

VALUE ENGINEERING (VE) AND DESIGN TECHNICAL REVIEW (TR) - CLEARING THE MIST

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ABSTRACT

This paper endeavors to clear the misconception of the difference between VE and TR, by projecting some light on some of these reasons. Thus putting things in proper perspective to widen the horizon for VE and to reach as many professionals as possible in all levels of different industries.

Introduction

Many people in engineering, manufacturing or construction, whether they are technical or non-technical don't have a clear understanding of the real difference between VE and TR. This misunderstanding of the difference is clouded even further in a society where the VE concept is relatively new.

The sign of deepening misunderstanding climaxes when one hears statements such as "VE is a form of design review, so what makes VE different or unique?" This statement shows an assertion and pre-judgement on the part of many, that there is no difference between the two concepts.

As a result of this misconception, many people think that any project which has been reviewed thoroughly by competent engineers, or designed by a reputable engineering firm, does not warrant a VE study. The only project designs which require VE study are those which are not properly designed, are done by obscure designers or did not have proper design review.

The confusion between the two concepts that I have encountered, in dealing with different entities, can be attributed to:

- I VE has been misrepresented by people who are not qualified Value Engineers, and therefore don't possess the real knowledge of what the VE mission is all about.
- II Recipients are unaware of the VE technique and do not comprehend it.
- III Prejudged opinion by some misinformed people, due to previous unsuccessful experience.
- IV Natural human fear of change, and cautiousness of any new or unknown technique or product.

What is VE?

VE methodology is analyzing systems, down to the subsystems and components level of a design or product, and consequently to its value. During a function analysis aesthetic and secondary functions are also determined and estimated worth is assigned to each. VE challenges requirements to determine whether true value is attained, or, what is really needed to achieve required function(s), at the lowest possible total cost, neither more nor less.

The distinguishing characteristics of VE can be summarized by:

- 1) Follow the VE job plan sequence during the study of a design (preparation, function analysis, idea generating, evaluation, development, reporting, presentation, and implementation).

- 2) VE is a problem solving technique that can be applied to management procedures as well as design, construction, manufacturing, and Operation & Maintenance (O&M).
- 3) In construction projects, VE can be applied during other phases of a project, such as during construction or O&M stages.
- 4) Conduct VE study at early stages of design (programming and concept) to maximize benefit and minimize time and effort.
- 5) Discuss and analyze design criteria on the basis of functions to be performed for each system and subsystem within the function of the whole project design, taking into consideration local and special requirements.
- 6) Separate needs from desires and identify overdesigned and high cost areas.
- 7) Compare level of required performance to the level set by the design.
- 8) Identify high cost areas and generate alternatives that have better value.
- 9) Challenge safety margins and contingencies, evaluate to see if they exceed needed requirements.
- 10) Make sure that the design under study is below or at least within budget without sacrificing performance or quality.
- 11) Question the end users' requirements when setting design criteria.
- 12) Generate alternatives that will perform required functions at the least possible overall cost, including O&M and Life Cycle Costs.
- 13) Question and challenge design habits and common practices. Should they survive, it must be based on merits, not on familiarity or practice.
- 14) Establish worth of a function, not the worth of an item, and that is unique to VE, and determine the value (Value = Worth/Cost). A value less than one is poor; greater than one equals good value.
- 15) Improve value by developing new design alternative(s) that satisfy economics, time, ease of implementation, and performance.

Hence, VE is a systematic approach and methodology that starts with the beginning of design formulation at the scope of work stage and goes along the design stages (concept, preliminary, etc.) (See Figure 1). The benefits from VE study will be greatest if applied at scope of work stage, where cost of implementing VE recommendations is the least (design changes). VE can be applied at other stages of design and even at implementation phase by introducing VE Change Proposals (VECPs), which will yield benefits and improvements but with less rate of return.

What is the Role of Design TR?

Design TR as the name indicates is reviewing what is already existing (drawings, specifications, design criteria etc.) to see if these documents are complete and comply with engineering standards and codes and to make sure that no discrepancies exist. Also to coordinate various engineering disciplines, to maintain the consistency. For the most part, it doesn't go further than checking safety, accuracy, and workability of the design.

Design Review Methodology Steps can be summed up in the following points:

- 1) Check and make sure that the designer (A/E) has fulfilled his contractual obligations.
- 2) Check the design drawings by reviewing:
 - a) Architectural plans are according to requirements, and no contradictions exist between different disciplines.
 - b) Structural calculations and the design assumptions to make sure of the adequacy of the design.
 - c) Foundation designs are according to soil bearing results.
 - e) Verification of the mechanical systems (HVAC, plumbing, fire protection, etc.) calculations and compliance with related codes and requirements.
 - f) Any other special systems that are a part of the design.
- 3) Check workability of the design and its compliance with local rules and regulations.
- 4) Check and verify the compatibility of all contract documents (drawings, specs, agreements, etc.) and make sure that no discrepancies exist between them.
- 5) Check to minimize errors and omissions or incompleteness as much as possible from the contract documents to reduce if not eliminate possible change orders and hence future claims.
- 6) Check cost estimate to ensure that the project is within budget.
- 7) TR is a discipline-oriented procedure, largely independently performed.
- 8) It can be applied only at preliminary stage (after 35%) of design where systems are identified and thereafter.
- 9) No function analysis is conducted.

It is clear from the preceding points that TR is directed to checking documents against established engineering codes and practice, in addition to local codes and regulations. TR does not question or challenge the intent of the design, try to alter or improve on it.

Why a VE Study?

The question that many people have in mind when it comes to VE, is "Why the need for VE study, if the design is well prepared, thoroughly reviewed by concerned parties and done by a reputable firm?" This question and a host of similar ones that value engineers encounter at work, display the lack of understanding on the part of many people, what VE is all about.

This situation confronts VE enthusiasts in their quest to get the VE concept adopted in the construction and manufacturing industries, whether they are in public or private sectors.

Before answering the question, consideration should be given to the following two points:

- 1) Every design is a result of the participants' perception of needs, requirements, or desires, and that perception is based on experience, environment, taste, time, and budget. So if the same scope is given to another individual(s) a totally different design will emerge, because the previously mentioned attributes are not the same.
- 2) Who decides if the design or product is well thought of? Is it the owner, designer, end user, or others? And, what is the measurement of a good design.

To answer these points, here are some of the reasons summarized below on why designs should be VEd:

- 1) The designer's desire to be creative, innovative, distinguished, and satisfy self esteem usually leads to a high cost design.
- 2) The designer's inherent insensitivity to cost, because it either doesn't concern him or he thinks it acts as a constraint to his imagination or horizon.
- 3) The designer's concentration on aesthetics to make good impressions.
- 4) The designer's cultural and environmental background, which would limit his/her deep understanding of local, cultural and social needs and requirements of another society.
- 5) If the designer is not from the local area, his design will be based on his home area products and standards for reasons of familiarity.
- 6) The designer's experience and education that influence and structure his/her thinking process.
- 7) Designers are executors of the owner's requirements, and to challenge these requirements needs skills and efforts beyond the normal scope of his work or his desires.
- 8) Every individual has his own interpretation of quality, and very often, these interpretations don't match.
- 9) Fast changing technology, and identifying outdated materials and systems.
- 10) Adopting new technology and better ways of doing things to projects and products under study.
- 11) Unrealistic requirements; setting up the exact needed requirements is a specialty and requires experience which users and owners do not possess.

These points are by no means the only reasons for the need of VE study, but they give an overall picture.

VE Working Environment

VE creates an effective working environment for creativity and talent, by the nature of its systematic procedures (Job Plan). It provides the interaction between different disciplines, different experiences and backgrounds in a dynamic group effort with one goal in mind, and that is optimization of resources for an optimum product in all aspects (quality, function, reliability, performance, cost), to make way for well analyzed compiled design. It provides the opportunity for challenging energetic and competent engineers who seek to solve design problems or develop new products which provide the function that costs less and performs better.

VE is also a problem solving technique that can be used for product design, construction, manufacturing process, or administrative procedures.

Conclusion

The difference between VE & TR is substantial. TR is a structured method of checking workability, adequacy, and safety of a design against established codes and practices (See Figure 1). It is a form of standard quality control for documents conducted by each discipline individually to make sure no omissions or mistakes have taken place.

On the other hand, VE is a technique to achieve the balance between function, reliability, performance, and total cost (See Figure 2). VE through its Job Plan challenges the design requirements by identifying the function(s) and building around them balanced alternatives to satisfy that function. VE can enhance Value either by:

- a) Increasing the function while keeping cost constant,
- b) Keeping the function constant and reducing the cost, or,
- c) Increasing function and decreasing cost at the same time.

All of this depends on a case by case situation. The aim is to increase the value of the project or product by increasing the function or reducing the cost without undermining performance.

Despite the long history of success and realized benefits of VE, the technique has one major weakness. That is the dependence on top management support and involvement. Management support is crucial to the success of VE. The decisions to let a VE study be performed and accepting the proposals lies with them.

Until VE gets top management on its side, the list or roadblocks will grow longer and longer. And the greatest hurdle of all is the misunderstanding about VE. Designers or any other practitioner may consider VE and proposals as criticisms which undermine their abilities; or at best adding more work or delaying their task. So the right approach and objectivity by a VE team is essential to the acceptance of the VE suggestions and proposals.

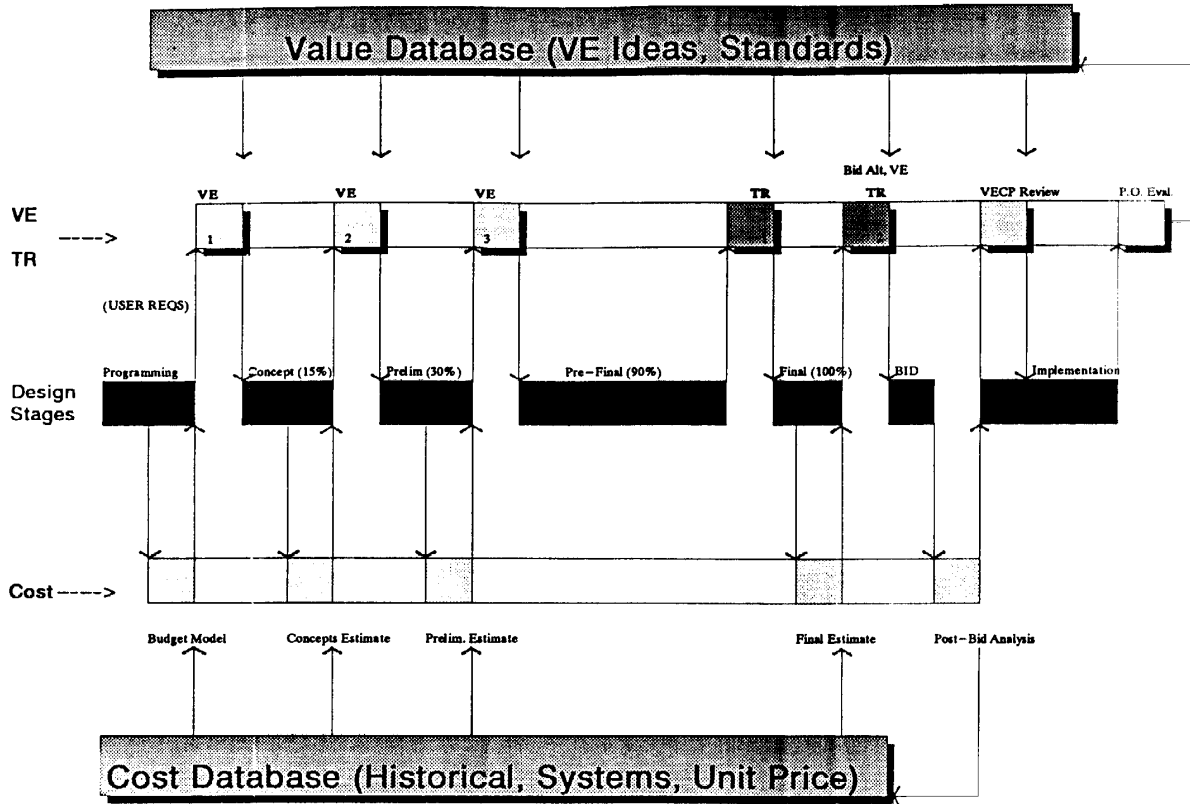
Clarity and effectiveness of the presentation will win the VE team listening ears of the participants. Getting the message of VE across to all levels of the organization is a role that VE people have to play with enthusiasm.

Creating a greater understanding of VE can be achieved through organized effort such as:

- 1) Writing articles in periodicals.
- 2) Distributing flyers through the mail.
- 3) Holding seminars.
- 4) Holding workshops.
- 5) Holding lectures and presentations to top management.
- 6) Conducting studies.
- 7) Developing training programs.
- 8) Introducing VE clauses in contracts.

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(Fig 1) VE & TR INTERFACE

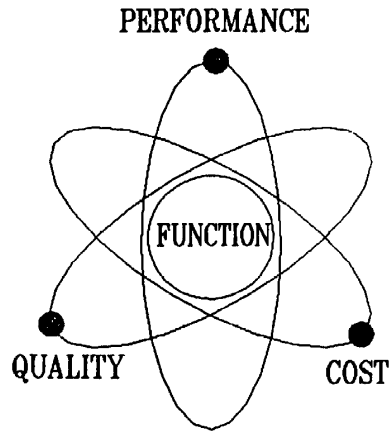


Fig-2
VE BALANCED APPROACH