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1.0 INTRODUCTION

Value Engineering (VE) is a systematic process designed to focus and improve upon the major elements of complex or high cost projects. It is a process that employs a multi-disciplined team of experts to develop recommendations aimed at improving the value of a project during its design phases. In effect, VE provides a second opinion on the design of a project.

The main objectives of a VE study are to make recommendations on how to minimize total costs (construction + life cycle), to reduce construction time, to make the project easier to construct, improve quality, and to ensure safe operations and environmental/ecological goals. The VE team seeks the optimum blend of scheduling, performance, constructability, maintainability, environmental awareness, safety, and cost consciousness.

The VE process incorporates, to the extent possible, the values of the major stakeholders. These generally include the designer, construction engineer, maintenance engineer, contractor, state and federal approval agencies, local agencies, and the public. See Section 7.0 of this appendix for a summary of the VE process.

VE has been formally recognized as an acceptable review process in highway development by both AASHTO and FHWA since the 1980’s. In 1987 AASHTO published the AASHTO Guidelines on Value Engineering which provides a general overview of VE and VE methodology. NYSDOT began implementing its VE program in 1997 under the direction of the Design Quality Assurance Bureau (DQAB).

2.0 DEFINITIONS

NYSDOT employs two separate and distinct Value Engineering techniques: Value Engineering in Design (VE Studies) and Value Engineering Change Proposals (VECPs). These terms are often incorrectly used interchangeably or are assumed to have the same meaning. Although both are effective techniques in reducing project costs, the approaches are entirely different.

Note: This appendix focuses on VE Studies.

2.1 VALUE

Value, as defined within the context of Value Engineering, is the comparison of the true cost of a project feature to its worth to those involved (i.e., owners, users and other stakeholders). Value can be expressed mathematically in terms of its Value Index (VI): \( VI = \frac{\text{worth}}{\text{cost}} \). Project features with VI’s of less than one indicate questionable value. These features would be good candidates for further investigation in a Value Engineering Study (see section 2.2). Features with VI’s equal to or greater than one demonstrate favorable results in terms of their value; the greater the VI, the greater the value to those involved. These features would generally not be investigated further in a value engineering study.

It should be understood that increasing the value of a project or feature does not necessarily mean cutting costs. Value could also be added by increasing the worth of the product to the involved parties, without adding cost.
2.2 VALUE ENGINEERING IN DESIGN (VE STUDIES)

A systematic application of recognized techniques, typically performed during the early phases of design, in which a multi-disciplined team of individuals not personally involved in the design of a project, takes a “fresh look” at the project to ensure that the transportation, safety and community needs are met in an efficient and cost-effective way. VE Studies include a formal report outlining the study team's recommendations.

2.3 VALUE ENGINEERING CHANGE PROPOSALS (VECP’S)

After contract award, contractors are encouraged to develop alternative construction proposals that allow the State to benefit from a contractor’s construction ingenuity and experience; any cost savings is shared between the State and the contractor. Refer to Section 104-10 of the Standard Specifications for detailed information regarding VECP’s.

3.0 APPLICABILITY

3.1 FEDERALLY MANDATED VE STUDIES

Title 23 Code of Federal Regulations Part 627 contains a mandate requiring State Departments of Transportation to carry out a minimum of one VE study for each federally funded design-bid-build project on the NHS, in excess of $50 million for highway projects and $40 million for bridge projects. These threshold amounts represent the project’s overall cost, including costs associated with environmental studies, preliminary engineering, final design, ROW acquisition and construction; and should consider all funding sources – federal, State and local. This mandate pertains to both State-let and locally administered federal aid projects. Design-Build projects are exempt from this requirement.

Regions should be cognizant to the fact that projects identified as having no federal participation, which are subsequently changed to include some degree of federal participation (as is often the case) will require a VE study, assuming the other mandated criteria apply. Similarly, federally funded NHS projects with overall project costs estimated less than the threshold amount will require a VE study in the event that the total project costs unexpectedly increase to a level exceeding the threshold.

FHWA can withhold Federal-aid highway funds on any eligible project that does not receive a VE study. Therefore, in order to prevent a loss in funding, NHS projects with total costs near the threshold amount, that include, or have the potential to include federal participation, should have a VE study conducted.
3.2 NON-MANDATED VE STUDIES

In addition to those projects which are required by federal statute to have a VE study conducted, Regions are encouraged to have VE studies conducted on any project it deems appropriate as a means of improving the overall value of that project. Although cost savings is a principle benefit of the VE process, other issues which add to the complexity of the project should be considered in the VE selection process. Complexities may include critical constraints, difficult technical issues, external influences or complicated functional requirements. The types of projects that provide the highest potential for value improvement are:

- high cost projects
- Projects with alternate solutions which vary the scope and cost
- New alignment or by-pass sections
- Widening of existing highways for capacity improvements
- Major structures
- Interchanges on multi-lane facilities
- Projects with costly or extensive environmental or geotechnical requirements
- Major reconstruction of existing highways
- Projects with major traffic control
- Projects with multiple stages

4.0 INITIATING A VE STUDY

4.1 VE STUDY TIMING

A VE study could be performed at any point during the design process; however, for optimum results, a VE study should be conducted as early as possible after basic design elements and preliminary cost information have been developed – typically after the preferred alternative has been identified. This allows VE recommendations to more readily be incorporated into the project. Proper timing helps to ensure that recommendations generated through a VE study do not cause significant impact on the project schedule. In general, the earlier VE is applied, the greater the potential for savings.
4.2 REGIONAL RESPONSIBILITIES

Each Region is responsible for identifying a VE Coordinator to act as a liaison between Project Designers, the Main Office VE Coordinator, and the VE Team. (See Complete list of Regional VE Coordinator’s Functions and Responsibilities) The Regional VE Coordinator should meet periodically with the Regional Design Engineer and the Regional Planning and Program Manager to identify candidate projects for which a VE study is either required or desired. Local let, Federal-aid projects shall be included in this process. Once the determination has been made that a project should receive a study, the Regional VE Coordinator should contact the Design Quality Assurance Bureau to arrange for a study. Studies are typically conducted in the Regional Office; however, in some cases it might be prudent to conduct the study in a hotel conference center located nearer the proposed construction site.

Regions are also responsible for furnishing relevant project information to the VE Team Leader. This generally includes, but is not limited to:

- Traffic Information
- Survey information, including aerial photography
- Information relevant to identification of preferred concept, including estimates of construction costs, potential environmental impacts, and safety and operation concerns.
- Right-of-Way information, including estimated costs for various alternatives
- Information, including estimated costs, for any potential alternatives
- Effects on local business
- Data relevant to life cycle costs, including maintenance costs, periodic improvements, and resurfacing requirements for each alternative.
- Typical sections and profiles.
- Drainage information.
- Utility and/or railroad information.

4.3 DESIGN QUALITY ASSURANCE BUREAU RESPONSIBILITIES

The Design Quality Assurance Bureau is responsible for ensuring that VE studies are carried out in accordance with the guidelines set forth herein. The Bureau, through the Department’s VE coordinator, is also responsible for:

- Formally notifying FHWA’s VE Coordinator of the description, dates and location of pending studies as they arise.
- Providing copies of VE study reports to FHWA’s VE Coordinator for review, comment and input prior to the development of recommendation dispositions by the Department.
- Providing copies of Regional dispositions to FHWA’s VE Coordinator.
- Submitting the VE Annual Report in accordance with Section 7.3.3., and distributing (or notifying of its online availability) the report to NYSDOT Regions and participating local sponsors.

5.0 TEAM STRUCTURE

A VE team is typically comprised of a team leader and four to six individuals with a diverse array of backgrounds relevant to the specific study. VE Teams of fewer than five tend to limit the amount and variety of creative input, while teams of more than seven can be difficult to manage. VE teams should be structured such that the appropriate areas of expertise are available to evaluate the potential value improvement areas associated within the project. Generally, expertise from the functional areas of design, structures, right-of-way, maintenance, and traffic operations make for a good team balance. All of these disciplines may not be appropriate depending on the project scope, while other specialties such as utilities, environmental analysis or railroad operations may be appropriate.

5.1 TEAM LEADER

The VE team leader is responsible for guiding the team in its efforts during the study. The team leader should be proficient in the VE process. A consultant serving as a VE team leader must be a Certified Value Specialist (CVS) as defined by the Society of Value Engineers (SAVE) International – the professional society which governs the VE industry.

5.2 TEAM MEMBERS

The VE team may consist of both technical and non-technical members. Technical team members are selected based on the various types of expertise needed to address the major functional areas and critical high-cost issues of the study. They play a vital role in the VE process by adding their individual perspectives and expertise to the VE process.

Non-technical team members may consist of representatives from groups or agencies not affiliated with the Department. In some instances, non-technical team members could be beneficial in providing greater objectivity and context sensitivity to the team effort. Non-Department team members may include individuals from FHWA, local agencies, environmental protection groups, citizen groups, etc.

Training in the concepts, application, and techniques of VE is highly desirable for those working as VE team members, particularly technical team members. Occasionally, a team may include one or two technical members untrained in the VE process, but highly skilled in disciplines vital to the study.
The Department offers a minimum of one VE training course every two years. Main Office and Regional staff as well as the staffs of FHWA and NYS Thruway Authority are encouraged to attend. Courses are conducted either through the Department’s VE consultant agreement or through the National Highway Institute (NHI).

**Note:** FHWA Regulation 23 CFR PART 627 – Value Engineering prohibits individuals directly involved in the design of a project from participating on the VE team analyzing the project. Project managers/designers should, however, be available for consultation with the VE team – particularly during the early stages of a VE study – to provide focus to areas in the design that may be challenging and where most value can be added.

### 6.0 CONSULTANT-RUN VE STUDIES

Presently, the Department retains consultants, under DQAB’s management, to conduct its VE studies. Department personnel -- both Regional and Main Office-- are encouraged to participate as team members to provide their expertise and to gain insight into the VE process and its benefits. Under this arrangement the VE Consultant is responsible for assembling the VE study team, leading the study, and coordinating the logistics of the study with the Regional VE coordinator (each Region designates a VE coordinator).

The Department has established a funding source dedicated solely to cover the cost of consultant-run VE studies. For bookkeeping purposes the Accounting Bureau ultimately charges this cost against the PIN; however, the cost does not come out of the Regional program budget.

**Note:** Consultants should not conduct studies of their own designs.

**Note:** For High Profile/Critical/Major or Unusual Projects, NYSDOT should have a presence on the VE team that conducts the VE study.

### 7.0 VE PROCESS/METHODOLOGY

NYSDOT’s VE studies are guided by a specific process based largely on AASHTO’s *Guidelines for Value Engineering*. The process is summarized below. The various activities have been separated into Pre-study, Project study, and Post-study activities.

#### 7.1 PRE-STUDY ACTIVITIES

- Team composition should be approved by the Regional Value Engineering Coordinator.
This may include consultant team members, Department personnel, outside agencies, etc.

- Determine the appropriate point in the design of the project for conducting a VE study. When possible, select a point that optimizes VE recommendations.
- Procure facilities for VE Team (meeting room, easels, etc.).
- Collect detailed project information, including plans, reports, cost estimates, and information related to project constraints.
- Coordinate the overview presentation which will be given to the VE Team during the Project Study Phase.
- Establish Quality Control procedures and expectations

### 7.2 PROJECT STUDY ACTIVITIES

The time required to conduct a VE study may vary depending on the complexity and size of the project, but typically will range from three to five days. During the study, the VE team follows a well-defined plan consisting of the following six phases: Investigation, Analysis, Speculation, Evaluation, Development and Presentation. These six phases are summarized below.

#### 7.2.1 Investigation

During the investigation phase, the VE team determines what they know about the project from readily available information and what they must know in order to define and/or solve the problem. Available information may include engineering reports, design plans, estimates, alternatives, right-of-way maps, etc. The team should also be made aware of any project constraints and/or commitments at this point in the study.

The project manager, designer, and any other person that can provide information relevant to the project should be available to make a formal presentation and to answer questions for the VE team.

Following the presentation, the VE team, accompanied by one or more members of the design staff, visits the site to become familiar with actual field conditions (a video of the project site might be more appropriate in some cases).

The team then begins its process of document review, cost model development, and selection of elements for function analysis.
7.2.2 **Analysis**

During the analysis phase, the team identifies the elements of the project with the greatest potential for value improvement. The team then examines each of these elements in terms of function, cost and worth -- the fundamental components of VE. In doing so, the following basic questions must be answered for each element identified:

- What is it?
- What does it do? (What is its function?)
- What must it do? (Is its function basic?)
- What is it worth? (What is the cost for the least expensive option to perform its function?)
- What does it cost?

By the end of the analysis phase the team will have identified the high-cost elements, functionally analyzed them, and assessed their cost/worth relationships.

7.2.3 **Speculation**

During this phase, the team conducts a brainstorming session to develop alternatives to the proposed project design. This technique generates a large list of potential alternatives to the original design. By applying creativity to the function statements identified during the analysis phase, the team keys in on the most feasible VE alternatives.

7.2.4 **Evaluation**

During the evaluation phase the VE team determines the best alternatives by listing the advantages and disadvantages of each alternative. Each advantage and disadvantage is described in general terms. The team can also perform weighted matrix analysis to determine which alternative is best, based upon the relative importance of each of the desired criteria. This analysis satisfies the VE objective to achieve the best blend of performance, cost and schedule. Alternatives for which disadvantages far outweigh advantages are dropped at this point.
7.2.5 **Development**

Once the most feasible alternatives have been identified, they are fully developed through sketches, cost estimates, validation of test data, and other technical analyses to confirm the validity of assumptions.

7.2.6 **Presentation**

On the final day of the study, the VE team presents its findings and recommendations to Regional management and staff. The presentation should be brief and should allow time for management and staff to question the team on any concerns.

7.2.7 **Written Report**

Within two weeks of the presentation, the VE team leader submits a written report summarizing the recommendations. The report should track the team’s deliberations and considerations throughout the entire VE process and should contain sufficient detail, including sketches, calculations, analysis, and rationale to allow for prudent assessment of recommendations by the Region.

7.3 **POST-STUDY ACTIVITIES**

7.3.1 **Regional Dispositions**

Although it is recognized that, in some cases, constraints may exist that preclude certain recommendations from being implemented, the post-study activities are designed to ensure that due consideration is given to each recommendation generated during a VE study. Each recommendation should be given a thorough assessment by Regional staff and documented on a Regional Disposition Form – Attachment A. One Disposition Form should be completed for each recommendation.

Dispositions may consist of one of the following:

- **Acceptance**
- **Conditional Acceptance** (for those recommendations that require further study)
- **Rejection**

**Note:** Conditional acceptance implies that further investigation is required before a final decision is made. Conditionally accepted and rejected recommendations require written justification.
Regional Disposition Forms should be signed by the Regional Director (not to be delegated before being sent to DQAB for tracking.)

In addition to the Regional VE review, recommendations may also be investigated by the Main Office. For instance, the Region may conditionally accept a recommendation but defer its decision to the appropriate Main Office technical unit. The Main Office may also play a role if, at the discretion of DQAB, a rejected recommendation is still considered to have merit. In such cases, recommendations will be passed on to the VE Review Standing Committee. This committee will consist of high level technical and administrative managers (i.e., Bureau, Division and Regional Directors).

DQAB will make arrangements such that appropriate committee members will meet (in person or via teleconference) to discuss unresolved recommendations. Recommendations that are determined by the committee to have merit, and are in conflict with the Region’s disposition, will be returned to the Regional Director for reconsideration.

The proposed post-study activities are highlighted in the Post-Study Timeline located on page 9-13. As shown, the entire review process should be completed within sixteen weeks of the VE Study Presentation, with most studies expected to be finalized within nine weeks. VE Reports, Regional Dispositions, and follow up documentation should be retained with the project documents.

7.3.2 Recommendations with Statewide Significance

Recommendations generated during a VE Study will be reviewed by DQAB for significance on a statewide or programmatic basis. Recommendations that are considered to be generic in nature (i.e., recommendations that might have applicability beyond the project being studied) will be forwarded to the appropriate technical unit for review and comment. The intent is to suggest to the Department new or different methods for accomplishing desired functions in ways that might be more efficient or effective.

Upon receiving a VE recommendation, the technical unit should complete the VE Statewide Proposal Form – Attachment B. This form requires the technical unit to document its disposition with regard to the appropriateness of the recommendation as a Department standard. The VE Statewide Proposal Form requires the technical unit Division Director’s signature before returning to the Design Quality Assurance Bureau.

In some cases, a new method introduced through a VE study could warrant a change in policy. For example, a recommendation that suggests the use of a proprietary retaining wall system in lieu of a cast-in-place retaining wall would require a change in policy if the Department has a policy in place that prohibits the use of proprietary retaining walls. In other cases, a recommendation might simply point out inefficiency in the design that may exist due to a lack of guidance. As a result, a modification or addition to the appropriate design manual may be
warranted. Changes to these manuals are the responsibility of the corresponding Division approving statewide action.

7.3.3 **Annual VE Summary Report**

23 CFR Part 627 requires the Department to track the results of its VE program and to submit to FHWA an annual VE summary report at the close of each Federal Fiscal Year. In addition to reporting the results for its own State-let projects, the Department is responsible for reporting results for all locally administered federal aid projects for which the federal mandate specified in section 3.1 applies – including but not limited to projects administered by the New York State Thruway Authority and New York City. As part of the annual VE summary report, DQAB submits a comprehensive list of programmed projects for which the VE mandate applies. FHWA uses this list to verify Department compliance with the Code of Federal Regulations.

8.0 **REFERENCES**

Background information regarding the Department’s Value Engineering program is available in a separate document entitled NYSDOT VALUE ENGINEERING PROGRAM. That document can be accessed on the Design Quality Assurance Bureau, Design Support Services IntraDOT website. The Regional Disposition and Statewide Proposal Forms may also be accessed at the IntraDOT website.

Further information about Value Engineering can be accessed at the following websites:

- AASHTO VE Task Force: [http://www.wsdot.wa.gov/eesc/design/aashtove](http://www.wsdot.wa.gov/eesc/design/aashtove)
- Society of Value Engineering (SAVE) International: [http://www.value-eng.org](http://www.value-eng.org)
POST-STUDY ACTIVITY TIMELINE

Each activity should be completed by the time indicated on the timeline.

START

VE Team presents findings on the last day of the 3-5 day study. Attended by: Designer, Project Manager, Regional Design Engineer, and Regional VE Coordinator. Invited: FHWA Division Office VE Coordinator.

END OF WEEK 2

VE Consultant issues written VE report. This report contains comparisons between proposed design and VE recommendations, and includes supporting data. Recipients: Designer, Project Manager, Regional VE Coordinator, the Design Quality Assurance Bureau (DQAB), and FHWA Division Office VE Coordinator.

END OF WEEK 5

Designer investigates VE recommendations for feasibility and determines an initial disposition for each study recommendation. Designer forwards initial dispositions to Regional VE coordinator. Dispositions should consist of one of the following:

- Accepted – will be incorporated into the design
- Conditionally Accepted – will be studied further to validate the technical feasibility and/or potential cost savings; or acceptance may be dependant on the EIS or other project decision document – written justification required.
- Rejected – will not be incorporated into the design – written justification required.

END OF WEEK 9

Regional VE Coordinator contacts or meets with appropriate technical personnel within the Region for review and comment. Once a final determination has been reached, dispositions are forwarded to the Regional Director for approval. Final dispositions are to be summarized on the Regional Disposition Form. One form should be filled out for each VE recommendation. Once the Regional Director signs off on the Region’s disposition, the forms are then sent to DQAB for Main Office review and comment. Final dispositions are sent to FHWA Division Office VE Coordinator.

END OF WEEK 13

DQAB will review regional dispositions for further investigation potential. Recommendations that the Region deferred to Main Office technical units for guidance, or rejected recommendations which are considered by DQAB to have merit, will be investigated further by the VE Review Standing Committee. This committee will consist of high level technical and administrative managers – i.e., Bureau, Division and Regional Directors. DQAB will make arrangements such that appropriate committee members will meet (in person or via teleconference) to discuss unresolved recommendations. Recommendations that are determined by the committee to have merit, and are in conflict with the Region's disposition, will be returned to the Regional Director for reconsideration or clarification of the Region's position on that recommendation.

END OF WEEK 16

Regional Director responds to committee comments/concerns. Responses sent to DQAB. Regional responses then forwarded to appropriate committee members. VE Reports, Regional Dispositions, and followup documentation to be retained with project files.
# NYSDOT VALUE ENGINEERING

## REGIONAL DISPOSITION FORM

Fill out one form for each VE recommendation
Attach additional sheets as necessary.

<table>
<thead>
<tr>
<th>Project:</th>
<th>PIN</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>VE Rec Description</th>
<th>VE Rec No.</th>
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</thead>
</table>

**Technical Feasibility:** Indicate how the technical feasibility of the VE recommendation was evaluated.

<table>
<thead>
<tr>
<th>DISPOSITION</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>G Accept</strong></td>
<td>will incorporate all or part of VE rec. into the design</td>
</tr>
<tr>
<td><strong>G Conditionally Accept</strong></td>
<td>will be studied further to validate the technical feasibility and/or potential cost savings; or, acceptance may be dependant on the EIS or other project decision document – justification required</td>
</tr>
<tr>
<td><strong>G Reject</strong></td>
<td>will not be incorporated into the design – justification required</td>
</tr>
</tbody>
</table>

## Accepted Recommendation

Implemented Portions: Identify which portions of the VE alternative can be implemented, which are rejected, and which require further study.

Estimated Savings or Added Cost:

## Conditionally Accepted and Rejected Recommendations

Justification

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Approved by ____________________________________________

Regional Director

9-14
### NYSDOT VALUE ENGINEERING
**STATEWIDE PROPOSAL FORM**

<table>
<thead>
<tr>
<th>PART I - to be completed by Design Quality Assurance Bureau</th>
</tr>
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<tbody>
<tr>
<td><strong>Project:</strong></td>
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<tr>
<td><strong>VE Rec Description:</strong></td>
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<tr>
<td><strong>Technical Unit to Review Recommendation:</strong></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>PART II – to be filled completed by Technical Unit</th>
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<tbody>
<tr>
<td><strong>CHECK ONE</strong></td>
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<tr>
<td>G Recommendation will be considered for statewide application.</td>
</tr>
<tr>
<td>Follow-up Actions:</td>
</tr>
</tbody>
</table>

G Recommendation will not be considered for statewide application
Justification:

Approved by  

Division Director

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9-15