Growing VE at the Ministry of Transportation Ontario

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Biographies

Edward C. (Ted) Lane, P.Eng., AVS

Ted Lane is currently the Head of Planning and Design, for the Ontario Ministry of Transportation Eastern Region, located in Kingston Ontario. Ted graduated in Civil Engineering, from the University of Western Ontario in London in 1975.
Ted's 29-year career with the Ministry of Transportation has been involved with the planning, design, construction and maintenance of bridges and highways.
As Chair of the Ministry's Value Engineering Task Force, Ted was responsible for the establishment of the Ministry's value engineering program in 1996. He has maintained his involvement in VE, and in the ministry's VE program.

Stephen Holmes, P.Eng, CVS

Stephen Holmes graduated from the University of Waterloo with a BASc in Civil Engineering in 1985. He has worked for the Ontario the Ministry of Transportation for 19 years. His technical background includes highway planning and design, foundation design, and highway safety. Stephen has coordinated MTO's VE program since 1999.
Stephen is a member of the American Association of State Highway and Transportation Officials (AASHTO) VE technical committee and is a director of the Canadian Society of Value Analysis (CSVA).

Abstract

How can a non-compulsory public sector Value Engineering program be successful without any legislative or other external requirement to undertake VE studies? Value Engineering was introduced to the Ontario Ministry of Transportation in 1995 by VE consultants working with local engineering firms. VE is now an established part of how the Ontario Ministry of Transportation does business. This paper provides insight into how the VE program was developed and grown in Ontario without the aid of government legislation.

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Introduction

The Ontario Ministry of Transportation (MTO) has established a successful, award winning Value Engineering (VE) program in a jurisdiction where VE is not a statutory requirement. This paper will describe the approaches, tools and resources used to develop and sustain Ontario's non-compulsory VE program.

The development of MTO's VE program has been dependent upon a number of key elements. These elements include a climate that embraces change, a pragmatic and systematic approach to developing a VE program, and an implementation strategy that accommodates learning and growth and is responsive to the needs of the clients.

Key elements of MTO's non-compulsory VE program are illustrated in Figure 1.

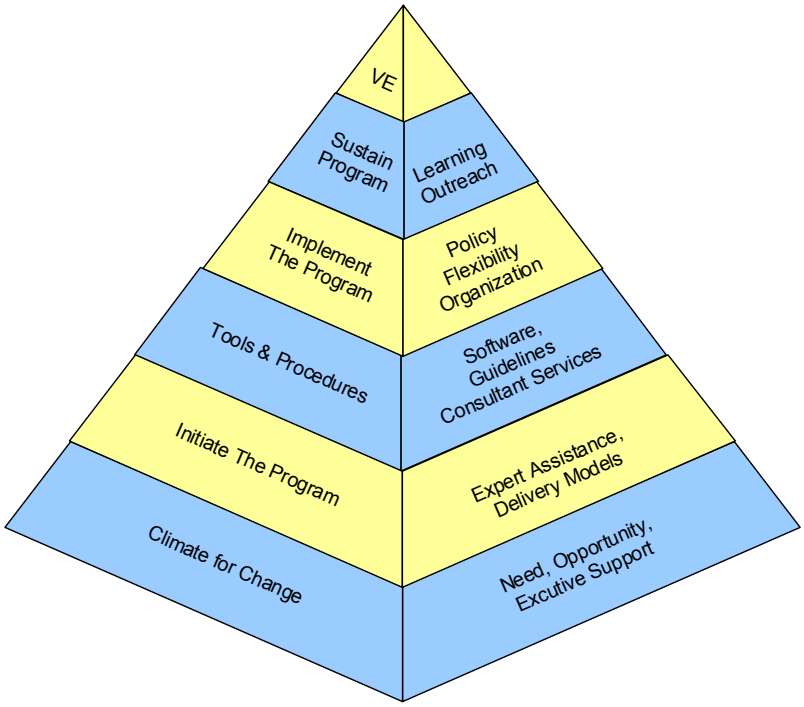


Figure 1- Key Elements of Non-Compulsory VE

Ontario Context

Ontario is situated in Eastern Canada and abuts the States of New York, Michigan, Ohio, Pennsylvania and Minnesota as illustrated in Figure 2. Ontario generates 42.1% of Canada's GDP and 53.5 % of national manufacturing shipments.

Ontario's population of 12 million is the largest of any province and MTO's is Canada's largest transportation ministry. MTO is responsible for Ontario's provincial Highway system, including:

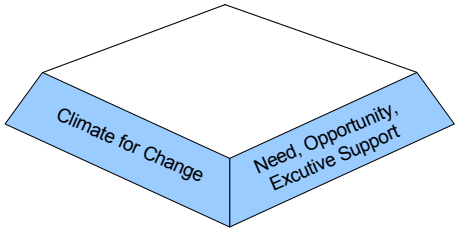
- 16,500 km of roads, and
- 2500 Highway bridges
- Ferries, remote airports, and other transportation facilities.

MTO's approximately $1 billion annual capital construction program represents approximately one half of the capital expenditures of the Ontario government.

Figure 2 - Ontario Map Including Major Cities and Highways

Climate for Change

In Canada, highway transportation is primarily a provincial responsibility. The



Federal government has only a limited role in funding, policy setting and rule making. In this relatively uncontrolled environment, Ontario's Ministry of Transportation established itself as a technically capable and innovative transportation agency. As an example, Ontario established it's own state-of-the-art bridge design code, and was involved in research in a number of areas. MTO looked to, and participated with US standards setting agencies, but on a voluntary basis.

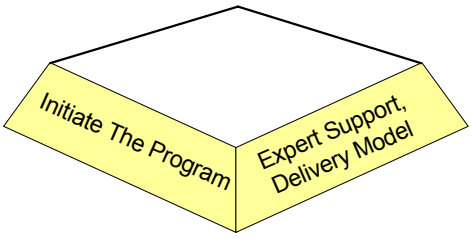
MTO's relative independence contributed to its late adoption of a Value Engineering program. Prior to 1996, MTO had not experienced formal VE on any of its projects. The term Value Engineering was familiar, and was commonly used to refer to any process, or decision that reduced cost. Ministry staff were aware of VE activities in other jurisdictions, and agencies, but in the days before the world-wide-web, and without first hand experience, it was not always clear how those VE activities varied from the cost cutting exercises being referred to as VE at home. Efforts to acquire VE services had repeatedly resulted in cost cutting exercises.

In the mid 1990's, the province of Ontario had amassed a $100 Billion debt. The Ministry was aware that its capital funding was not sufficient to that required to address the deficiencies in pavements and bridges. Aggressive measures were implemented to address the shortfall.

The term Value Engineering received some attention related to the Design, Build, Operate contract for a new toll highway north of Toronto. The selection process for this project had included a "Value Engineering Phase" in which proponents were invited to identify cost reducing modifications to the original design. The Ontario Provincial Police raised concerns about the safety of the new highway, prior to its opening. At the request of MTO, the Professional Engineers of Ontario undertook a review of the highway's design. The *Highway 407 Safety Review* was conducted by a group of leading experts in highway safety, design, and Value Engineering. The findings of the report highlighted concerns with the present approach of addressing safety in highway design, and with the practice of designing to minimum standards.

The Report's findings and recommendations have significantly influenced the approach to safety in highway design, and in Value Engineering studies in Ontario.

Initiating the Program



In January of 1996, MTO launched a comprehensive overview of its approach to Planning, Design and Construction of its capital program. The Engineering and Construction Review (ECR) established over 40 task groups, towards studying over 120 ideas for change. The Value Engineering Task Force (VETF) was charged to look at several initiatives identified as

having the potential to reduce project costs. Those initiatives included introducing VE, and Value Engineering Change Proposals. The task force included ministry staff representing several functions, as well as representatives from the construction industry, and Ontario's Consulting Engineers (CEO).

The ECR exercise was a large-scale re-engineering effort. The task force approach was selected to identify, define and implement change in a condensed time period. In order to accomplish this goal, the process provided a streamlined environment for innovation and change.

The VETF identified that other agencies had experienced substantial cost savings through the use of VE and recommended the establishment of an on-going VE Program for the ministry. Over the next year and a half, the VETF took up the challenge to become knowledgeable about Value Engineering and to establish an effective VE program.

As the VETF was beginning its work, the Ministry's Northern Region was in the midst of a preliminary design project for a major highway expansion. The Ministry's consultants had been exposed to VE through projects in other jurisdictions, and undertook two VE studies of the project. The VE firm of Lewis and Zimmerman Associates (LZA) was subcontracted to lead the studies. This was MTO's first exposure to VE.

The Ministry, together with the Consulting Engineers of Ontario, and the Ontario Road Builders Association enlisted LZA to present an introduction to VE to a group of engineering consultants, municipal engineers, and contractors.

The Engineering and Construction Review initiative provided ongoing opportunities to inform ministry executive, staff, and stakeholders about VE. Initiatives selected through this process received strong executive support for implementation.

Task Force members looked to US Highway authorities for assistance, and participated in SAVE International conferences and training opportunities.

Pilot Project

A pilot project was initiated for a VE study and Module 1 training session of a highway reconstruction project in the Ministry's Eastern Region. Lewis and Zimmerman Associates were selected to provide the VE services. There were thirty participants in that training included ministry staff, consultants and contractors. Further studies would follow. Several of the attendees to this initial Module 1 session have remained involved in promoting and using Value Engineering in the Ministry.

Expert Support

With limited expertise in Value Engineering, the VETF engaged the services of KCM, ltd. of Seattle Washington, later Robinson Stafford and Rude (RSR) to provide advice and assistance in setting up the VE program.

Working with RSR, a model for the program was defined, and a number of procedures and tools were created. A program organization was defined, including head office and regional coordinators. The tools that were developed, included:

- Manuals and documentation for Program Coordinators and Project Managers whose projects would be subjected to VE
- Position Descriptions for Head Office and Regional Coordinators
- A Proposed VE program coordination model
- Software and tools to assist in the selection, definition, and timing of VE studies and the selection study teams
- Terms of reference for consultant assignments for VE services

Delivery Model

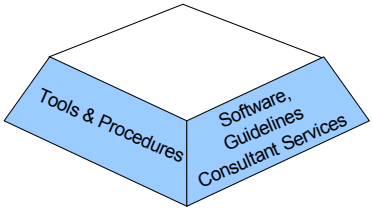
The Engineering Construction Review had resulted in the decision to outsource the majority of planning and design, and construction administration. Value Engineering would also be outsourced. The Task Force decided upon a delivery model for VE services, which required consultants to have both Ontario highway planning and design expertise, as well as Value Engineering. It was anticipated that this approach would lead to partnerships between Ontario based consultants and VE specialist firms, ensuring high quality studies, while fostering the establishment of an Ontario based VE industry.

In the absence of any legislated or other requirements for VE, project selection criteria were proposed that would see all projects over $2 million in value subjected to V.E. This threshold would capture 85% of the value of the Ministry's capital construction program. The proposed VE-by-default model would require approximately 60 studies per year. Ultimately, this aggressive criterion was not adopted, but was replaced by a series of suggested project selection criteria.

A series of one-day training sessions were held in each region, and head office, so that all ministry project management staff were trained in VE.

The involvement of a firm experienced in the establishment of Value Engineering programs was effective, not just in developing the program, but also in marketing VE to senior ministry decision makers.

Tools & Procedures



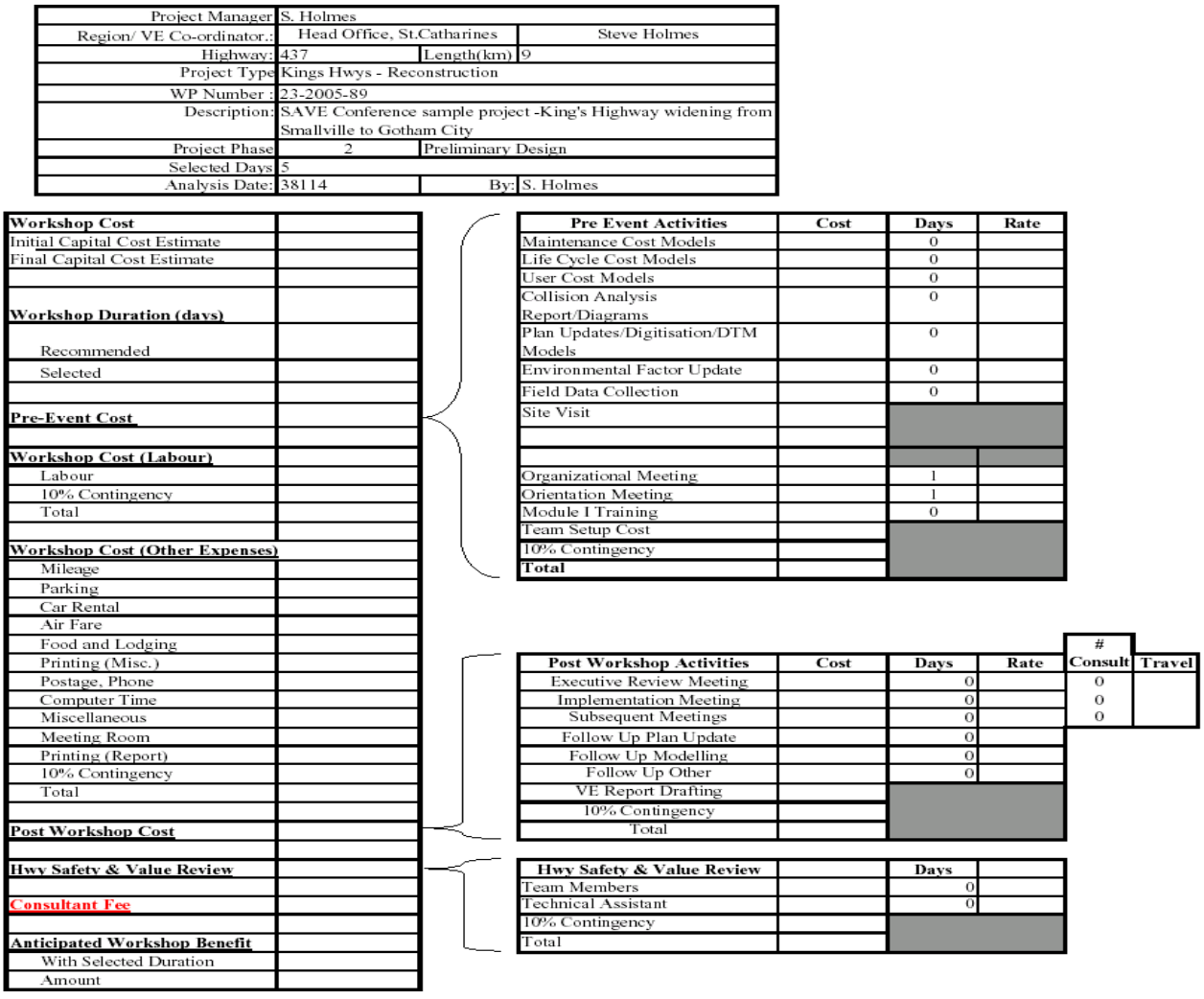
A successful start-up was understood to be essential to building momentum and acceptance for the

program. Tools and procedures would be needed to support a successful program. With assistance from RSR, a number of tools and procedures were developed for MTO's use. The primary tools that supported the launch of the program and the changes that evolved are described below.

VE Software

A spreadsheet-based computer program, VE.xls was introduced to simplify development of project specific VE plans. The output of this program as shown in figure 3 included a cost estimate for the recommended workshops, suggested team size and composition, and workshop timing and duration.

MTO project managers were responsible to acquire and manage consultants and needed accurate and timely estimates of projected consultant fees. VE.xls was updated to accurately estimate consultant costs as the Ministry required greater pre and post workshop preparation and support from the consultant than was common practice.



Project Manager	S. Holmes		
Region/ VE Co-ordinator.:	Head Office, St.Catharines		Steve Holmes
Highway:	437	Length(km)	9
Project Type	Kings Hwys - Reconstruction		
WP Number :	23-2005-89		
Description:	SAVE Conference sample project -King's Highway widening from Smallville to Gotham City		
Project Phase	2	Preliminary Design	
Selected Days	5		
Analysis Date:	38114	By:	S. Holmes

Workshop Cost	
Initial Capital Cost Estimate	
Final Capital Cost Estimate	
Workshop Duration (days)	
Recommended	
Selected	
Pre-Event Cost	
Workshop Cost (Labour)	
Labour	
10% Contingency	
Total	
Workshop Cost (Other Expenses)	
Mileage	
Parking	
Car Rental	
Air Fare	
Food and Lodging	
Printing (Misc.)	
Postage, Phone	
Computer Time	
Miscellaneous	
Meeting Room	
Printing (Report)	
10% Contingency	
Total	
Post Workshop Cost	
Hwy Safety & Value Review	
Consultant Fee	
Anticipated Workshop Benefit	
With Selected Duration	
Amount	

Pre Event Activities	Cost	Days	Rate
Maintenance Cost Models		0	
Life Cycle Cost Models		0	
User Cost Models		0	
Collision Analysis Report/Diagrams		0	
Plan Updates/Digitisation/DTM Models		0	
Environmental Factor Update		0	
Field Data Collection		0	
Site Visit			
Organizational Meeting		1	
Orientation Meeting		1	
Module I Training		0	
Team Setup Cost			
10% Contingency			
Total			

Post Workshop Activities	Cost	Days	Rate	# Consult	Travel
Executive Review Meeting		0		0	
Implementation Meeting		0		0	
Subsequent Meetings		0		0	
Follow Up Plan Update		0			
Follow Up Modelling		0			
Follow Up Other		0			
VE Report Drafting					
10% Contingency					
Total					

Hwy Safety & Value Review		Days	
Team Members		0	
Technical Assistant		0	
10% Contingency			
Total			

Figure 3- VE.xls Consultant Fee Estimate

Program Coordinators and Project Manager Guidelines

Guideline manuals were developed to support those who would coordinate the program, and to assist project managers whose projects would be studied. These documents have since been enhanced to better support the acquisition and management of consultants, and to provide guidance on how to manage VE studies.

Consultant Services

Recognizing that VE services would be outsourced, terms of reference for consultant assignments for VE services were developed. These terms of reference enabled the ministry to acquire services, with the consultant proposing the study team composition, the duration and the logistical arrangements for the VE studies. The terms of reference were enhanced as experience was gained in managing VE studies to include the following changes:

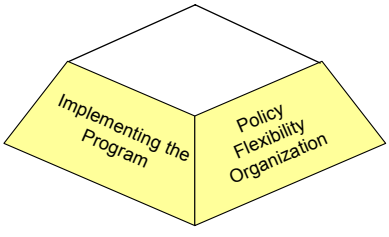
- Incorporating highway safety activities
- Fixing the duration of the workshop and the team composition
- Identifying logistical requirements for the workshops
- Requiring the preparation of an information workbook with specified content for the workshop participants
- Specifying the logistical requirements
- Identify supplementary activities to support the implementation process
- Requiring the use of project performance measurement techniques

- Different consultant acquisition models for provision of VE services have been developed to assist project managers to obtain VE services including:

- VE Services on demand arrangements (retainers)
- VE included in design assignments
- Stand-alone VE studies, and
- In-house studies

Implementing the Program

Once the work of the VETF was completed, a committee of Value Engineering Coordinators (VEC) undertook the implementation and ongoing management of the VE program.



Value Engineering Program Organization

The VEC committee is composed of a full-time Value Engineering program manager, based in the Ministry's head office in St. Catharines, with part-time and volunteer Regional VE coordinators in each of the Ministry's five Regional offices as shown in Figure 4. The regional coordinators are project managers reporting to management in their respective regions, as well as VE coordinators.

Figure 4- VEC Structure

The regional coordinators work within their regions to find suitable projects and assist local project managers in developing a suitable plan to incorporate VE into a study. The timing and duration of the study, the team composition, and estimated fees for the study are all determined by the VEC with the aid of the VE.xls software and other resources.

The regional VE coordinators report back to the full time Value Engineering program coordinator, who is responsible for compiling and reporting program results.

A Flexible Approach to VE

For the project manager, introducing a VE study into a project means additional workload, increased consultant fees and potential complications to incorporate recommendations into the design while maintaining the project's schedule. The coordinators assist project managers to incorporate VE into their projects.

Supporting the project manager has become a key objective for the program. MTO's flexible approach to VE supports project managers by:

- Accommodating regional variations in decision-making and implementation procedures. The presence of a coordinator within each region encourages flexibility in how VE studies are conducted.

- Applying VE to projects at all phases, value planning, preliminary design, detail design, standards with the most common application during preliminary design.

- Flexible Selection Criteria – the criteria to select studies is not based on a fixed dollar value, but rather on complexity and uncertainty. Studies are undertaken on large projects with high ROI, but also on small projects where the VE is seen to be an effective aid to solving a difficult problem.

- A range of methods to meet the different needs of project managers in supplying consultant services for a VE study.

Building Study Demand

An important challenge for MTO's non-compulsory VE program has been to identify projects for study. VE has been recognized as an effective tool to improve value for the Ministry. It has been highlighted in the ministry's 2001-2002 Annual Business Plan and division business planning documents. These references have led to requirements for VE studies in performance contracts for Ministry executives and project managers.

VE Policy

MTO's VE policy is a flexible policy that supports a non-compulsory VE program through encouraging the use of VE, rather than a policy that requires the mandatory use of VE. The policy seeks to encourage the use of VE through the statement:

"Value Engineering is to be applied to suitable projects to the maximum extent that time and resources will allow. Regions should provide an annual plan that outlines which projects are suitable for VE studies in their Region based on the above selection criteria and their project specific knowledge"

MTO's policy document is included in Appendix A.

The policy provides guidance on the types of projects that are suitable for VE studies, but does not specify mandatory selection criteria such as a minimum dollar value. The primary mechanism to maintaining some consistency in application is a requirement for an annual VE plan. The activity to document upcoming studies on a plan tends to generate demand for VE studies.

Sustaining the Program

The approach to sustaining the VE program at MTO and building momentum for Value Engineering in Ontario has focused on building a critical mass of understanding, enthusiasm and interest in VE. This is accomplished in a number of ways from continuous improvement to resolving criticisms of the VE program.

To help generate interest in VE, MTO has provided Module 1 training to ministry staff, consultants and municipal officials. VE knowledge has been formally identified as a core technical competency for the ministry's project managers.

Continuous Improvement

MTO has kept abreast of developments through attendance at SAVE International, AASHTO and CSVA conferences, through exposure to the varying techniques of different VE Team Leaders, and through the use of new tools. Examples of continuous improvement include:

- Approach to highway safety
- Road User cost consideration
- Multi-phased Implementation procedures for study recommendations
- Adoption of Project Performance Measures Adoption of Scenarios to identify logical combinations of recommendations
- Use of Risk Management approaches
- Value Planning
- Experiments with study duration and team composition and acquisition
- Development of a standardized report format

Using the Tools

Using VE tools, such as function analysis, outside of studies, shows that VE is a practical approach to solving problems. MTO's VE Coordinators Committee routinely uses FAST diagramming to identify program improvements as shown in Figure 5 below.

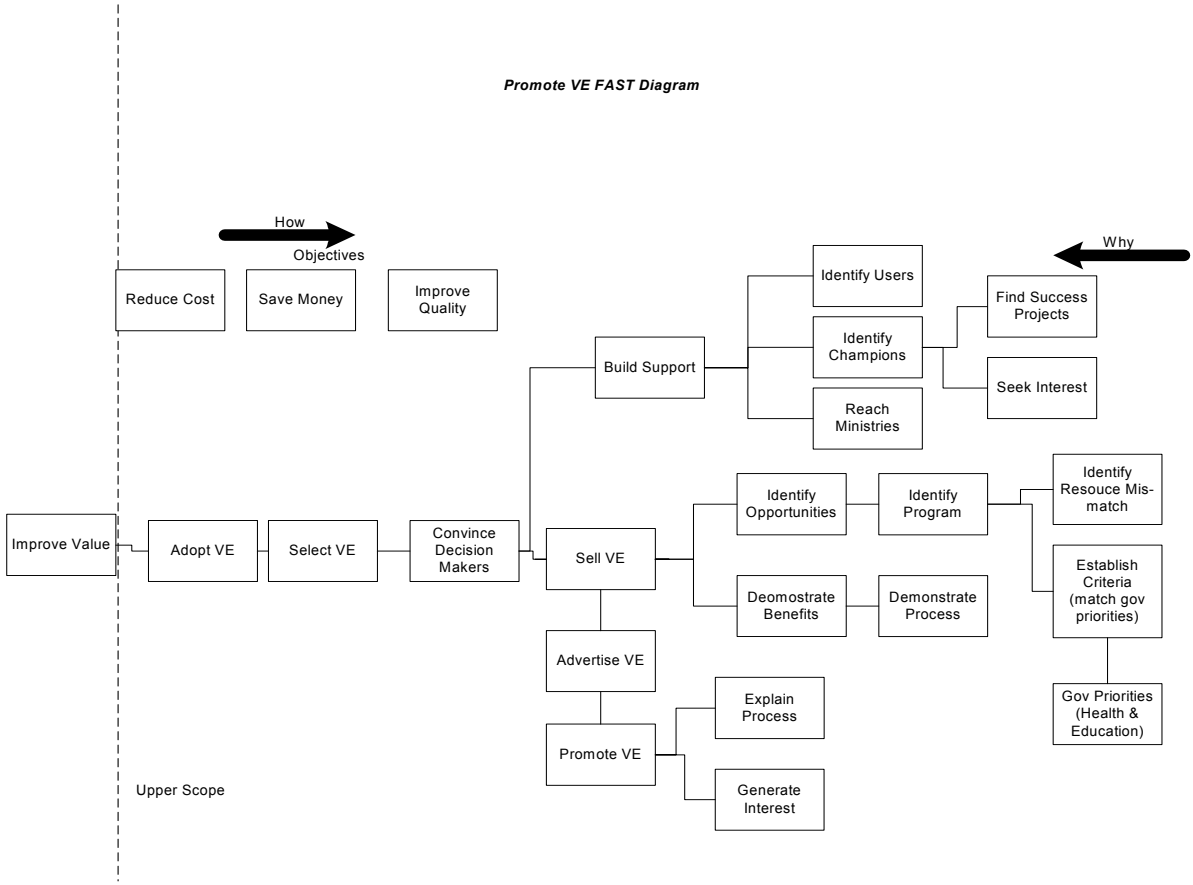


Figure 5- FAST diagramming as used by VE Coordinators Committee

Highway Safety

As discussed, MTO's VE program was launched in a climate where the fundamental assumptions of designers about highway safety were being challenged. According to the Ontario Road Safety Assessment Report (ORSAR 2002) Ontario's highways currently ranks among the safest in North America. Ontario is committed to further improving safety on its highways.

In response to this commitment, MTO's approach to highway safety in VE differs from the traditional approach of targeting a required level of safety. All improvements to safety are considered to add value and VE teams are challenged to improve upon "minimum standards".

Specific techniques and experts are used to measure and improve highway safety in the VE process. The approach has and continues to evolve with experience as shown in Figure 6 below. The process is described in Appendix B.

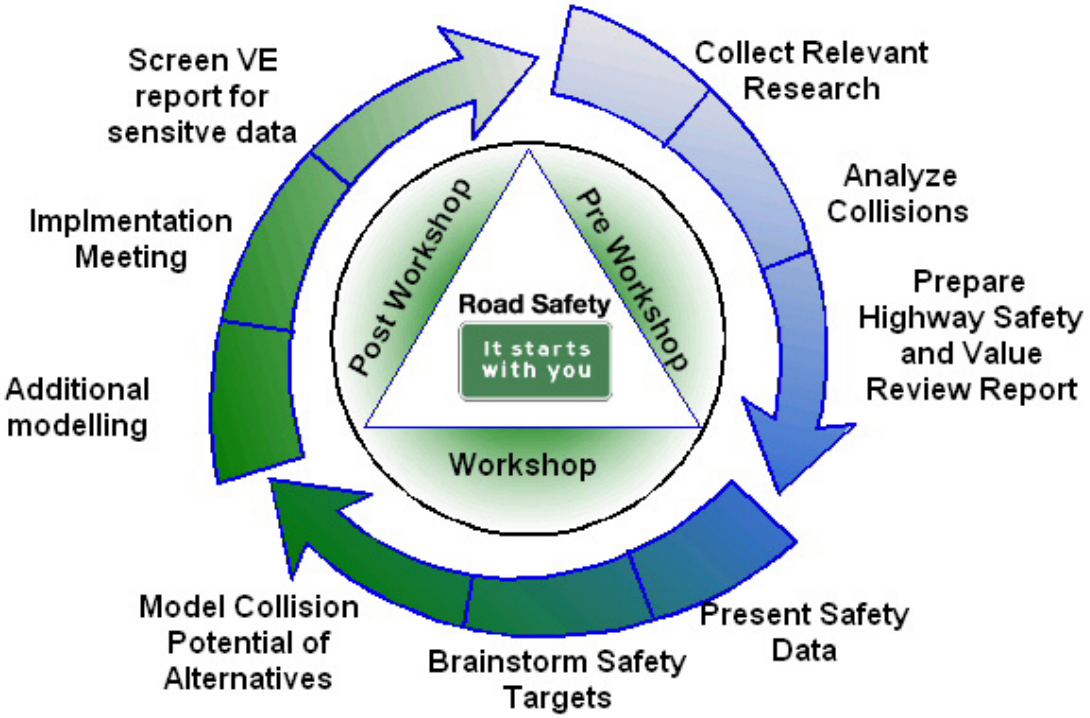


Figure 6- Road Safety Approach

Outreach

MTO has become an active supporter of societies that promote Value Engineering /Value Analysis because these societies help develop the skills of service providers and ministry staff. MTO is a sustaining member in SAVE International and the Canadian Society of Value Analysis (CSVA).

Outreach activities encourage other sectors of Ontario to consider Value Engineering. VE enthusiasts at MTO contributed many VE related ideas to a recent government ideas campaign. Lunch and learn sessions on value engineering/value analysis have been held throughout the province and are offered to other government ministries. MTO's technology transfer journal, Road Talk, has frequently feature articles about Value Engineering as shown in Figure 7.

Figure 7- Road Talk Articles

Lessons Learned

In developing, implementing and operating MTO's VE program, a number of lessons have been learned:

- It is important to understand and address the needs and interests of those who will make decisions about the VE program, studies, and implementation of recommendations

- VE Training is effective to build understanding and interest in VE, but training alone does not generate study candidates

- In MTO's initial VE studies, VE recommendations were sometimes perceived as criticism of the original design and were resisted by the designer. The inclusion of selected design team members in study teams can help to build consensus

- Success should be celebrated, but not at the expense of the designer, and to the future detriment of the program. VE recommendations are characterized as improvements to a good design, rather than the identification of errors

- Identify study opportunities that allow for significant change, without major impacts to the design and environmental process. For MTO, a study of the preliminary design recommendations, prior to public presentation has proven to be particularly successful

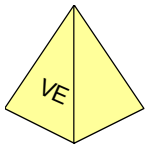
- The inclusion of safety expertise, and tools to explicitly assess changes in safety has been successful in dispelling concerns that effectively VE would compromise safety. In fact, MTO has selected VE to develop new standards for safety conscious highway design

- While the adoption of VE was originally based on its promise of financial savings, VE's ability to improve project performance and find better solutions has been of greater interest to users. The use of performance measures in workshops helps to identify and assess non-monetary improvements

- Study recommendations must be of high quality, to stand up to scrutiny after the study is finished. Similarly conservative claims of cost savings help maintain the credibility of VE. The adoption of "scenarios" helps present recommendations and savings in logical and achievable combinations

- Funding for VE studies from a central or dedicated funding source ensures that project delivery budget pressures will not impact VE

Summary



MTO's experience has demonstrated that a non-compulsory VE Program can be successful and effective. In order to be perceived as worthwhile, VE must demonstrate effectiveness, improve value, and not overly burden those who have the discretion whether or not to use it.

Demonstrated results, verified by users are important to show the value of the VE program to corporate decision makers to ensure their ongoing support for the program.

To date, MTO's VE program has conducted about 60 studies resulting in $150 M in implemented savings. The consulting industry, and municipalities now understand the process. Ontario has established expertise in Value Engineering and VE services are now exported to other jurisdictions. In 1995 there were no CVS or AVS involved in transportation in Ontario. There are now 4 Certified Value Specialists and 23 Associate Value Specialists involved with highway planning and design in Ontario. Hundreds have been trained in Value Engineering and the demand for VE is increasing.

MTO's program has been instrumental in growing VE in Ontario, particular with the consulting, construction and municipal sectors. In 2003, MTO received an award from the Canadian Society of Value Analysis for its contribution to the advancement of Value Management and support of the Society. An in-house VE study team recently won a division award (Prism Award) for building collaboration between ministry divisions and delivering an innovative solution on a project as a result of a VE study.

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Appendix A – **VE Policy**

Ministry of Transportation

Ministère des Transports

Ontario

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Operations Division
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MEMORANDUM

To: Regional Directors
Director, Construction and Operations Branch
Director, Engineering Standards Branch
Director, Strategic Project Branch
Director, Program Management Branch

From: Assistant Deputy Minister, Operations Division
Assistant Deputy Minister, Policy, Planning & Standards Division

July 9,2001

Annual Value Engineering Plans

MTO initiated a Value Engineering Program in 1997 as a tool to improve value on selected projects. VE has proven to be an effective method of improving project value through reducing capital cost, reducing operations and maintenance costs, and maintaining or improving safety, performance and quality. To maximise the benefits from VE, study selection criteria and an annual VE planning process is being established.

Selection criteria have been developed to identify projects with the most opportunity of change. Technical difficulty, complicated functional requirements, and external stakeholder challenges all tend to lead to projects with opportunities for improved value. Projects that provide the highest potential for value improvement include:

Expansion projects;
New Interchanges;
High Complexity reconstruction;
- Projects with complex traffic control and staging;
- Route planning studies;
- Projects with multiple stages;
- Corridor studies;
- Projects undertaken with other stakeholders;
- Projects with extensive or expensive environmental or geotechnical requirements;

Projects over $10 million;
Policies, Standards & Business Processes

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Value Engineering is to be applied to suitable projects to the maximum extent that time and resources will allow. Regions should provide an annual plan that outlines which projects are suitable for VE studies in their Region based on the above selection criteria and their project specific knowledge.

Value Engineering consultant services are available through the Highway Design Office to assist the Regions in adding value to their projects. The Highway Design office will co-ordinate the submission of an annual VE plan to the Joint OPS & PPS Committee.

Original Signed by
Carl A. Hennum
Assistant Deputy Minister
Operations

Original Signed by
Bruce McCuaig
A/Assistant Deputy Minster
Policy, Planning & Standards

Appendix B – Highway Safety

Pre Workshop

Project details including the highway geometry, safety and other issues, and data sources are discussed with the consultant. Based on the project details, relevant safety research documents will be reviewed and prepared for the workshop.

An analysis of the collision characteristics for each intersection, interchange and highway section along the corridor will be prepared.

The appropriateness of the collision models that have been proposed to compare the collision potential of the alternatives may also be reviewed.

When required, a highway safety and value review report will be prepared using explicit highway safety principles to access the value of major geometric features and make recommendations, where appropriate, to increase the value of these features.

Workshop

Include highway safety and human factors experts on project teams. The safety experts expand the knowledge of the project team through an information phase presentation on the safety aspects of the project.

Where possible, the collision costs of the proposed design and VE alternatives are calculated. Models are used to assess the changes to safety resulting from VE recommendations.

Measurable aspects of safety are included as a project performance measurement.

Consciously look for opportunities to improve value by tangibly improving safety.

Post-Workshop

Review and refine the safety modelling and finalize any other safety related analysis. It is sometimes not possible to finalize a safety model during the workshop.

At the implementation meeting the capital costs and collision costs of alternatives are presented separately.

Prior to the submission of the final report, the consultant and project manager screen the report for sensitive material.