Design

The Value Engineering (VE) Process and Job Plan

A common response heard when discussing the VE process or the requirements to conduct VE studies is "**we do it all the time, but we just don't call it VE!"** Because the VE process contains many elements and phases, such as team work, functional analysis, "brainstorming", and cost-worth analysis, unless a review conducted for a particular project includes these and other related elements and phases, it is not considered to be VE.

The FHWA defines VE analysis as: A systematic process of review and analysis of a project, during the concept and design phases, by a multidiscipline team of persons not involved in the project, that is conducted to provide recommendations for:

1. providing the needed functions safely, reliably, efficiently, and at the lowest overall cost;
2. improving the value and quality of the project; and
3. reducing the time to complete the project.

Simply stated, VE is an organized application of common sense and technical knowledge directed at finding and eliminating unnecessary costs in a project.

The "systematic application of recognized techniques," referred to in the above definition is embodied in the VE Job Plan. The Job Plan is a systematic and organized plan of action for conducting a VE analysis and assuring the implementation of the recommendations. The methodology utilized for any VE analysis shall follow widely recognized systematic problem-solving procedures that are used throughout private industry and governmental agencies.

The Job Plan contains eight phases. The first phase is completed prior to the commencement of the VE analysis, six of which are performed by the VE team, and one that is conducted to "close out" the process. Each phase of the Job Plan includes several tasks. It is the melding of the various tasks and techniques, coupled with finesse in their application that makes the VE process work.

The following table summarizes the VE Job Plan and provides a link to additional discussion on key considerations associated with each of the eight phases:

- Selection of projects for VE analysis
- Investigation (gathering of information)
- Function Analysis (analyzing functions, worth, cost, performance and quality)
- Creative (speculating using creative techniques to identify alternatives that can provide the required functions)
- Evaluation (evaluating the best and lowest life-cycle cost alternatives)
- Development (developing alternatives into fully supported recommendations)
- Presentation (presenting VE recommendations for review, approval, reporting and implementation)
- Close Out (Implementing and evaluating of the outcomes of the approved recommendations)

Selection: The responsibility to select the projects for a VE study is usually outside the control of the study team. Beyond the Federal requirements for conducting studies, some criteria used to select projects include but are not limited to:

- high-cost and/or high-priority projects
- important, but lower priority projects, that fail to meet the transportation agency's budgetary cut-off
- complex or challenging projects with multiple stages or complicated/costly traffic control and staging

- projects with extensive or costly environmental or geotechnical requirements
- projects that substantially exceed their initial cost estimates
- projects that have encountered "scope creep"
- projects involving multiple stakeholders
- projects that involve the use of other quality and cost review techniques (Road Safety Audits, Context Sensitive Solution workshops, Risk Based Cost and Schedule Estimates)
- corridor or route planning studies;

Investigation: The Investigation (or Analysis) Phase is where the study team first becomes involved. In this phase, the team determines what they know about the project from readily available information and what they must know in order to really define and/or solve the problem. It is in this phase of the VE study that the elements that have the greatest potential for value improvement are identified.

The Investigation Phase immediately brings the three fundamental concepts of VE (function, cost, and worth) to bear on the problem. It is these concepts that make the VE process different from all other management and cost control techniques. This phase requires the team to ask and answer the following basic questions:

- What is it?
- What does it do? (what is the function?)
- What must it do? (is its function basic?)
- What is it worth?
- What does it cost?

Most of the information required in this phase is readily available. The length of the project, its cost estimate, traffic projections, design speeds, and the major elements designed into the project can be easily identified from a review of the plans and other documentation. Sometimes the VE team must investigate further for other information necessary to adequately complete the investigation phase.

Applying Pareto's Law of Distribution is helpful when beginning to look for potential savings. Pareto's Law states that 80% of a project's cost will be in 20% of the work. Preparing a project cost model will begin to identify targets of opportunity.

Identifying the **functions** the project and its elements perform is the next step in the Investigation Phase. Function denotes the specific accomplishment to be achieved by an element or combination of elements in the overall design. The value methodology requires that we describe a function by the use of two words - an action verb and a measurable noun (that is acted upon).

For example, the function of a bridge is to "cross obstacle." The VE study team should not care whether that obstacle is a ditch, river, creek, railroad, another highway or a building. The bridge's basic function is to provide a means to cross that obstacle. If it does not accomplish that function, we wouldn't buy it, therefore the cross obstacle function is considered to be basic. The study team should be as non-specific as possible when describing functions to leave as many options open as possible to perform the generalized problem or function that the project presents.

To summarize, the goals of the VE study team by the end of the Investigation Phase are to:

- Identify the project's high-cost elements
- Conduct a functional analysis of the high-cost elements
- Assess their cost / worth relationships

Creative: The Creative (also referred to as Speculation) Phase follows Investigation and is where the power and the benefits of the VE technique are manifested. The team applies brainstorming techniques to develop viable alternatives to the way the project is currently designed. Brainstorming forces people to be creative. The mechanism that produces

this phenomenon is called synergism --one idea triggers other ideas or thoughts through: similarities or like ideas; contiguous or adjoining ideas; contrasting or opposite ideas; and sound-alikes.

The value study team applies creativity to the functional statements selected from the previously conducted cost/worth estimates. The team uses the generic format of the function to speculate on all possible solutions to the problem presented in that functional statement.

The VE study team uses brainstorming to generate a large list of potential solutions to the problem described by the two-word function, which prepares the team to enter the next phase, when they are charged with paring down a laundry-list to a manageable few ideas through the feasibility analysis.

Evaluation: During the Evaluation Phase, the advantages and disadvantages of each remaining alternative are listed. Each advantage and disadvantage is described in general terms. The team can perform a weighted matrix analysis to determine which alternative is best based upon the relative importance of each of the desirable criteria which must be addressed. Of course, if the disadvantages are found to far outweigh the advantages of any alternative, the alternative is dropped from further consideration at this point.

Conducting this analysis satisfies the VE objective--to achieve the best blend of performance, cost, and schedule. Perfection is not the objective of the VE study team.

Development: Once the team selects the best alternatives, they are fully developed through sketches, cost estimates, validation of test data, and other technical work to determine if any assumptions made during the study are in fact valid. The Development Phase is the final step before presenting the team's recommendations to the agency's management. The study team formulates an implementation plan which describes the process that the agency must follow to implement any recommendations.

Presentation: The final product of a VE study is the formal VE Report and the presentation of the team's recommendations. In this phase, the VE team presents their findings to the project decision makers, and strives to convince them that their ideas should be implemented.

This formal presentation should be brief but thorough, with sufficient time allocated for discussion and responding to questions. When making the presentation, the study team should exercise care when presenting estimated cost savings or, in some cases, increased costs associated with recommendations. Overstating or double counting savings should be avoided. For VE studies taking a longer time to complete, it is beneficial for the study team to provide progress updates to the appropriate project management staff.

The VE Report serves as a step-by-step record of the work accomplished during the preceding phases. The report provides documentation to support the team's recommendations, tracks the team's deliberations and considerations, and aids in implementation of the recommendations. It can also be a useful reference tool for future projects and VE studies that must address similar topics.

Close Out/Implementation: No recommendation for cost savings can achieve savings until it has been implemented. Although it may not be practicable to implement each and every recommendation proposed, the project decision makers must take the appropriate action to ensure that a fair and serious consideration of the proposed recommendations occurs. A key activity of the Implementation Phase is the information sharing within the transportation agency as the recommendations are implemented --- and the associated savings are realized --- on projects. Not only does this activity promote the benefits associated with conducting the VE studies, it will provide benefit to future transportation projects.

The final phase of the Job Plan also involves determining the actual amount of savings generated by the VE analysis based on the amount of recommendations implemented in the construction project and evaluating the outcome the recommendation achieved in the project.

Federal Highway Administration | 1200 New Jersey Avenue, SE | Washington, DC 20590 | 202-366-4000