighted evaluation techniques were used for selection of alternatives. In this the criterion used for the evaluation contains various factors like durability, strength, heat, fire and moisture resistivity, initial cost, material availability, maintenance cost, sound insulation etc. To select & prioritize a few doors among the various systems this evaluation technique will help to great extent. In this paper, an attempt has been made to evaluation and selection technique for doors that are available in Maharashtra (India).

Key Words: Value, Value Engineering, Value Analysis, Basic functions, weighted matrix, Evaluation criteria.

1. INTRODUCTION:
Low cost housing is a new concept in which planning for effective budgeting is done which reduces the cost by using locally available material, new techniques without disturbing the selection parameters. In developing countries such as India, only 20% of the population are high-income earners, who are able to afford normal housing units. The low-income groups in developing countries are generally unable to access the housing market. Hence it is necessary to afford a house to the low-income groups with the low cost. It is found that about 25% of the construction cost can be saved by using low cost housing technologies in comparison with the traditional construction methods. It is observed that very less attention is paid to the evaluation & selection of construction materials by design & consulting firms. For a single storey building about 40% cost requires for the finishing work. Hence for reducing the cost here I selected one building component for evaluation which is door.

A door is defined as a movable barrier through a building wall or partition. This provides an access to the inside of a building or rooms of a building. Door consists of two main components, frame and panel. Frame is used to hold the panel and panel is used to control access. When door opens, which admit people, animals, ventilation, and light. The door is used to control the physical atmosphere within a space by enclosing the air drafts, so that interiors may be more effectively heated or cooled. Doors are significant in preventing the spread of fire. They act as a barrier to noise.

2. LITERATURE REVIEW:
In recent times, a lot of work has been done in the value engineering. Also the work is carried on the low cost housing. In this paper the various research studies are used for the use of different materials for the components of low cost housing.

Swaptik Chowdhury, Sangeeta Roy (1)

In this paper the work is carried out on low cost & sustainable building materials in the areas where concrete or steel housing is expensive. This paper gives the availability of natural fibre in India & its applications to building materials. Also gives the properties of these building materials and their availability in different states in India.

Vivian W. Y. Tam (2)

This paper gives the comparison of construction cost with traditional and low cost housing technologies. For that case studies in India are used for the investigation. Strength and durability of the structure, stability, safety and mental satisfactions are factors that assume top priority during cost reduction. In this the comparison is done between the roofing and walling systems. It was found that about 26.11% and 22.68% of the construction cost, including material and labour cost, can be saved by using the low cost housing technologies in comparison with the traditional construction methods. Hence from this paper it is proven that using low cost housing technologies is a cost effective construction approach for the industry.

RINKU TAUR & VIDYA DEVI T (3)

This paper aims to use various prefabricated building methodologies for the low cost housing by highlighting the different prefabrication techniques, & its economical advantages achieved by its adoption. In this the components such as foundation, walls, doors and windows, floors and roofs are analyzed individually by using different building materials. This method is suitable for mass housing target which can reduce the construction cost & improve the speed of construction.

Value Engineering technique is used, for the selection & development of low cost technology & materials for door.

3. RESEARCH METHODOLOGY:

The Value engineering methodology considered in the following phases-

1. Information Phase
2. Functional analysis Phase
3. Creative Phase
4. Evaluation Phase
5. Recommendation Phase

4. DOOR SYSTEMS AVAILABLE IN INDIA:

In India there are different types of doors are used for the opening, for that different types of materials used for the panel and frame. In India Teakwood, Jungle wood and flush door materials that are commonly used for the manufacturing of door panel and frame. In building there is much more cost is spend on the doors, depends on the numbers used. Hence it is necessary to save the total cost of building by reducing the cost of doors. Following are the advantages and disadvantages of such types of doors.

Conclusion - From the above research studies it is observed that lot of work is carried on the low cost housing. They have used various technologies & natural materials for the construction of a low cost house. But while selecting the materials they have not used Value Engineering technique for the selection of materials. Hence in this paper materials that are commonly used for the manufacturing of door panel and frame. In building there is much more cost is spend on the doors, depends on the numbers used. Hence it is necessary to save the total cost of building by reducing the cost of doors. Following are the advantages and disadvantages of such types of doors.
Sr. No. | Type of Door & Frame | Advantages | Disadvantages
--- | --- | --- | ---
1 | Teakwood | Durable, resistance to water, Chemical free, smooth surface, sound insulation, resistance to termite, life long, Available in different design & color. | Re-polishing is necessary, Not fire resistance & crack resistance.
2 | Jungle wood | Heat resistance, available in many designs, smooth surface, sound insulation, weather resistant, termite proof. | Life is less; it bends after some years, expansion & contraction done.
3 | Flush door | Termite resistant, durable in all weather, powder free, Termite free, water resistant, eco friendly, design accuracy. | Oil paint necessary, life is less.

Table (a) cost of doors

By considering advantages & disadvantages of different types of timber doors, we can consider the cost of each type for that the size of door is 3’x6’. The cost is as follows:

<table>
<thead>
<tr>
<th>Type of Door</th>
<th>Cost (Rs.)</th>
<th>Total cost (Rs.)</th>
<th>Average cost (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Door</td>
<td>Door Frame</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Teakwood- a) Ghana</td>
<td>7300</td>
<td>4400</td>
<td>11700</td>
</tr>
<tr>
<td>b) Kokan</td>
<td>6000</td>
<td>3500</td>
<td>9500</td>
</tr>
<tr>
<td>c) Punama</td>
<td>6750</td>
<td>4150</td>
<td>10900</td>
</tr>
<tr>
<td>2) Jungle wood- a)Limb</td>
<td>3000</td>
<td>1300</td>
<td>4300</td>
</tr>
<tr>
<td>b) Akeshia</td>
<td>4400</td>
<td>2450</td>
<td>6850</td>
</tr>
<tr>
<td>c) Kinjal</td>
<td>2430</td>
<td>1110</td>
<td>3540</td>
</tr>
<tr>
<td>3) Flush Door – a) Bison panel</td>
<td>1700</td>
<td>1200</td>
<td>2300</td>
</tr>
<tr>
<td>b) Shakti Hardwood</td>
<td>2400</td>
<td>1200</td>
<td>3600</td>
</tr>
<tr>
<td>c) Wood green 100% Hardwood</td>
<td>2700</td>
<td>1200</td>
<td>3900</td>
</tr>
<tr>
<td>d) Chetak 100% Hardwood</td>
<td>2800</td>
<td>1200</td>
<td>4000</td>
</tr>
</tbody>
</table>

Table (b) cost of doors

From the above cost table it is observed that the total cost of door is more which is not economical to the common people. Door frame required 40% cost of total cost of door. If we reduce the cost of door frame then automatically reduces the total cost of door. For this the solution is to reduce the cost of door by using the alternative material for the components.

For reducing the total cost door first reduce the cost of door panel and frame. If we make the door without frame then ultimately reduces the total cost of door. For that the solution is make the door frameless such as sliding door, hinged door. For making the door frameless there is a solution of sliding door by using the low cost material for the panel. Hence such type of door is economical to the common people.

5. VE JOB PLAN:

In search of unnecessary costs, the VE technique has developed a systematic approach that is known as a job plan. The job plan consists of a different phases. These phases have to be applied in a sequential way.

The phases which are included in a job plan are as: 1) Information Phase, 2) Function Phase, 3) Creative Phase, 4) Evaluation Phase, 5) Recommendation Phase. We can apply these different phases to the different types of door for eliminating the unnecessary costs and make the door economical.
1) Information Phase -

The information phase involves the definition of the project, background information leading to product design, limitations and sensitivity to the costs involved in owning and operating the facility. The purpose of this phase is to gain as much information and knowledge as possible on the project design.

2) Function Phase –

This phase is used to clearly identify the work involved and the requirements of the project. It helps to identify what we really want to do and how we really should have to pay for doing it.

2.1 Component of door –

In this the door is divided into the different components, which are 1) Frame, 2) Panel, 3) Hinge, 4) Lock system, 5) Tower bolt, 6) Stopper, 7) Eye hole, 8) Door handle.

2.2 Feature Function Matrix of Door –

The next step in this phase is to identify the basic function of the project, process. The method is defined in two words- active verb & measurable noun. In this the component is divided into sub-components & their functions are identified in the basic & secondary form.

2.3 Function-Cost-worth analysis –

The next step is to determine the cost of each of the function so defined. The simplest method to determine the function cost is by comparison with each other. It is the lowest cost required to perform the function. By using knowledge, imagination, creativity & comparing with existing design, alternatives are established, as the worth of the item.

2.4 Function Analysis System Technique of door –

The next stage of the VA exercise is to commence the analysis of the product by identifying systematically the most important functions of a product or service. This is known as functional analysis.

3) Creative Phase –

The main objective of this phase is to generate creative and brainstorming alternatives for providing basic functions of the items. In the case of door, cost of frame is high due to which total cost of door is increased. So make the door with low cost. For the selection of material for door panel one team is selected in this Owner, Contractor, Engineer & Labour are involved.

For frameless door alternative solution is provide sliding door by using suitable material. This solution is economical but not provides proper security. Hence select the normal door by using Bison panel & Angle frame. Material used for the door panel is bison panel & for the frame angle is used. It is highly flexible, Low-cost and environment friendly. It is lightweight design, better flexibility, and toughness. Its great strength makes it a good construction material.
4) Evaluation phase –

The evaluation phase helps to find out best alternative. In this phase the various alternatives are evaluated on the basis of their merits and demerits. For the selection of alternative various parameters are selected. Then place the key letters to each parameter.

4.1 Quantitative Method Matrix (i) of Door –

In this table all the parameters & key letters are inserted. Then two parameters have to be compared at a time. The parameter, which in the opinion of team members is more important, should be placed in a box. The parameter should be placed by considering all the factors & give the scale of importance to each parameter.

4.2 Quantitative Method Matrix (ii) Of Door –

In the following fig. the scale of importance is given to each parameter from that raw score & final score is given. This is done for external & internal door. The scale of importance in this method is as follows: 0 = No difference in importance, 1 = Minor difference in importance, 2 = Medium difference in importance, 3 = Major difference in importance.
Weightages of the parameters –

In this process all remaining alternatives from previous screening stages will be evaluated against the aforementioned criteria. It is assumed that all the alternatives that have survived meet the minimum need of basic functions of the owner or the user. The scoring system used in the analysis matrix involves assigning 1-5 points on a scale of fair to excellent.

The ranks of each alternative were multiplied by the corresponding weight of the criteria and the resulting scores entered into the matrix. The total scores were then determined for each alternative. Select the alternative having the more score.

5) Recommendation Phase –

In this phase the recommendation is made in order to reduce the project cost without sacrificing for the safety and quality as expected by the architects and engineers. From the evaluation matrix select the alternative 2, having the weightages more as compared with other alternatives. Also the cost is less as compared with other alternatives.

6. CONCLUSION:

This paper presented a proposed method of evaluating and selecting door system which utilized the value engineering principles. The method depends on a survey of the existing door system used in the India and in different types of doors. For the evaluation the value analysis technique includes the evaluation by comparison, weighted evaluation which include paired comparison of the criteria and evaluation matrix resulted in the selection and prioritization of four alternatives. From this alternatives sliding door alternative is selected as best alternative, which saves cost up to 60-80% than the existing doors.

This method should help designer and owner to specify the best door system for any given situation. In addition, this method can be used for the evaluation and selection of any construction system by using the procedure presented in this paper.

7. REFERENCES:


