

Value Engineering Guidelines



Idaho Transportation Department

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INTRODUCTION

Value Engineering (VE) is the systematic application of recognized techniques, called the VE Job Plan, by an objective, multi-disciplinary review team, called the VE team. The VE team is normally a separate group of individuals from the design team. VE studies identify functions of a project (or product or service), establish relative worth for each function, and generate recommended cost-saving alternatives through the use of creative thinking that do not compromise functional integrity of the project. VE studies focus on essential project functions to accomplish the original purpose of the project, reliably, and at the lowest life-cycle cost without sacrificing safety, necessary quality, operational capability, or environmental attributes of the project. Often a positive by-product of value engineering is decreased project construction duration.

The purpose of these guidelines is to provide a consistent and uniform process for executing VE studies during the development of a transportation project.

1. PROJECT SELECTION

1.1 REQUIRED PROJECTS

All projects on the NHS Federal-aid system with an estimated total cost of \$50 million or more shall have a Value Engineering analysis performed during the development of the project. Bridge projects with an estimated total cost of \$40 million or more shall have a Value Engineering analysis performed. The total estimated cost shall include all costs associated with the project, including but not limited to environmental studies, preliminary engineering, final design, right-of-way, construction, and administrative costs. There is not a process to waive the Value Engineering requirement for projects on the Federal-aid system.

Other required projects may include any Federal Aid project that FHWA determines to be appropriate.

1.2 ADDITIONAL PROJECTS

The districts have the flexibility to study additional projects below the mandatory \$50/\$40 million cost threshold. Projects that provide the highest potential for value improvement include:

- New alignment or alternate routes
- Major structures
- Projects with extensive or expensive environmental or geotechnical requirements
- Major reconstruction of existing highways
- Projects with major traffic control
- Projects with multiple stages
- Projects that substantially exceed initial cost estimates
- Capacity projects
- Interchanges
- Corridor studies
- Projects with high right of way costs

1.3 SCHEDULING

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Ideally, two studies should be performed on each project. A Concept-Level VE Study can be commissioned during conceptual design development in order to evaluate essential project functions and constraints and to provide a recommendation as to a preferred major design alternative from several major alternatives under consideration by the design team and owner. A traditional VE study should then be commissioned between Preliminary and Final Design in order to focus on possible cost-saving measures that will deliver the selected design alternative at the lowest reasonable initial and life-cycle cost without compromising essential project functions. There may be opportunities to investigate the value and effectiveness of individual project components during any stage of design development, so the above description of Concept-Level VE, and VE at Preliminary or Mid-Design, should be considered as general guidelines to apply on a case by case basis as they make sense for individual projects. For example, a major interchange (new or reconstructed) with multiple geometric alternatives should receive both a Concept-Level VE study to confirm a preferred design alternative, and a follow-on VE study at Preliminary Design of the selected alternative to further evaluate cost-saving measures for that specific design alternative should be employed. However, reconstruction of a section of highway where there are very limited alternatives might only call for one VE study at the preliminary to mid design phase of the project.

This Concept-Level VE study provides a review by the design, construction, and maintenance sections, as well as any other relevant subject matter experts. The involvement of construction and maintenance could lead to significant life cycle cost savings. The VE study shall occur prior to the public hearing in order to depict the team's enhancements and VE alternatives. This step is critical in building public credibility for the project purpose and need.

VE alternatives compared at this stage will include those submitted by the consultant and/or designer, and any concepts introduced by the Concept-Level VE team during the VE study.

Information or data that may be available to the team at the time of the Concept-Level VE Study include:

- Major design alternatives developed to date by the design team (such as several geometric alternatives for an interchange)
- Environmental impact analysis (ideally the in-progress draft, or final environmental analysis)
- Conceptual plans for each major alternative
- Traffic operation analysis
- Safety evaluations
- Life cycle costs including maintenance costs, operating costs and periodic improvements for each alternative (if available)
- Summary of public involvement
- The number and cost of business and residential relocations for each alternative
- Estimated right of way cost for each alternative based on actual real estate values in each area
- Estimated construction cost breakdown by alternative

The second VE study may occur between Preliminary Design and Final Design, although there may not be as much flexibility to incorporate significant geometric changes into the design at this stage. Elements of the final VE study may include selection of materials, refinements to drainage

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features, vertical grades, and horizontal alignments within the established corridor, structures, construction phasing/staging, work zone safety and utilities.

These two opportunities for a VE study during project development are general in nature and internal district discussions are needed to determine the proper timing for a Value Engineering study with the greatest potential for success. The Districts can contact HQ Design/Materials/Construction (DMC) section for input on study timing. It is important for project elements to be developed to enough detail for the VE team to comprehend the intent of the design, but not developed to the extent that any proposed change would impact implementation. Teams should focus on features that are being developed during that particular phase of project design.

A VE study performed on a Design-Build project shall be performed prior to the release of the Request for Proposal (RFP). The VE team on these studies should focus on the criteria contained within the proposed RFP. VE studies are not required on ANY Design-Build projects.

1.4 STATEWIDE VALUE ENGINEERING WORK PLAN

The Districts are responsible to develop and execute an annual Value Engineering Work Plan. Upon completion of the Draft STIP, the Districts will identify projects that require VE studies and select additional projects for VE studies. The districts will also select the timing and schedule to complete VE studies for their district. The Statewide VE Work Plan will be compiled annually by the HQ VE Coordinator upon submittal by the Districts. The HQ VE Coordinator will prepare and submit an annual Value Engineering Program Summary Report to FHWA.

2. TEAM SELECTION AND STRUCTURE

The District shall review potential team members and coordinate the selection of team member disciplines with the project manager/designer. A team leader should be selected who is preferably a Certified Value Specialist (CVS) through SAVE International – The Value Society. VE teams should be structured to include appropriate expertise to evaluate the major areas anticipated within the project. At a minimum, several multi-disciplinary design representatives, construction, cost estimating, and maintenance shall be represented on the VE team. In the event of specialized projects, individuals with specific expertise necessary to perform a proficient Value Engineering study should be included in the team makeup. Anyone directly involved in the design of the project should not be a team member, but is expected to participate as source for information. However, for Concept-Level VE studies, key representatives from the design team and owner typically participate full-time in the Concept-Level VE study along with other objective VE team members who represent the major disciplines involved in the project. The VE study shall be independent of other design reviews. The Districts shall determine whether to utilize Department personnel, consultant personnel, or a mixture of both to form the team. Invite FHWA to participate in all VE studies being done on full oversight projects.

3. VALUE ENGINEERING STUDY

3.1 VE JOB PLAN

This is a systematic and organized plan of action for conducting a VE analysis and ensuring the implementation of the recommendations. The following methodology for VE analysis utilizes

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widely recognized systematic problem-solving procedures that are used throughout private industry and governmental agencies.

- Selection - Select the team, timing, processes, and/or elements.
- Investigation (Information) - Investigate the background information, technical input reports (such as traffic, soils, hydraulic, environmental, accidents) and field data, function analysis, team focus, and objectives. Review the cost estimate and identify high cost functions with potential for improvement.
- Speculation - Be creative and brainstorm alternative proposals and solutions.
- Evaluation - Analyze alternatives, technical evaluation, life cycle costs, documentation of logic, and rationale.
- Development - Develop technical and economic supporting data to prove the feasibility of the desirable concepts or ideas. Develop realistic team recommendations. Recommend long-term as well as interim solutions as applicable.
- Presentation - Present the findings and recommendations of the VE team in an oral presentation at the conclusion of the study, and in a written report following the completion of the study. In many cases, the way the findings are presented can be as important as the findings themselves.
- Implementation - The recommendations formulated by the VE team are given a fair and thorough evaluation and proposals are either accepted, modified or rejected. The implementation plan should include the response from the evaluations and a schedule for accomplishing the recommendations. Rejected recommendations must provide explanation in the Final VE Report.
- Reporting/Tracking – VE Coordinator will establish a tracking system to record the results and accomplishments of the VE program on a statewide basis and to compile the appropriate statistical analysis.

3.2 VE STUDY PREPARATION AND DURATION

VE studies are normally one-week (five work-days) in duration, during which time the VE Team Leader leads the multi-disciplinary VE team through the VE Job Plan. Sufficient time also needs to be budgeted prior to the VE study for study setup, and following the VE study for VE report preparation.

Study setup involves coordinate with the design team and owner in setting up the VE study, to prepare the VE agenda, List of Reference Materials that will be needed during the study from the design team and owner, and to prepare an agenda that will be distributed to all parties involved in the VE study at least 2 weeks in advance of the VE study actually taking place. The VE team will need time to review some of the design information made available to the VE team in advance of the VE study. The VE team leader and support staff will need time following the VE study to prepare the Preliminary and Final VE reports to document the VE study proposals, methodology, and final results from the VE study.

Depending upon the project size and complexity, the VE study duration should be a maximum of five workdays, with shorter duration as necessary. However, the agency commissioning the VE study should avoid the tendency to shorten the VE study to an unreasonably short duration, which would compromise the quality of the VE effort. The VE team should be allowed sufficient time to work through the VE job plan given the project's dollar volume and complexity. For many projects a full five-team-day VE study is required, and that is the norm.

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3.3 REQUIRED STUDY ELEMENTS

Several steps in the application of VE have been determined by the Department to be of such significance that special attention is noted here. These ten (10) items shall be required in conducting a VE study:

1. Define or validate the original project purpose and need
2. Identify or validate the stated design criteria for the project
3. Specify all project constraints
4. Identify specifically the components and elements of high cost
5. Consider Practical Design Initiative
6. Evaluate the alternatives by comparison
7. Review of Environmental Considerations
8. Consider life cycle costs of alternatives
9. Develop a detailed implementation plan
10. Define which VE alternatives can be implemented together and which stand alone

In addition to the required elements listed above, VE studies on bridge projects shall include the following:

1. Bridge substructure and superstructure requirements based on construction materials
2. Evaluation of acceptable bridge designs based on engineering and economic basis
3. Evaluate using life cycle costs and construction duration

The information required for the VE study should be the information already available and/or prepared for the project. The information should not be generated for the sole purpose of the VE study; it should be gathered together and packaged appropriately for the VE study team. The VE team shall select which combination of developed solutions is being specifically recommended.

3.4 VE EXECUTIVE SUMMARY PRESENTATION

The VE study team will make a formal Executive Summary presentation to ITD District management and design team representatives on the findings and recommendations of the VE study. ITD District Management may be involved as necessary during the presentation. This presentation is typically made on the final afternoon of the VE study. The VE Team Leader provides an overview of the VE process and methodology followed during the preceding days of the VE study. Individual VE team members (the multi-disciplinary VE team participants) have an opportunity to provide an overview of the VE proposals and observations.

It is not the purpose of this presentation to specifically identify the disposition of the VE proposals (accepted, rejected, or modified). Rather, the purpose of this presentation is to advise the attendees (design team and owner) of the general scope of each proposal and the cost savings or functional enhancements that are attributable to each proposal.

The VE Team Leader typically summarizes the presentation with identification of the VE proposals and observations that are highly recommended for further consideration and implementation into the design. Follow-up tasks are discussed, such as when the Preliminary VE Report will be produced and distributed for review.

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3.5 PRELIMINARY VE REPORT

A Preliminary Value Engineering Report, including all pertinent data, shall be assembled, published, and made available to the team members and District management for their review and comments, preferably within one week, but not more than two weeks, of the VE study conclusion.

The VE Team Leader shall resolve any issues that arise from the draft report. If the team leader deems it necessary, the team may be contacted, or reassembled to enhance sketches, make editorial changes, refine cost calculations, etc. This may only be needed for complex projects.

The Preliminary VE Report is typically distributed to the design and owner team in both hard copy and electronic (consolidated PDF) format. This allows the design and owner team to fully evaluate and understand the basis of each VE proposal and observation, leading to determinations as to the final disposition of each VE proposal and observation.

3.6 VE PROPOSAL EVALUATION

The design team, in conjunction with the District Engineer and designees, will review the Preliminary VE Report and its recommendations to determine acceptance, modification or rejection of each VE Proposal or VE Observation. The VE Team Leader and other VE team members are consulted on an as-needed basis during this time. The VE Team Leader will provide documentation of the VE proposal evaluation in the appendix of the subsequent final report. The Summary Report spread sheet will include the number and dollar cost of all proposals accepted, modified or rejected.

3.7 FINAL VE REPORT

The Final VE Report will incorporate comments on the draft report and include final recommendations to reject, modify or accept the VE Proposals or Observations. The Final VE Report will identify any VE recommendations that have potential application to the Statewide Practical Design Initiative. The VE Team leader shall submit copies (electronic and hard copy) of the Final VE Report to the District Engineer, project manager, designer, PDE, VE Coordinator, FHWA (full oversight projects only), and third-party design team representatives as appropriate.

The final report shall be organized in sections by areas of focus consistent with the Value Engineering Job Plan. The format of the report should contain, as a minimum, the following:

- Cover Page
- Table of Contents
- Executive Summary
 - Introduction
 - Project Description
 - Project issues
 - Figure 1 - Project Vicinity Map
 - VE Proposals Summary (Narrative)
 - VE Observations Summary (Narrative)
 - Practical Design Recognition (Identify specific VE recommendations that have potential application to the Statewide Practical Design Initiative)
- VE Overview
 - Introduction and Project Description

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- Table 1 - VE Participants
- VE Proposals
 - Individual Proposal details
 - Table 2 - Summary of VE Proposals
- VE Observations
 - Individual Observation Details
 - Table 3 - Summary of VE Observations
- VE Proposal Evaluation
 - Proposal Evaluation Methodology
 - Final VE Recommendations
 - VE recommendations that have potential application to the Statewide Practical Design Initiative
- VE Study Summary Report
 - Completed Summary Report Spreadsheet
- Implementation Plan
 - Person(s) responsible for implementation
 - Impact on Design & Construction Costs
 - Impact to Resources
 - Impact to the Schedule

APPENDIX

- VE Proposals Documentation
 - Proposal Descriptions
 - Sketches
 - Performance Measures
 - Assumptions and Calculations
 - Initial Costs
 - Life Cycle Costs
 - Evaluation Documentation – Acceptance, Modification, Rejection
- Cost of the VE Study
 - ITD Costs
 - Consultants costs
 - Other costs
- VE Participants
 - Sign In Sheets
- Reference Materials Utilized during the VE Study
 - Charter/ Concept Report
 - Materials Reports
 - Traffic Studies and Reports
 - Plans
 - Special Provisions
 - Cost Estimate
 - Funding/Obligation Data
- ITIP Forms and Supporting Data

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4. IMPLEMENTATION

The implementation plan, included in the VE Study Final Report, should identify the person, department, or organization that will be responsible for the implementation of the changes that have been approved by District management. In addition, the plan should address the general impact on design and construction costs, letting date, manpower requirements, consultant resources, design and construction schedules, and any other impact resulting from team recommendations. Specific changes required by these impacts shall be defined and addressed by the project manager or designer and communicated to VE Coordinator.

The District shall have the responsibility to monitor and report on all projects in the implementation process. They must be aware of the progress of time critical implementations and take appropriate actions as problems arise or delays occur. The project manager/designer will be responsible for modification of the project reports, plans, and documentation. Final project savings or cost avoidance shall be calculated based on actual team recommendations and calculations or modified recommendations approved by District Management. District Management must also approve and document when implementation of recommendations cannot be accomplished.

Inform VE Coordinator of any VE recommendations that have potential application to the Statewide Practical Design Initiative.

5. VALUE ENGINEERING CHANGE PROPOSAL (VECP)

The contractor is encouraged to propose changes in project's plans, designs, specifications or the contract documents that would lower the project's life-cycle cost to the owner agency, or improves the performance, value and/or quality of the project with no increase or adverse affect to the life-cycle cost. The net savings of each proposal is usually shared with the contractor at a stated reasonable rate.

6. REPORTING/TRACKING

The VE Coordinator shall be responsible for monitoring program compliance and annually reporting to FHWA. Value engineering operations will be monitored for compliance with the policies, procedures, and standards identified in the preceding sections. Specific areas to be monitored include:

- District Value Engineering Work Plan and Schedule.
- District Value Engineering accomplishments (accepted cost savings, return-on-investment, functional enhancements).
- Documentation of Value Engineering activities.
- Economic analysis methods being used in cost/benefit determinations for project decisions.
- Compliance with the provisions of the Value Engineering procedures.

Monitoring of program compliance may include the following:

- Regular visits with district engineering personnel.
- Periodic participation in Value Engineering team meetings.
- Attending VE team presentations.
- Formal program review of all records, study summaries, interview documentation, periodic activity, and quarterly VE reports.

The VE Coordinator will prepare the Value Engineering Program Summary Report detailing the progress made during the current fiscal year, as outlined in Statewide VE Work Plan. The Districts must provide the information necessary to answer the Questionnaire found in Appendix A. This report will be submitted to FHWA on an annual basis and will reflect the program accomplishments for the fiscal year.

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7. DEFINITIONS

Constraint: A limit or restriction that provides definition as to the parameters of a project or that provides guidance to the number of potential solutions available to a specific facet of a project. It may include but is certainly not limited to permitting, access, or geometrics.

Cost: The amount paid for a good or service, a project, or a project component.

Design Observation: An observation or suggestion that the VE team wishes to convey to the design team for consideration.

Evaluation Matrix: A method by which competing VE alternatives, proposed Design, and potential solutions can be evaluated through the use of weighted objectives.

Federal-aid System: Rural major collectors and higher

Job Plan: An organized plan of action for accomplishing VE studies and assuring the implementation of the recommended changes.

Life Cycle Costs: The total cost of a project or item over its useful life. This includes all the relevant costs that occur throughout the life of a project or item, including initial acquisition costs (such as right-of-way, planning, design, and construction), operation, and maintenance, modification, replacement, demolition, financing, taxes, disposal and salvage value as applicable.

Project: A portion of a highway that a State or public authority 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.

SAVE International – The Value Society: The premier international society devoted to the advancement and promotion of the value methodology (also called value engineering, value analysis, or value management).

VE Alternatives: The individual concepts the VE team identifies as potential cost-saving solutions (or in some cases cost-increase solutions) that may be substituted for features currently depicted.

VE Milestone: A point in the development of a project that is appropriate to perform a Value Engineering study.

VE Recommendation: A VE alternative or compilation of VE elements recommended by the VE team.

Concept-Level VE Study: A VE study implemented at the conceptual stage of a project design, when several geometric or alignment alternatives are being evaluated during the environmental review phase.

VE Study at Preliminary or Mid-Design: A traditional VE study commissioned after a geometric design alternative has been selected and carried forward into a specific design approach at roughly 35% preliminary engineering.

Statewide VE Work Plan: A statewide plan that identifies VE candidate projects based on the STIP and sets a schedule for VE studies to be completed.

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8. REFERENCES

1) American Association of State Highway and Transportation Officials (AASHTO) Guidelines for Value Engineering, AASHTO Bookstore, <https://bookstore.transportation.org/>

2) Federal Highway Administration (FHWA) Value Engineering web site, <https://www.fhwa.dot.gov/ve/index.cfm>

3) Code of Federal Regulations Title 23 Section 627

http://edocket.access.gpo.gov/cfr_2008/aprqrtr/pdf/23cfr627.5.pdf

4) United States Code Title 23 Section 106(g)

<http://uscode.house.gov/uscodecgi/fastweb.exe?getdoc+uscview+t21t25+3981+0++%28%29%20%20AND%20%28%2823%29%20ADJ%20USC%29%3ACITE%20AND%20%28USC%20w%2F10%20%28106%29%29%3ACITE%20%20%20%20%20%20%20%20%20>

5) MAP 21 Questions and Answers, <http://www.fhwa.dot.gov/map21/qandas/>

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Appendix A

District Annual VE Report Questionnaire (answer for each VE study completed)

1. Was this VE study specially designated by FHWA?
2. Was this VE analyses completed during the concept phase?
3. Was this VE analyses completed during the preliminary design phase?
4. Was this VE analyses completed during the final design/pre-PS&E phase?
5. Was this VE analyses completed by agency staff?
6. Was this VE analyses completed by consultant staff?
7. Was this a successful VE analyses?
8. What are the estimated costs associated with conducting this VE analyses?
9. What are the estimated total costs of this project ?
10. What is the total number of proposed VE recommendations for this project?
11. What is the \$ value of proposed VE recommendations?
12. How many approved VE recommendations improved safety?
13. How many approved VE recommendations improved traffic operations?
14. How many approved VE recommendations mitigated environmental impacts?
15. How many approved VE recommendations improved construction?
16. How many approved VE recommendations mitigated right of way impacts?
17. What is the total number of approved VE recommendations on this project?
18. What is the \$ value of approved VE recommendations?
19. Describe a unique or innovative VE recommendation that provided a significant benefit and was implemented on this project.
20. If this was a special VE analyses briefly describe it.