

# USE OF VALUE ENGINEERING IN ROAD CONSTRUCTION PROJECT

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## 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 is a methodology used to analysis the function of the goods and services and to obtain the required functions of the good and service of the user at the lowest total cost without reducing the necessary quality of performance. It is an intensive, interdisciplinary problem solving activity that focuses on improving the value of the functions that are required to accomplish the goal, or objective of any product, process, service, or organization.

*Keywords:* Cost ,Time , Road construction, Alternative material, public project , value engineering (VE)

## 1. Introduction

Value engineering (VE) is a systematic method to improve the "value" of goods or products and services by using an examination of function. Value, as defined, is the ratio of function to cost. Value can therefore be manipulated by either improving the function or reducing the cost.

Value engineering can be defined as an organized effort directed at analyzing designed building features, systems, equipment, and material selections for the purpose of achieving essential functions at the lowest life cycle cost consistent with required performance, quality, reliability, and safety.

Value engineering (VE) is a management tool to achieve essential functions of a product, service or project with the lowest cost. VE has become a standard practice for many government agencies and private engineering firms and contractors since its first adoption in the 1950s. It has been widely practiced in the construction industry and become an integral part in the development of many civil infrastructure projects. VE has been practiced for half a century in the construction industry with an aim to produce innovative ideas and solutions for enhanced project value. Value Engineering (VE) or Value Management (VM) is one of the important project management tool, it can be defined as the systematic effort directed at analysing the functional requirements of systems, equipment, facilities, procedures and supplies for the purpose of achieving the essential function at the lowest total cost, consistent with meeting needed performance, reliability, quality, maintainability, aesthetics, safety and fire resistance. VM as a management style focuses on value system evolution and resolution within projects, or organizational systems for that matter, by bringing the right team of stakeholders together at the right time.

VE is understood to increase customer satisfaction and value to investments. In enhanced assessment is seen that VE can be used also in improving the value and optimizing the life cycle cost of a process and its practices. The VE is a professionally applied, function oriented, creative and systematic team approach, used to analyze and improve value in construction-a powerful methodology for solving problems and/or reducing cost while improving performance and quality requirements .Value Engineers

are trained in saving money while improving the value of products or services and hence improving the shareholders' value of large corporations.

VE may be performed in two ways; proactively or reactively. A proactive approach uses VE to collect ideas starting at the beginning of design. Thus, multiple design alternative are considered and the most cost effective selected on a continual basis throughout the design phase a reactive approach gathers cost effective alternatives through design reviews by other project personnel such as constructors and other designer engineers. This is performed after the entire design or specific component of design is complete. One of the best field to apply VE concepts is the productivity. In construction projects; the productivity is the most critical factor to determine the project cost, duration and as a result; the benefit for all parties. The goal of the study is to verify the effect of VE as a valid approach for road improvement construction.

and easier.

## 2. Literature review

### 2.1

Khaled Ali Alabd Ahmed (2013) VE within a project's life increases the rewards which can be reaped from focusing on design functions and construction objectives, highlighting how the budget cost can be achieved, while maintaining quality and performance standards. The only obvious missing benefit cited by literature that the respondents did not consider was that VE could be used to benefit other similar work without completing another VE study encouraging the use of feedback and data collection. There is a need therefore to review how the budget of a project is allocated. If this stage of a project's life is considered to be one which has the greatest impact on the outcome of a project, then the resources spent on this stage should reflect its importance. It may be that there is as yet no universal acceptance of the importance of the construction stage and without this the standard use of design management tools, such as VE, will not spread.

### 2.2

A Ismail (2010) researched that main Road projects are reviewed and opportunities for better, less expensive means of completing the projects are analyzed. The intention is to improve project quality and productivity, foster innovation, optimize design elements and ensure overall economic costs. The goal of a VE study is to achieve performs excellence. Its objectives are to improve quality, minimize total ownership costs and decrease construction time.

### 2.3

Ms. Sayali Dhayalkar (2016) Value Engineering can be applied during any stage of a project's design development cycle. However, the greatest benefit and resource saving are typically achieved early in the development and conceptual design stages. VE may be applied more than once during the life of the project. Early application of VE helps to get the project started in the direction, and repeated application helps to filter the project's direction based on new or changing information. It is important available and compare quality elements of the design with the owner's requirements.

### 2.4

Renata Schneiderova Heralova (2016) VE methodology provides for analyzing the project objectives and attributes, which, in turn, focuses the development of alternatives in the value study. VE program use in the public sector, significant improvement in project performance and cost savings has been experienced. Improving the relationship between the project performance and project life cycle costs has been a major benefit to public projects. These savings have been extended into other public projects, creating a real value for the taxpayer. Most importantly, using VE could accelerate construction because it creates a consensus-building foundation. VE studies carried out in the public sector have allowed for the development of consensus on what the project scope, budget, and delivery should be. This consensus has been formed within project stakeholders, such as local governments, transportation and regulatory agencies and the communities involved or affected.

### 2.5

Bruce A. Lind ,(1986) Value engineering consultants can provide highway agencies and design consultants with assistance in VE training and studies. Their expertise in guiding VE studies assures that the job plan is followed, encourages a creative environment, and promotes objectivity. Value engineering consultants may be retained by the highway agency or the design consultant; of prime importance is the consultant's qualifications as a VE practitioner.

### 3.Value engineering in Road construction projects

The following steps carried out for the implementation of the project.

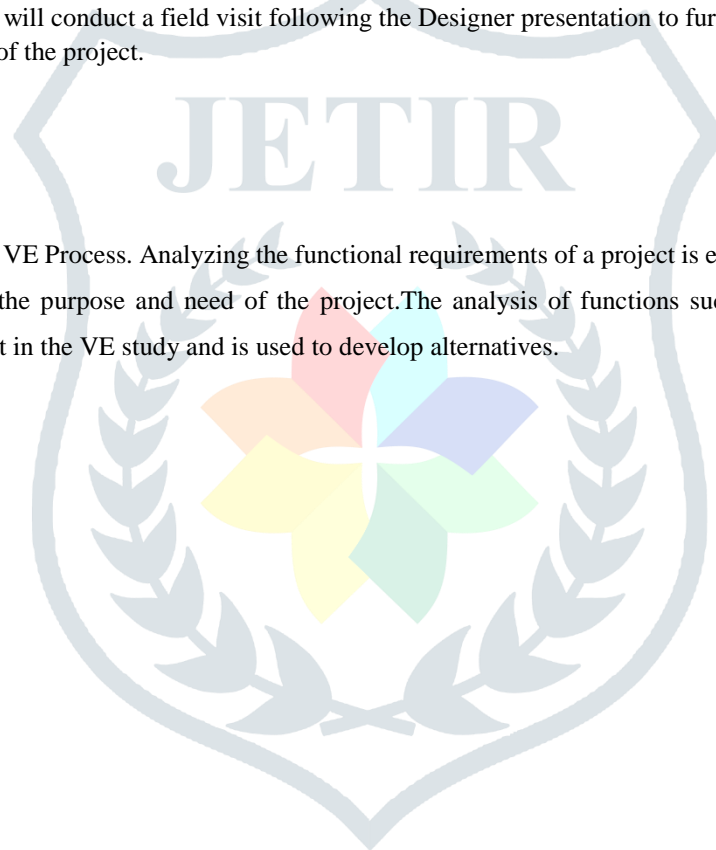
1. Information Phase
2. Functional Phase
3. Creative Phase
4. Evaluation Phase
5. Development Phase

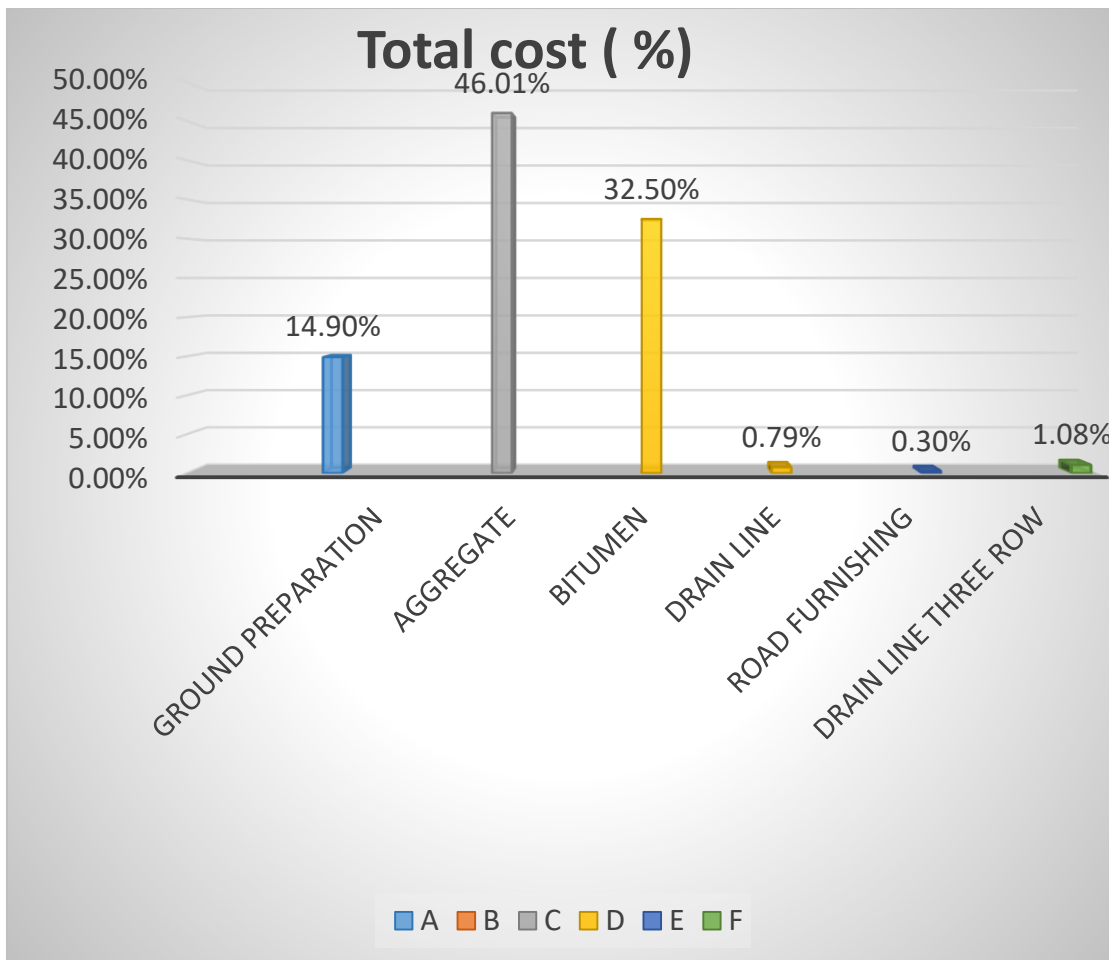
#### Information phase

This purpose of this phase is to insure that the VE Team members understand the objective and the purpose and need of the project. The major goals and objectives of the project will be discussed and identified. The Designer's team will provide an overview presentation of the project and its various risks and requirements, describe the proposed, and cover the important technical reports. The VE Unit will conduct a field visit following the Designer presentation to further enhance the VE Team's knowledge and understanding of the project.

#### Functional Phase

Function analysis is key to the VE Process. Analyzing the functional requirements of a project is essential to insure that the project design meets the criteria and the purpose and need of the project. The analysis of functions such as cost, performance, and acceptance are primary element in the VE study and is used to develop alternatives.





**Creative phase**

The Creative Phase involves identifying and listing creative ideas. During this phase, the VE Team participates in a brainstorming session to identify as many means as possible to provide the necessary project functions. The idea list includes all of the ideas suggested during the study. These ideas should be reviewed further by the project team, since they may contain ideas that are worthy of further evaluation and may be used as the develops. These ideas could also help stimulate additional ideas by others.

**Evaluation Phase**

The purpose of the Evaluation Phase is to methodically assess the potential impacts of ideas generated during the Speculation Phase relative to their potential for value improvement. Each idea is evaluated in terms of its Strength, Hardness, Toughness, Durability, shape, Adhesion, Ductility, Plasticity, viscosity, cost, availability, weather effect, and durability, with material.

**Evaluation Phase Rank**

During the Development Phase, the highly rated ideas are expanded and developed into VE alternatives. The development process considers the impact to Strength, Hardness, Toughness, Durability, shape, Adhesion with material. . This analysis is prepared as appropriate for each alternative, and the information may include a performance assessment, initial cost, operational performance and the level of service.

**Development Phase**

- During the Development phase all members of participate in the Idea write ups. It is important that the selected ideas are written so that the project Owners and stakeholders may easily understand how the value alternative benefits the project over the Base design. Idea write-ups typically include:
  - Clear textual description of the concept, if applicable this text should also include other alternates that this alternate complements.
  - Sketches schedules and diagrams.
  - Assumptions
  - Cost comparison worksheets, supporting calculations, vendor information.

#### 4. Discussion

- We can use lime stone aggregate according to following reason & make compare it with crushed aggregate.
- Higher yields — limestone is very durable and wear resistant which contributes to higher spread rates
- Light weight — limestone is about 6% lighter than granite aggregate or gravel
- Permeability — limestone is an ideal product for maintaining natural water flow and drainage while meeting regulatory compliance for managing run-off, controlling pollutants, and sustaining forestry
- Plastic roads can be made into interlocking pieces that can be quickly assembled or disassembled. This makes on-site construction much faster and convenient. Simplicity and speed of road work also correlates to lower cost.
- Plastic roads can be built from waste plastic --- the majority of which is usually put into landfill, incinerated, or polluted into the environment. Land filling and incinerating plastic are both problematic methods of managing plastic waste. Plastics in landfills can leak pollutants into the surrounding soil; incinerating creates gaseous pollutants, such as carbon dioxide.
- Plastic-bitumen composite roads need not be especially discriminating with the plastics used, thus increasing the reuse of plastic. Most plastic waste is not recycled because it is usually mixed with different types of plastic and non-plastic (e.g. paper labels) and, so far, the segregation process is labor-intensive with no easy solution.
- As the exploitation of the nature and natural materials had increased exponentially, new thoughts of recycling the wastes is the only way to preserve the nature. The above results are at par with the studies of conventional materials readily available in market.
- Several steel fibers that are commercially available in market were confined to the experimental needs.
- It was observed that the addition of steel fibers to the concrete increases the properties of concrete up to a certain limit.
- Stone is one of the most accessible natural resources, and is a major basic raw material used by construction, agriculture, and other industries. Despite the low value of its basic products, the crushed stone industry is a major contributor to and an indicator of the economic well-being of a nation. The demand for crushed stone is determined mostly by the level of construction activity, and, therefore, the demand for construction materials. Stones contains High strength, Durability, Hardness then M15 Grade of P.C.C.

#### 5. Conclusion and Recommendation

Value Engineering can be applied during any stage of a project's design development and use of alternative material. However , the greatest benefit and source saving are typically achieved early in the use of alternative material and conceptual design stages. VE maybe applied more than once during the life of the project. Early application of VE helps to get the project started in the direction ,and repeated application helps to filter the project's direction based on new or changing information. As a conclusion , the area of Value engineering analysis and study will be controlled by the first three function.

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