

KENTUCKY TRANSPORTATION CABINET

VALUE ENGINEERING GUIDELINES

PURPOSE

This document provides information and guidance regarding the implementation of a Value Engineering Program within the Kentucky Transportation Cabinet (KTC). It is intended to be a reference for designers, managers, consultants, and other KTC employees who are involved in or affected by the Value Engineering Program.

INTRODUCTION AND BACKGROUND

There are many million kilometers of transportation facilities in the United States. Each segment of this complex system will probably require repair and/or reconstruction during its lifetime. Public input, environmental considerations, inflation, revenue limitations, and other factors have reduced the availability of dollars to meet the ever growing transportation needs. Value Engineering is a tool that can counteract these problems by providing cost reduction, product or process improvement, and alternate means and materials for construction and maintenance.

Value Engineering (VE) is the systematic application of recognized techniques which identify the function of a product or service, establish a value for that function, and provide the necessary function reliably at the lowest overall cost. The required function should always be achieved at the lowest possible life-cycle cost that maintains the requirements for performance, maintainability, safety, and esthetics.

The VE process is not meant to criticize or "second guess" today's designs, processes, or designers. It does not imply that there is intentional over design, conscious neglect, or unjustifiable error. VE is designed to complement the efforts being made. It recognizes, however, that social, psychological, and economic conditions exist that inhibit good value. These conditions may include:

- lack of information.
- unidentified or misunderstood project requirements.
- habitual thinking.
- risk of personal loss.
- reluctance to ask for advice.
- time pressures.
- last minute changes in scope.
- changes in scope and/or conditions over time.

- negative attitudes.

- rapidly changing technology.
- strict adherence to "requirements."
- poor human relations or communications.
- reluctance to make a decision.
- decisions made before costs and/or value of alternates are known.

VE is not a typical cost reduction program in that it does not cheapen or cut corners with the product or service. VE is not routine project or plan review. The purpose of VE is to achieve design excellence. Its objectives are to improve quality, minimize total ownership costs, reduce construction time, simplify construction processes, insure safety, and meet environmental/ecological goals. Value Engineering accomplishes these objectives using multi-disciplinary teams and creative thinking to generate alternatives.

A VE job plan consists of the following eight phases:

- 1) Selection of Projects
- 2) Investigation of Projects
- 3) Speculation of Alternatives
- 4) Evaluation of Alternatives
- 5) Development of Alternatives
- 6) Presentation of Value Opportunities
- 7) Implementation of Value Opportunities
- 8) Evaluation of Results

Each step above is called a phase because many tasks are involved in each one. Phases 2-6 are performed during the VE team study. Phases 1, 7, and 8 are conducted outside of the team study. While some activities in the phases overlap, it is the blending and application of these tasks that is the art of value engineering.

The United States Congress in the 1970 Highway Act authorized the Secretary of the U. S. Department of Transportation to require VE or other cost reduction analysis on any federal-aid highway projects. FHWA established an office to administer the VE program in 1974. Throughout this time VE was strongly encouraged in the planning, design, and/or construction phases of projects.

The 1991 Intermodal Surface Transportation Enhancement Act (ISTEA) of 1991 required the Secretary of U. S. Department of Transportation to study the benefits of VE for Federal-aid highway projects and report the results to Congress. Concurrently with the passage of ISTEA, the FHWA issued nonregulatory guidance that reiterated the policy strongly encouraging the use of VE.

The FHWA issued a Notice of Proposed Rulemaking in November 1994 that would require application of VE to selected Federal-aid highway projects when funded under FHWA's grant-in-aid process. To comply with this proposed rule, KTC established a position for a Value Engineering Coordinator in 1995 to develop and implement a VE program. Before the proposed rule became final, the National Highway System Designation Act of 1995 required States to conduct life-cycle cost and value engineering analysis of project segments on the National Highway System with costs of \$25,000,000 or more.

VALUE ENGINEERING DURING CONSTRUCTION

VE during the construction phase is covered under Section 111 of the Standard Specifications for Road and Bridge Construction. Value Engineering Change Proposals (VECP) developed during the construction phase are administered by the Division of Construction and are not subject to the requirements of this guideline.

REFERENCE PUBLICATIONS AND DOCUMENTS

The following list of publications is provided for information purposes and may be referenced later in the guidelines:

Guidelines for Value Engineering (VE), AASHTO-AGC-ARTBA Joint Cooperative Committee, Task Force #19, US Department of Transportation/FHWA, Pub. No. FHWA-HI-88-048, February 1987 & 88.

NHI Course No. 13405, Value Engineering for Highways Textbook, US Department of Transportation, FHWA, Pub. No. FHWA-HI-88-047.

ORGANIZATION AND RESPONSIBILITIES

1. Value Engineering Coordinator (VEC) - The VEC is responsible for coordinating the selection of potential VE study projects, selection of VE study team members, conducting VE studies on the selected projects, reporting and tracking recommended value opportunities, coordinating VE training, managing the VE staff, and coordinating efforts of VE consultants.

The VEC and VE staff are attached to the Division of Highway Design for administrative purposes. The VEC reports to the Director of the Division of Highway Design.

2. VE Advisory Committee (VEAC) - The VEAC consists of the following persons or their designees:

- Deputy State Highway Engineer for Project Development (chair)
- Chief District Engineers (2) (appointed by SHE for two year terms with staggered appointments)
- Director, Division of Highway Design
- Director, Division of Construction
- Director, Division of Operations
- Federal Highway Administration representative

The VEC serves as a liaison to the committee. The role of the committee is to provide overall guidance and direction for the VE program. The committee specifically performs the following:

- reviews and approves the annual VE Workplan.
- reviews the annual VE Status and Implementation Report.
- provides input for development of goals and objectives for the VE program.
- advises on the need for special studies.
- provides input for the development of VE training.
- provides input on VE program operations.

The committee meets at least annually to review the VE Workplan. Additional meetings may be called by the Chairperson. Interim business may be conducted by telephone or mail.

3. VE Study Teams - VE study teams are generally composed of four to eight members trained in the VE process. These team members should be familiar with the appropriate design principles but have had no direct involvement in the design or review of the project under study. Team members are selected by the VEC based on their expertise in the specific disciplines needed for the study. Team members without training may be selected if their experience is needed, but there should be no more than one or two untrained members on the study team.

The VEC will notify the appropriate management or supervisors to gain approval for the participation of the selected study team members. Once approval is granted, the VEC will notify the team members of the project to be studied, the location of the study, and the daily schedule.

The VE study team will be independent of other design review processes.

4. VE Team Leader - The VEC will appoint a study team leader to conduct the assigned study according to the VE Guidelines. Team leaders should have served on at least two team studies as a member, have attended a VE workshop, and attended a team leader training course. The team leader will be responsible for preparing the VE study report and preparing presentations, if necessary, to the VE Decision Team.

5. VE Decision Team - The Decision Team will include the following persons or their designees:

- Location Engineer
- Director, Division of Construction
- Director, Division of Operations
- Chief District Engineer
- Project Manager or Engineer (consultant or Department as applicable)

According to the type of project or value opportunities, other appropriate division directors or their designees will also be listed as members of the Decision Team. For example, the Director of the Division of Bridge Design would be included on bridge replacement projects. The VE study team may identify other Decision Team members as a result of their study.

The members of the Decision Team will receive a final copy of the VE Study Report and may be asked to attend a short presentation by the VE Study team. The VE Decision Team will then respond to indicate which value opportunities they consider acceptable for implementation and provide reasons for rejecting those that are not acceptable. These responses will be sent to the VEC. The VEC will compile the results and forward them to the Director of the Division of Highway Design for final approval.

6. Director of the Division of Highway Design - The Director of the Division of Highway Design will give final approval for implementation of value opportunities. The Director will indicate which value opportunities are accepted and will provide reasons for rejecting those which are not acceptable. The Director's response will be returned the VEC for forwarding to the members of the Decision Team and/or project managers for implementation.

VE ANNUAL WORKPLAN DEVELOPMENT

VE studies for the annual VE Workplan will be selected to meet the requirements of the National Highway System Designation Act of 1995. These include projects on the National Highway System (NHS) with an estimated cost of \$25 million or more. A "project" is defined as a portion of a highway that a State proposes to construct, reconstruct, or improve as described in the preliminary design report or applicable environmental document. A project may consist of several contracts or phases over several years. Therefore, breaking a project into smaller construction or design projects does not relieve the requirement that these projects be value engineered. Projects that are likely to qualify will be long corridor roadway projects, large bridges, and major urban ramp reconstruction.

Other projects may be selected from the Cabinet's Six Year Plan to complete the annual VE Workplan as time, capabilities, and resources allow. These projects may include:

- roadway and bridge construction/reconstruction projects with construction, right-of-way, and utility costs that exceed \$2,000,000.
- standard plans and specifications.
- special projects.
- policies, procedures, and processes.

Projects selected for VE studies should meet the following criteria:

- 1) substantially exceed cost estimates.
- 2) have complex design, construction, or function requirements.
- 3) have grown from simple to complex during the project development process.
- 4) have critical or expensive materials.
- 5) have difficult construction or fabrication requirements.
- 6) have high right-of-way costs.
- 7) have complicated maintenance of traffic requirements.
- 8) have high life-cycle or operation costs.

Projects selected may be in the initial concept phase, comparison of alternatives phase, or in the design phase. Generally, projects that are value engineered early in their development have greater potential for savings than projects value engineered late in their development. VE studies should normally occur while the project is in the preliminary portion (30-60% complete) of their current phase. Projects past 60% complete or "on the shelf" may be studied at the request and approval of the VEAC unless otherwise required.

Pareto's Law of Distribution may be used in selection of projects for the Annual VE Workplan. Pareto's Law points out that a small number of elements contain the greater percentage of costs. Therefore, it follows that a small number of projects will contain the greater percentage of unnecessary costs. Generally 20% of the projects will represent 80% of the total program costs.

Location Engineers will review projects once a year prior to the beginning of the fiscal year to determine whether or not the projects meet the requirements for VE study. The Location Engineer will complete the VE Candidate Project Review Form for projects that meet the requirements for value engineering and return the form to the VEC no later than two months prior to the beginning of the fiscal year. Projects previously reviewed should be screened again for changes that would make them candidates for VE.

The VEC will prepare a draft VE Workplan for submission to the VEAC one month before the beginning of the fiscal year. The Workplan will include projects for study and training needs to maintain a pool of study team members. The VEAC will approve the Workplan no later than one month after the

beginning of the fiscal year. Since the Workplan is subject to schedule and cost changes, a list of additional projects that may be inserted will be included with the Workplan. Any additions or deletions to the Workplan are subject to the approval of the Chair of the VEAC.

REQUIRED INFORMATION FOR VE STUDIES

The following information should be provided to the VE Study Team for initial concept studies:

- traffic information, projections, counts, and impacts.
- aerial photos depicting corridors or layouts, zoning, and land use.
- right of way values for areas affected.
- identification of preferred concept including construction cost, right of way cost, environmental impacts, safety, operation, and relocations.

The following information should be provided to the VE Study Team for comparison of alternatives studies:

- estimated construction cost breakdown for each alternate.
- estimated right of way cost for each alternate.
- business damage estimates for each alternate.
- traffic operation analysis.
- life cycle costs that include maintenance and periodic improvement for each alternate.
- relocation plan showing number of residences and business that would require relocation for each alternate.

The following information should be provided to the VE Study Team for design phase studies:

- plan sheets with location map.
- drainage map showing existing data, high water, drainage areas, directions of flow, horizontal alignment, and retention areas.
- typical sections.
- plan and profile sheets including existing topo and utilities.
- intersection and interchange layouts.
- cross sections.
- drainage outlets.
- conceptual structure plans (if available).

Copies of environmental impact statements, preliminary design reports, and other correspondence should be included for review by the VE study team.

VE STUDY PROCEDURE

VE studies should follow the guidelines presented in NHI Course No. 13405, Value Engineering for Highways or in SAVE Module I courses. The VE study team will complete the VE Study Workbook to document the activities and findings of the study. The VE study team will also prepare for any required presentations to the VE Decision Team.

REPORTS AND PRESENTATIONS

The VE team leader will be responsible for compiling the VE Study Workbook and preparing the VE Study Report. The VE Study Report will as a minimum consist of a cover letter, executive summary, and VE Study Workbook. Other documentation or information may be attached as necessary.

The cover letter should include the following:

- project studied.
- date of the study.
- location of the study.
- study team members.
- decision makers (preliminary and identified by the VE study).
- project overview, issues, and major elements.
- project cost.
- anticipated improvements in service and/or efficiency from implementation of value opportunities.
- anticipated project savings from implementation of value opportunities.
- recommendations for implementation or follow up.

The Executive Summary should include the following for each proposed value opportunity:

- brief overview of the original design.
- brief description of the proposed change.
- advantages of proposed change.
- cost of original design and estimated savings from proposed change.

IMPLEMENTATION

The VEC will forward to the Location Engineer a copy of the value opportunities approved by the Director of the Division of Highway Design. The Location Engineer will notify the designer of the approved value opportunities and will monitor their incorporation into the project plans. Any problems with implementation of the approved value opportunities should be reported immediately to the VEC. The VEC will coordinate resolution of these problems with the affected parties.

The Location Engineer will notify the VEC once the plans are finalized. The VEC will then verify that the approved value opportunities have been incorporated into the plans. The VEC will document project savings or costs for future reporting. The VEC will document comments from involved parties concerning implementation of the approved value opportunities.

AUDIT, EVALUATION & REPORTING

The VEC will conduct the following activities:

- track the project through construction to determine the effects of the value opportunities.
- document project savings and costs for future reporting.
- document comments from construction and maintenance personnel concerning implementation of the approved value opportunities.
- notify management of the results of VE studies and their subsequent implementation.
- prepare the annual VE Status and Implementation Report to present to the VEAC.
- coordinate reporting of the VE study results and implementation to the FHWA.
- track and report on VE training activities.

VE STATUS AND IMPLEMENTATION REPORT

The VE Status and Implementation Report will include the following information from the past fiscal year:

- number and location of projects studied.
- number of recommendations and proposed savings from projects studied.
- number of recommendations and proposed savings from accepted value opportunities.
- cost of conducting studies.
- number of persons trained in VE techniques.
- number of persons in VE team member pool.
- other items concerning implementation of the VE program.

This report will be presented to the VEAC one month prior to the beginning of the fiscal year for their review and approval.

RECORD KEEPING

The VEC will maintain files for each VE study performed. The file will include as a minimum the following:

- VE Study Report.
- project data the team used for their evaluation.

- correspondence concerning the VE project.

The VEC will maintain databases for the following:

- VE projects with costs, value opportunities, accepted savings, team members, etc.
- VE team member pool with training dates, number of studies participated in, date of last study participation, etc.

TRAINING

The VEC will recommend and schedule training with VEAC approval for KTC personnel in order to maintain a team member pool of persons trained in VE concepts. This training may be provided by NHI or by consultants. Training provided by consultants for team members will be SAVE Module I certified.

The VEC will recommend and schedule training with VEAC approval for KTC personnel in order to develop a pool of VE study team leaders. This training may be provided by consultants. Training provided by consultants for team leaders will be SAVE Module II certified.

The VEC will coordinate management briefings and/or training to inform KTC management of VE principles, practices, and results.

CONSULTANT ACTIVITIES

KTC may elect to involve consultant services in the VE process. The consultants may act as a supplement or instead of KTC staff.

1. Design Consultants - Design consultants will support KTC's VE efforts and will provide close support to the VE study team. This may be at any phase from concept development through the design phase. The design consultant should not be assigned the responsibility to VE their own designs. The majority of the design consultant support should include supplying the VE study team the following information:

- original project objective.
- given design criteria.
- appropriate project constraints.
- major components and elements with their costs.
- required plans or documents as outlined in this guideline.
- project briefing with VE study team.

In addition, the design consultant shall review and comment on the recommend value opportunities as documented in the VE study team report. The design consultant will work with KTC to implement the

approved value opportunities.

Most of this information is developed during a normal design process; however, the design contract should contain requirements that this information be developed into a concise report and presented to the VE study team. Any additional effort required by the design consultant to support the VE study should be outlined and included for payment to the consultant. The design consultant's contract should address each party's obligations and responsibilities with respect to changes necessary for implementation of accepted value opportunities.

2. Value Engineering Consultants - The KTC may engage VE consultants because staff is not available for VE activities, peak workload exceeds in-house resources, and project design is large or complex. The services provided may cover one specific project or may cover multiple projects or services.

a. Consultant requirements - Value engineering consultants will have at least one person on staff that is a licensed Professional Engineer (PE) as well as a Certified Value Specialist (CVS) by the Society of American Value Engineers (SAVE). The PE/CVS should have extensive experience in the design and/or construction of highways and bridges. The consultant will demonstrate their experience conducting VE studies for transportation facilities, particularly highways and bridges. The consultant will be able to provide all the services listed in the following section.

b. Services provided by the consultant - The VE consultant may provide the following services:

1.) Provide the team leader only. The consultant will provide a team leader while the KTC will provide the study team members. The PE/CVS will be the team leader. The team leader will conduct the study, compile the information for the report, prepare the report, and prepare/conduct a presentation for management if necessary. Team leaders may be a CVS, instead of a PE/CVS, only if they have sufficient expertise in transportation related topics and a background in conducting VE studies for highways and bridges. The KTC has the right to reject, accept, or request the team leader on a project by project basis.

2.) Provide a partial team. The consultant will provide a mix of study team members to complement/supplement the team members provided by the KTC. This may or may not include providing the team leader. Team staff provided by the consultant will be forwarded to the KTC for review and approval prior to conducting the VE study. The KTC will specify certain disciplines to be provided and minimum experience requirements. The team members will have some value engineering training.

3.) Provide the entire team. The consultant will provide the entire study team. The study team should have significant highway experience and some value engineering training. Team staff provided by the consultant will be forwarded to the KTC for review and approval prior to conducting the VE study. The KTC may specify certain disciplines to be provided and minimum experience requirements.

4.) Provide training. The consultant will provide basic value engineering workshops, team leader training, or management briefings. Training will be in accordance with these guidelines. Training courses provided by the consultant will be certified by SAVE.

5.) Provide other services. The consultant may provide other services to complement the VE services. These may include:

- information gathering for team studies.
- providing facilities for team study activities.
- preparation of VE study report.
- formal presentation of VE findings.
- development of implementation plans.

c. Other - The KTC will define the time frame and consultant responsibilities for all VE studies. The conduct of all studies will be in general accordance with these guidelines. Final approval of any identified value opportunities is the responsibility of the KTC. The consultant will be evaluated for the effectiveness of the team at the end of each study.

STEP-BY-STEP VE STUDY DEVELOPMENT PROCEDURE

1. The VEC will notify Location Engineers at least three months prior to the beginning of the fiscal year that VE Candidate Project Review Forms are due.
2. Location Engineer reviews potential projects for compliance with VE criteria.
3. If VE Criteria is met, Location Engineer recommends a VE study or requests a waiver (with justification). Projects meeting the requirements of the NHS Designation Act are **required** to have a VE study. A VE study is not required if the VE Criteria is not met. Location Engineer may request a VE study for projects that do not meet VE Criteria (with justification) if circumstances indicate that the project may be a good VE candidate.
4. The Location Engineer completes the VE Candidate Project Review Form and returns it to the VEC at least two months prior to the beginning of the fiscal year.
5. The VEC reviews the Candidate Project Review Forms and recommends or does not recommend the project for VE study. The VEC uses the review forms in preparing the Annual VE Workplan.
6. The VEC forwards the proposed Annual VE Workplan along with the Candidate Project Review Forms to the VEAC for approval at least one month prior to the beginning of the fiscal year.
7. The VEAC approves or disapproves the project for VE study. Based on the approval or rejection of potential VE study projects, the VEAC approves, revises, or rejects the Annual VE Workplan.

8. The Annual VE Workplan and Project Review Forms are returned to the VEC no later than one month after the beginning of the fiscal year. If the workplan is not approved, the VEC revises the workplan and resubmits it to the VEAC for approval.
9. The VEC notifies the Location Engineer of the projects accepted for VE study.
10. The Location Engineer monitors the project to determine when the project will be at a proper stage of development for VE study. The Location Engineer notifies the VEC the project will be ready for VE study approximately three months prior to the expected date of the study.
11. The VEC arranges for a VE study for the project. Study arrangements may include selecting a study team, coordinating with the VE consultant, notifying Decision Team members, scheduling a meeting location, gathering study materials, etc. The VEC notifies the Location Engineer of the planned date.
12. The Location Engineer will notify the designer of the planned date and will arrange for the designer to discuss the project with the VE study team.
13. One month prior to the study the Location Engineer provides the VEC with two copies of the plans, notes, applicable correspondence, etc., as required in the VE Guidelines. The VEC will forward this information to the VE study team members.
14. The VE study team will conduct the study according to the VE Guidelines. The VE study team leader will prepare a report and conduct any necessary presentation of results.
15. The VE study team leader will forward a copy of the report to the VEC.
16. The VEC will forward copies of the report to the VE Decision Team as identified by the preliminary list and by the study team.
17. The Decision Team will review the report, indicate approval or rejection of the proposed value opportunities, and will forward their comments to the VEC.
18. The VEC will compile the comments from the Decision Team and forward the results to the Director of the Division of Highway Design.
19. The Director of the Division of Highway Design will review the comments, indicate approval or rejection of the proposed value opportunities, and return the final decision to the VEC.
20. The VEC will forward a copy of the final decision to the Location Engineer, the Decision Team members, and other interested parties.

21. The Location Engineer will forward a copy of the final decision to the designer and will monitor incorporation of accepted value opportunities into the project.
22. The Location Engineer will report any problems with incorporation of accepted value opportunities into the plans to the VEC. The VEC will coordinate any discussion and resolution of the problem.
23. The Location Engineer will notify the VEC once the plans have been finalized.
24. The VEC will verify that the accepted value opportunities have been incorporated into the plans and will document project savings or costs for future reporting. The VEC will also document comments from involved parties concerning implementation of the value opportunities.
25. The VEC will track the project through construction to determine the effects of the value opportunities. The VEC will document project savings and costs for future reporting. The VEC will also document comments from construction personnel concerning implementation of the value opportunities.
26. The VEC will notify management of the results of VE studies and their subsequent implementation. The VEC will also coordinate reporting of the VE study results and their subsequent implementation to the FHWA.