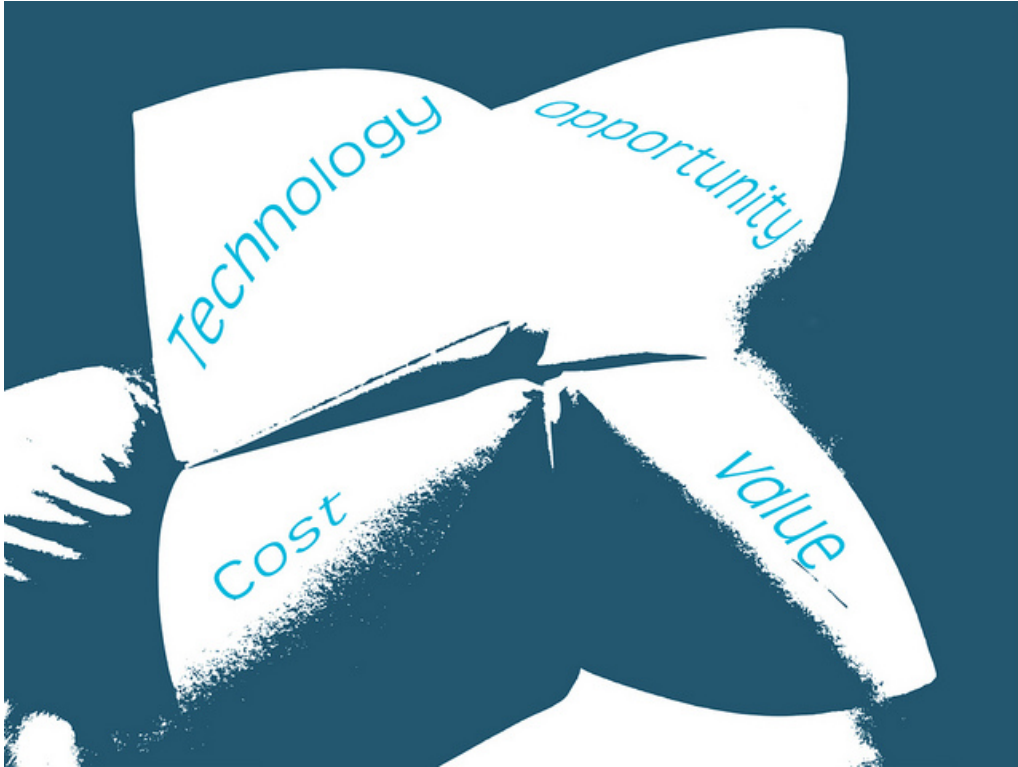


Value Engineering Manual

July 24, 2015



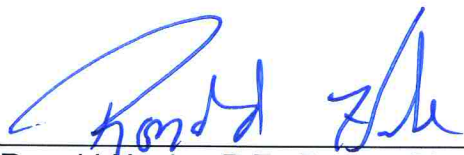
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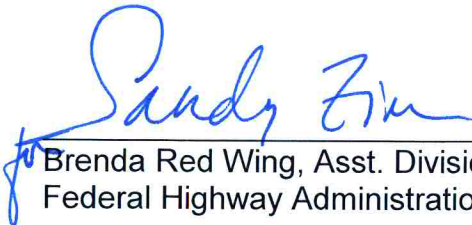
ENVIRONMENTAL & TRANSPORTATION SERVICES
Mark S. Gaydos, P.E.

Value Engineering Manual



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North Dakota Department of Transportation

7/29/15
Date



Brenda Red Wing, Asst. Division Administrator
Federal Highway Administration

8-12-15
Date

INTRODUCTION

The purpose of this Value Engineering (VE) Manual is to comply with the Federal Highway Administration (FHWA) VE program required in 23 CFR part 627.

The Technical Services Section of the Environmental and Transportation Services (ETS) Division has developed and will administer a VE program that complies with FHWA VE requirements. The responsibilities and procedures to be followed are described in the Value Engineering Manual, specifically to insure:

1. VE program and policies are established, updated and followed;
2. Coordinate with other NDDOT divisions to insure VE process is integrated in the planning, design and construction program procedures where warranted;
3. Ensure that the VE analysis are planned and conducted in accordance with this policy and VE Manual, and that recommendations developed and implemented for each project are properly documented in a final report before bid letting and;
4. Monitor, evaluate, and annually report to FHWA the results of the VE analyses that are conducted and the recommendations implemented for each project in the State.

Value Engineering Manual

I. General

Value Engineering is the systematic application of recognized techniques by a multidiscipline team to identify the function of a product or service, establish a value for that function, generate alternatives through the use of creative thinking, and provide the needed function to accomplish the original purpose of the project, reliably, and at the lowest life-cycle cost without compromising safety, necessary quality, and environmental attributes of the project.

The purpose of the VE Program is to:

1. provide the needed functions safely, reliably, efficiently, and at the lowest overall cost;
2. foster innovation;
3. eliminate unnecessary and costly design elements;
4. improve the value and quality of the project; and
5. reduce the time to complete the project.

II. Definitions

Total project cost – The estimated costs of all work to be conducted on a project including the environment, design, right-of-way, utilities, and construction phases.

Final design – Any design activities following preliminary design and expressly includes the preparation of final construction plans and detailed specifications for the performance of construction work.

Life-cycle cost – The total cost of a project or item over its useful life. This included all of 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, maintenance, modification, replacement, demolition, financing, taxes, disposal, and salvage value as applicable (as defined in 23 USC 106(f)(2)).

Project – A portion of a highway that a STA or public authority proposes to construct, reconstruct, or improve as described in the preliminary design report or applicable environmental document. A project is defined as the logical termini/independent utility in the environmental document and may consist of several contracts or phases of a project or contract, which are implemented over several years.

Major project – A project receiving Federal financial assistance:

1. With an estimated total project cost of \$500 million or more, or

2. That has been identified by the Secretary of Transportation as being “Major” as a result of special interest (23 USC 106(h)).

III. Project Selection

a. Federal Requirements

Projects federally requiring VE analysis are:

1. Each project located on the National Highway System (NHS) with an estimated total project cost of \$50 million or more that utilizes Federal-aid highway program (FAHP) funding;
2. Each bridge project located on the NHS with an estimated total project cost of \$40 million or more that utilizes FAHP funding;
3. Any major project located on or off the NHS that utilized FAHP funding in any contract or phase comprising the major project;
4. Any project where a VE analysis has not been conducted and a change is made to the project’s scope or design between the final design and the construction letting which results in an increase in the project’s total cost exceeding the thresholds as identified in III.a.1, 2, or 3;
5. Any other project FHWA determines to be appropriate that utilized FAHP funding;
6. Any project that has been split into smaller projects or programmed to be completed by the letting of multiple construction projects that has a total combined cost that exceeds the above federal requirements for VE.

Additional VE analysis is not required when a VE analysis has been completed for a project which is then subsequently split into smaller projects during the design phase or the project is programmed to be completed by the letting of multiple construction projects. VE analysis is also not required for projects delivered using the design/build method of construction.

b. NDDOT Requirements

A VE analysis will be conducted for any project that has been recommended from the Technical Services Section of the ETS Division where there is a high potential to realize the benefits of a VE analysis and has also been recommended by the Office of Project Development and approved by the Deputy Director for Engineering.

IV. Responsibility

a. Design, Programming, and Local Government Divisions

The Design, Programming, and Local Government Divisions will be responsible for reporting all projects that either meet the federal requirements for a VE study, as stated above, or meet the requirements for project tracking to the Technical Services Section.

b. Districts

Each District is responsible for promoting and encouraging the use of the Value Engineering Change Proposal (VECP) program.

c. Technical Services Section

The Technical Services Section of the ETS Division is responsible for:

1. establishing and documenting the VE program policies and procedures;
2. ensuring VE is conducted on all projects that meet the VE threshold and are completed before the final design of a project;
3. ensuring all approved recommendations are implemented and documented in a final VE report before the project is authorized to proceed to construction letting;
4. keeping a roster of experienced NDDOT personnel and periodically arranging for training of additional personnel in VE; and
5. monitoring, evaluating, and annually reporting to FHWA the results of the VE analyses that are conducted and the recommendations implemented for each project in the State.

V. Project Tracking

Projects with an estimated total project cost that exceeds the thresholds outlined in this section will be tracked by the Technical Services Section to ensure that VE is performed on all projects that meet or exceed the federal requirements. Projects will be identified early for tracking using an estimated total project cost from either the Statewide Transportation Improvement Program (STIP) or scoping report. Projects that require tracking are:

1. Each project located on the NHS with an estimated total project cost of \$40 million or more that utilizes FAHP funding;

2. Each bridge project located on the NHS with an estimated total project cost of \$32 million or more that utilizes FAHP funding;
3. Any major project located on or off the NHS that utilized FAHP funding in any contract or phase comprising the major project that has an estimated total project cost of \$400 million or more; and
4. Any Local Government project located on or off the NHS with an estimated total project cost of \$25 million or more that utilizes FAHP funding. Local Government projects that pass this threshold will also be reviewed by the Technical Services Section to see if they warrant a recommendation for a VE analysis.

The Technical Services Section will monitor the Milestone committee reports to keep the tracked project's estimated total project cost up to date. The projects that are tracked for the year will be documented using the format in Table 1.

**Table 1
VE Project Tracking**

Project Number	PCN	Bid Opening	Project Type	Current Cost Estimate	Current Cost Estimate Date	Proposed VE Date
ABC-X-XXX(XXX)XXX	XXXXX	MM/DD/YYYY	NHS (Roadway)	\$45,000,000	MM/DD/YYYY	MM/DD/YYYY
ABC-X-XXX(XXX)XXX	XXXXX	MM/DD/YYYY	NHS (Bridge)	\$35,000,000	MM/DD/YYYY	MM/DD/YYYY
ABC-X-XXX(XXX)XXX	XXXXX	MM/DD/YYYY	Non-NHS (Major)	\$490,000,000	MM/DD/YYYY	MM/DD/YYYY
ABC-X-XXX(XXX)XXX	XXXXX	MM/DD/YYYY	Non-NHS (LG)	\$24,000,000	MM/DD/YYYY	MM/DD/YYYY

VI. Preconstruction VE Study

a. VE Study Timing

Preconstruction VE studies should be performed as early as practicable in the planning or development of a project, preferably before the completion of the project's preliminary design. At a minimum, the VE study must be conducted before final design.

b. Team Selection

VE teams should be a multi-disciplinary team consisting of 5 to 10 people having technical expertise which is appropriate for the study and not directly involved in the planning or design of the project. Technical Services Section will recommend study team members. Members will be approved and made available by their District Engineers and Division Directors.

c. VE Facilitator

A Value Engineering Facilitator will be assigned to each VE study by the Technical Services Section. The Facilitator will implement the VE Job Plan

using analytical methodology and tools following recommended industry practices and FHWA guidance to evaluate the potential benefit and impacts that may be expected to occur with the proposed VE recommendations.

The Facilitator will document the VE study with a written report including:

1. Project information,
2. Identification of the VE analysis team,
3. Background and supporting documentation,
4. Documentation of the stages of the VE Job Plan,
5. Summarization of the analysis conducted, and
6. Documentation of the proposed recommendations and approvals or rejections received at the time the report is finalized.

For all projects that include bridges, in addition to the items above, the Facilitator will:

1. Include bridge substructure and superstructure requirements that consider alternative construction materials, and
2. Conduct the VE study based on an engineering and economic assessment, taking into consideration acceptable designs for bridges and using an analysis of life-cycle costs and duration of project construction.

The formal VE report will be retained for 3 years after completion of the project (FHWA final payment).

d. VE Job Plan

The VE Job Plan is a systematic and structured action plan for conducting and documenting the results of the VE study. The VE Job Plan includes the following seven phases:

- 1. Information Phase:** Gather project information including project commitments and constraints.
- 2. Function Analysis Phase:** Analyze the project to understand the required functions.
- 3. Creative Phase:** Generate ideas on ways to accomplish the required functions which improve the project's performance, enhance its quality, and lower project costs.
- 4. Evaluation Phase:** Evaluate and select feasible ideas for development.
- 5. Development Phase:** Develop the selected alternatives into fully supported recommendations.

6. Presentation Phase: Present the VE recommendation to the project stakeholders.

7. Resolution Phase: Evaluate, resolve, document and implement all approved recommendations.

VII. Review and Implementation of pre-construction VE Recommendations

All VE recommendations will be discussed with the appropriate Divisions that are affected before being reviewed by the Director of the Office of Project Development. After review, VE recommendations will be approved or rejected by the Deputy Director for Engineering.

All approved recommendations will be implemented and documented in a final VE report before the project is authorized to proceed to construction bid letting. Technical Services Section will monitor the implementation of the approved VE recommendations and will be reported in the VE annual report to FHWA.

Any VE recommendations that have elements in it that could improve upon a NDDOT standard practice should be directed to the appropriate Division for consideration and review.

VIII. Value Engineering Change Proposals (VECP's)

All VECP's will follow the guidelines stated in the *Standard Specifications for Road and Bridge Construction*. Acceptable VECP's submitted to the Engineer will be sent to the Technical Services Section. A review team will be formed with representatives from divisions that are appropriate for the VECP review.

The Technical Services Section will evaluate all VECP's to determine whether the recommendation should be included in NDDOT standard practices.

IX. VE Program Annual Report

Technical Services Section will disseminate an annual report to NDDOT management and the North Dakota Division of FHWA, summarizing all approved and implemented recommendations resulting from VE studies of applicable projects and all accepted VECP recommendations.

Appendix A

Value Engineering Report



Value Engineering Report

PCN

Table of Contents

Project Location	
Project Purpose and Objectives	
Project Cost Estimates	
Value Engineering Job Plan.....	
Value Engineering Team	
Investigation Phase	
Speculation Phase	
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Summary	

Project Location

Project Purpose and Objectives

Project Cost Estimates

Value Engineering Job Plan

- Value Engineering Job Plan –
- Project Overview –
- Investigation Phase –
- Evaluation Phase –
- Development Phase –

Value Engineering Team

Investigation Phase

Speculation Phase

Idea Rating and Evaluation Criteria

Idea Rating

"A" - Good idea without apparent downside

"B" - Good idea with downside (additional cost, maintenance, staging, etc.)

"C" - Don't evaluate this idea

Idea Evaluation

		Benefits of Implementation		
		Low	Medium	High
Difficulty of Implementation	Difficult	1	2	3
	Medium	4	5	6
	Easy	7	8	9

Example: An idea with a "medium" benefit that is "easy" to implement would receive an 8.

Selection Criteria for Idea Development

"A" and "B" ideas that receive a "6", "8" or "9" should be developed for recommendation.

Idea Development

Ideas generated by the Value Engineering team were rated according to the criteria shown in the previous section.

The Idea Development Summary and individual Idea Development Sheets are presented on the following pages.

Idea Development Summary

Idea	Description	Idea Rating	Estimated Idea Savings	Estimated Idea Costs	Benefits	Discussion Points
1						
2						
3						
4						
5						

Individual Idea Development

IDEA DEVELOPMENT

Creative Idea Number:

Rating:

Recommendation:

Discussion:

Original Design:

Pros

Cons

Comments

Summary

Recommendations

IDEA IMPLEMENTATION

Idea	Should this idea be investigated further or incorporated into the design?	Additional Comments

Comments: _____

Deputy Director of Engineering