

## **2.15 CDOT DESIGN PHASE VALUE ENGINEERING (VE) PROGRAM**

### **2.15.01 General**

Value Engineering is the systematic process of review and analysis of a project during the planning and design phase by a multi-disciplined team not involved in the project, to make recommendations for:

- Providing the needed functions safely, reliably, and at the lowest overall cost;
- Improving the value and quality of the project; and
- Reducing the time to complete the project.

The scope of this VE program is to provide guidance for selecting projects for VE analysis, and to standardize the procedure for conducting studies and reporting results in compliance with federal requirements. This guidance focuses on Value Engineering during the planning and design phase of a project.

The goal of the VE program is to provide a positive benefit to a given project, and CDOT as a whole. This benefit may take the form of monetary saving, reduced construction time, reduced impact to the travelling public, improved maintainability, reduced environmental or cultural impacts, or some other identified benefit. The effectiveness of the VE Program will be tracked and reported to CDOT management in the spirit of continuous improvement.

### **2.15.02 Requirements**

The CDOT/FHWA Stewardship agreement states that CDOT will conduct VE analyses for:

- Projects on the Federal-aid system with an estimated total cost of \$40 million or more, and
- Any other project that the U.S. Secretary of Transportation determines to be appropriate.

Total project cost is defined as the cost of all phases of a project, including environmental, design, right of way, utilities, construction, and construction engineering costs. If total project cost is revised any time prior to award to exceed \$40 million, then a VE analysis is required. If construction is advertised in multiple projects for a corridor improvement, all construction projects need to be considered in the total. VE analyses are not required on projects delivered using a design-build method of construction.

### **2.15.03 Additional Guidance**

A VE analysis is not just limited to projects meeting the total cost threshold. A VE analysis during design may also be considered for other design-bid-build projects with one or more of the following elements:

- Major Structures,
- Complex design or construction,
- Challenging constraints and/or difficult technical issues,
- External influences and unique or complicated functional requirements,
- Potential to improve the projects' performance or quality,
- Competing community and stakeholder objectives,
- Potential alternative solutions that impact scope and cost,
- New alignment or bypass sections,
- Capacity improvements that widen existing highways,
- Interchanges,
- Extensive or expensive environmental or geotechnical requirements,
- Materials that are difficult to acquire or have special requirements,
- Inferior material sources,
- New/reconstruction project, and
- Major traffic control requirements or multiple construction phases.

### **2.15.04 Roles and Responsibilities**

#### **2.15.04.01 State VE Coordinator**

The State VE Coordinator role is held by the Design Program Manager in the Project Development Branch. The State VE Coordinator ensures statewide implementation of the VE Program in compliance with federal requirements, and is responsible to:

- Coordinate the Statewide VE Plan;
- Prepare and submit to FHWA an Annual VE Report to summarize results, accomplishments, costs, and benefits;
- Maintain VE program documents and forms and monitors federal requirements;
- Maintain an informational webpage and a list of resources to support the VE program, including a statewide pool of qualified Team Leaders and Members,
- Assist Project Managers to select VE Team Leaders and Team Members;
- Serve as a proponent for the VE program and monitor and publicize benefits; and
- Develop and coordinate training.

### **2.15.04.02 Project Manager**

The Project Manager is responsible to:

- Review assigned projects to identify opportunities to implement VE analyses per the requirements and guidelines;
- Initiate VE Studies and work with State VE Coordinator to select VE Team Leaders and Team Members;
- Coordinate the preparation of VE study packages for the project, and provide those study packages to VE team members;
- Coordinate and facilitate VE Team Review;
- Ensure preparation of Final Report for completed studies;
- Ensure implementation of approved recommendations; and
- Report the results of the project VE study to the State VE Coordinator.

### **2.15.04.03 VE Team Leader**

The VE Team Leader oversees all aspects of individual VE studies including coordinating the logistical arrangements, leading team efforts, and completing the final report. Team Leaders can be affiliated with the region, another region, headquarters, or the consultant community, but should have some autonomy from the project. If utilizing a consultant as the VE Team Leader, the consultant shall provide his or her VE qualifications to the Project Manager for review and acceptance. A generally accepted qualification for Team Leaders is to be licensed by the Society of American Value Engineers (SAVE International). Being licensed by the SAVE International is not required, but should be considered by the Project Manager. The Team Leader should be knowledgeable and proficient in transportation design and construction as well as the VE analysis process, and is responsible for:

- Planning, leading, and facilitating the VE study;
- Scheduling a pre-workshop meeting with the project team, providing the pre-study materials to team members, and preparing the agenda for the VE study;
- Ensuring proper application of VE methodology.
- Guiding the team through the activities needed to complete the VE study, preparation of the report, and the post-study stages.

### **2.15.04.04 VE Team Members**

The VE team is typically comprised of five to ten members with diverse expertise relevant to the specific project including major functional areas and any critical, high-cost issues. Team Members may be from the regions; headquarters; other local, state,

or federal agencies; or the private sector. Team Members must not be directly involved in the planning and development phases of the project, and preferably, should have attended Value Engineering training.

## **2.15.05 Planning and Reporting**

### **2.15.05.01 Annual VE Plan**

The State VE Coordinator works with the individual Project Managers to prepare an annual VE Plan that lists projects identified for VE analysis. The VE Plan is the basis for determining projected VE program needs, including costs, team members, team leaders, consultants, and training. The Annual VE Plan will be completed by November 30<sup>th</sup>.

### **2.15.05.02 Annual VE Tracking Report**

The State VE Coordinator will prepare an Annual VE Tracking Report that summarizes project benefits and cost savings from completed VE studies. The State VE Coordinator will report VE program achievements and best practices to the FHWA as required. The Annual VE Tracking Report will be completed by November 30<sup>th</sup>.

### **2.15.05.03 Conducting a VE Study**

A VE analysis should be conducted as early as practicable in the planning and development of a project, preferably before the completion of preliminary design and at a minimum, prior to completing the final design. If the need for a VE study has yet to be determined, the topic shall be discussed at the Scoping, FIR, and FOR meetings, and the decision to conduct a study or not, shall be documented in the meeting minutes. The VE analysis should be closely coordinated with other project development activities to minimize the impact that approved recommendations might have on the project. Although benefits can be realized by performing a VE analysis at any time during project development, four prime windows of opportunity are:

- 1. Planning Phase:** The subject of whether or not to conduct a VE analysis on a given project is to be discussed once a preferred alternative has been identified during the NEPA phase.
- 2. Post Scoping Meeting:** The subject of whether to conduct a VE analysis is to be discussed at the scoping meeting and should be documented in the scoping meeting minutes, along with justification for the decision. The best time to consider alternatives

to design solutions is soon after the scoping meeting when preliminary engineering information is available. At this point, the study can also provide an opportunity for building consensus among stakeholders.

**3. Pre-Final Inspection Review (FIR):** Major design decisions with regard to project scope have been made at this point, preliminary costs have been established, and the design team has initiated the development of plans, specifications, and estimates (PS&E). Although the VE analysis may be limited by these decisions and activities, there is opportunity for the study to focus on technical aspects of specific design elements.

**4. Pre-Final Office Review (FOR):** At the FOR stage, most of the important project decisions have been made and the opportunity to affect the project design is limited. At this stage, the VE analysis should focus on constructability, construction sequencing, staging, traffic control, and significant design issues.

**Note**

If a project has been identified for a VE analysis, the Project Manager shall notify the State VE Coordinator.

A VE study can be conducted in conjunction with or in lieu of a Constructability Review if the VE team consists of two or more members of the Contracting community. If the VE is to be considered in lieu of the Constructability Review, this shall be noted in the introduction portion of the VE Final Report.

**Process**

To initiate a VE study, the Project Manager will contact the State VE Coordinator. The State VE Coordinator maintains a list of qualified Team Leaders and Team Members. The Project Manager and the State VE Coordinator will work together to appoint a VE Team Leader and select Team Members for the VE study. The VE Team Leader will work with the Project Manager and Design Team to prepare a study package (see Figure 1) that is provided to each of the Team Members at least one week prior to the study. The Project Manager should arrange for the use of a meeting facility and needed equipment for the team meeting. The facility, if possible, should be near the project site, to allow for a site visit.

<b>Figure 1 - VE Study Team Information and Logistics Planning</b>	
<p><b>Study Package for VE Team Members:</b> Accident data, traffic data, aerial photos, contour maps, cross-sections and profiles, environmental documents, estimates, as-built plans for existing elements, geotechnical reports, hydraulic report, land use maps, plan sheets, quantities, right-of-way plans, vicinity maps, design decision memos, and any other identified design information.</p>	<p>Provide to VE Team Members at least 1 week prior to meeting.</p>
<p><b>Facilities and Equipment:</b> Conference room with a large table and adequate space for the team, AASHTO Green Book, Field Log of Structures, calculators and/or computers, telephone, projector, CDOT Design Guide, design file, large scale aerial photos (if available), easel(s)/paper, field tables, office supplies, network access, power strip(s) and extension cords, scales, straight edges, and curves, Standard Plans, Standard Specifications, and vehicle or vehicles with adequate seating to transport the VE team for a site visit.</p>	<p>Typically allow 3 to 5 days for the team to meet.</p>

It is recommended that the VE Job Plan (see Figure 2) approach be followed for conducting and documenting the results of a VE analysis. The phases can be tailored as appropriate for each project, and more information is available regarding this approach in the *Value Methodology Standard and Body of Knowledge* by The Society of American Value Engineers ([www.value-eng.org](http://www.value-eng.org)).

<b>Figure 2 - VE Job Plan</b>	
<b>Phase</b>	<b>Activities</b>
1. Information Phase	<ul style="list-style-type: none"> <li>• Gather project information, including project commitments and constraints.</li> <li>• Investigate technical reports and field data. Develop team focus and objectives.</li> </ul>
2. Function Analysis Phase	<ul style="list-style-type: none"> <li>• Analyze the project to understand the required outcomes.</li> <li>• Review and analyze these project outcomes to determine which items could benefit from improvement to meet overall project goals.</li> </ul>
3. Creative Phase	<ul style="list-style-type: none"> <li>• Generate ideas on alternative proposals and solutions to accomplish the required outcomes, which improve the project's performance, enhance its quality, and/or lower project costs.</li> </ul>
4. Evaluation Phase	<ul style="list-style-type: none"> <li>• Evaluate and select feasible ideas for development.</li> <li>• Analyze design alternatives, technical processes, and life-cycle costs</li> </ul>
5. Development Phase	<ul style="list-style-type: none"> <li>• Develop the selected alternatives into fully supported recommendations.</li> <li>• Develop technical and economic supporting data to prove the benefits and feasibility of the desirable concepts.</li> <li>• Develop team recommendations including long-term and interim solutions.</li> <li>• Generate cost and/or time saving based on proposed solutions.</li> </ul>
6. Presentation Phase	<ul style="list-style-type: none"> <li>• Present the VE recommendation in an oral presentation to the project stakeholders, the region project team, region management, FHWA, and any other relevant stakeholders that the Project Manager has identified.</li> <li>• Provide a written report.</li> </ul>
7. Resolution Phase	<ul style="list-style-type: none"> <li>• Evaluate, resolve, document, and implement all Approved recommendations and record this information in the VE Study Summary and Implementation Report.</li> <li>• Post VE analysis activities include the implementation and evaluation of the outcomes of the approved recommendations.</li> <li>• Conduct a VE Close Out meeting to review VE study results with identified members of CDOT and FHWA.</li> <li>• Document for each recommendation whether the recommendation has been "Approved, Declined, or Tabled for Further Consideration"</li> </ul>

**2.15.05.04 VE Final Report**

The results of a VE analysis will be documented in a Final Report prepared by the VE Team Leader that includes the following sections:

- Introduction;
- Executive summary;
- Project number and narrative description of project information, including estimated project cost prior to the VE study;
- VE Project Team;
- Background, history, constraints, and controlling decisions;
- VE team focus areas;
- Discussion of the team speculation and evaluation processes;
- Approximate cost to conduct the VE;
- Benefits that the VE outcome will provide to the project;
- Time and/or cost savings to the project; and
- Final recommendations recorded on the VE Study Summary and Implementation Report.

All of the team's evaluation documentation including sketches, calculations, analyses, and rationale for recommendations should be included. A copy of the Final Report will be included in the project file and made available to the region's project team.

Following the VE analysis, the Project Manager and the region's design team will add their evaluation to the VE Final Report. The Project Manager will provide a copy of the VE Study Summary and Implementation Report to the State VE Coordinator. The State VE Coordinator will record the study outcome on the Annual VE Tracking Report for reporting to FHWA.

#### **2.15.06 Training and Information**

The State VE Coordinator will identify regular VE training courses in order to build a pool of qualified VE Team Leaders and Team Members. The State VE Coordinator will maintain a list of qualified VE Team Leaders and Team Members.

#### **2.15.07 Attachments:**

VE Study Summary and Implementation Report



VE Study Summary  
and Implementation Re

### **2.15.08 References**

1. CDOT/FHWA Stewardship Agreement
2. 23 United States Code (USC) 106 (e, g, and h);
3. 23 CFR Part 627, Value Engineering;
4. P.L. 112-141, MAP-21;
5. Value Engineering, Circular A-131, Office of Management and Budget
6. Guidelines for Value Engineering, 3rd Edition, American Association of State Highway and Transportation Officials (AASHTO);
7. *Value Methodology Standard and Body of Knowledge*, SAVE International, The Value Society: [www.value-eng.org](http://www.value-eng.org); and
8. CDOT VE Website (Under Development)