

Value Engineering



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Objectives

- **Background**
- **What is VE**
- **Why, What, Who, & When to VE**
- **Review VE Job Plan (How)**
- **Team Member & PM Roles**
- **2013 AASHTO VE Winner**
- **References**



Background

- 1947 VE Process Established
- 1954 Adopted by US Navy
- 1959 SAVE International
- 1970 Highway Act
- 1978 FDOT VE Program
- 1995 National Highway Systems Act
- 1997 Federal Regulation (23 CFR 627)
- 2005 SAFETEA-LU
- 2012 Updated Federal Regulation
- 2012 MAP-21



What is Value Engineering?

It is not cost reduction!!!

Value Engineering is the systematic application of function-oriented techniques by a multi-disciplined team to analyze and improve the value of a product, process or service.



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Value Engineering is the systematic application of **function-oriented** techniques by a **multi-disciplined team** to analyze and improve the value of a product, process or service.



Why use VE?

- Shrinking Resources
 - Do More with Less
 - Put more product on the street
- Bold, Innovative & Inspirational



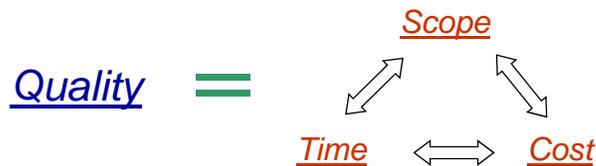
Why use VE?

- Improve Project Schedule
- Improve Constructability
- Resolve Stakeholder Issues
- Reduce Operating Costs
- Reduce Overall Project Costs
- Mitigate Risks



VE & Project Management

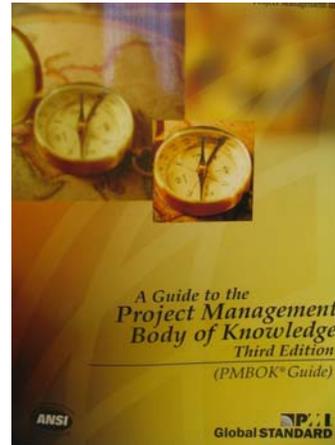
Triple Constraint



Project Quality is affected by
balancing Scope, Time, & Cost

Project Management Body Of Knowledge (PMBOK)

- ◆ **Five Project Management Process Groups**
- ◆ **Nine Knowledge Areas**



9 Knowledge Areas

1. **Integration**
2. **Scope**
3. **Time**
4. **Cost**
5. **Quality**
6. **Human Resources**
7. **Communications**
8. **Risk**
9. **Procurement**



9 Knowledge Areas

1. Integration
2. Scope
3. Time
4. Cost
5. Quality
6. Human Resources
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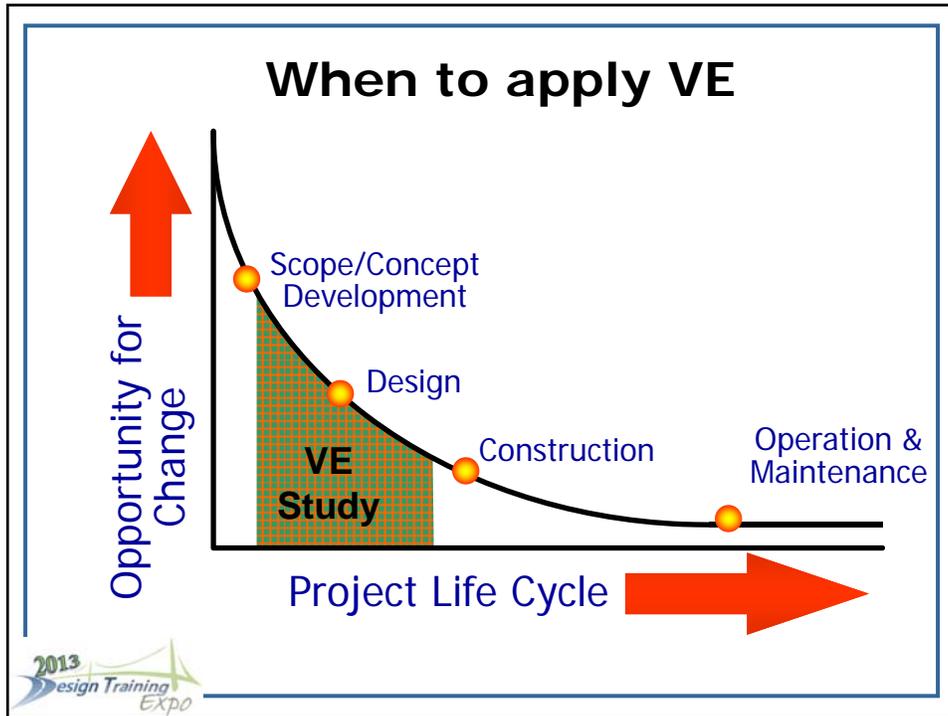
Areas that VE can help improve



How Can VE Help - Nine Knowledge Areas

- Improve Project Schedule **Time**
- Improve Constructability **Quality**
- Resolve Stakeholder Issues **Scope**
- Reduce Operating Costs **Cost**
- Reduce Overall Project Costs **Cost**
- Mitigate Risks **Risk**





When is VE Performed

- **Planning**

Typical Information Required :



- **Traffic Information**
- **Aerial Photo**
- **ROW Information**
- **Preferred Alternative**

2013 Design Training Expo

When is VE Performed

Project Development & Environmental

Typical Information Required :

- ◆ Construction Cost Estimates
- ◆ ROW Cost Estimates
- ◆ Business Damage Estimates
- ◆ Traffic Analysis
- ◆ Preliminary Plans
- ◆ Environmental Impact Analysis
- ◆ Summary of Public Involvement



When is VE Performed

Design

Typical Information Required :

- ◆ Drainage Information
- ◆ Typical Sections
- ◆ Plan & Profile
- ◆ Intersection & Interchange Layouts
- ◆ Cross Sections
- ◆ Structure Info
- ◆ Traffic Control Plans
- ◆ Preliminary Cost Estimate



When is VE Performed

Design/Build Projects

- Conducted prior to release of RFP
- Design/Build Rule – 23 CFR 627.5



Typical Information Required :

- RFP Package



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MAP-21



How Is VE Done?

VE Job Plan

- Pre-Study
- Project Selection
 - Team Selection

VE Team Study

- Information Phase
- Function Analysis
- Creative
- Evaluation
- Development
- Presentation



- Post-Study
- Implementation
 - Report Results



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Projects Selected for VE (What)

- \$25 million or more
- Large Right-of-Way Purchases
- Major Bridges
- Complex Projects
- Large Corridor & Multi-modal Projects
- Project Manager Requests



Team Selection (Who)

- **Team Leader**
 - Consultant
 - In-house
- **Design**
- **Construction**
- **Maintenance**
- **Specialized Expertise**



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5 QUESTIONS

ASKED DURING THE VE STUDY

1. **What is it?**
2. **What does it do?**
3. **What does it cost?**
4. **What else can do it?**
5. **What does that cost?**



Information Phase

- ◆ **Introductions**
- ◆ **Review Project Information**
- ◆ **Team briefing by design team**
- ◆ **Site Visit**
 - ✓ **Video Logs**
 - ✓ **Google Earth**

Information Phase

- ◆ **Review Project Information**
 - ✓ **Discuss Design/Estimate**
 - ✓ **Develop Questions for Design Team**
 - **Constraints ?**
 - **Major issues?**
 - **What keeps you up at night?**
 - **Significant Risks?**
 - ✓ **Identify any missing information**



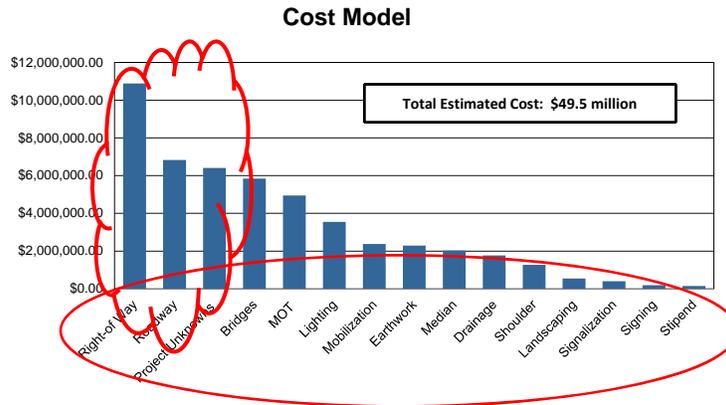
Information Phase

- ◆ **Site Visit**
 - ✓ **Meet at site and walk the site as a team**
 - ✓ **Record any observations**
 - ✓ **Take Pictures**
- ◆ **Post Site Visit**
 - ✓ **Review Cost Model**
 - ✓ **Areas of Review**



Cost Model - Pareto

- ◆ 20% of functions contain 80% of cost



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Function Analysis Phase

What is Function?

- ◆ Intent or purpose that a product or service is expected to perform.
- ◆ Expressed in 2 words, active verb and measurable noun.

WHAT DOES IT DO?

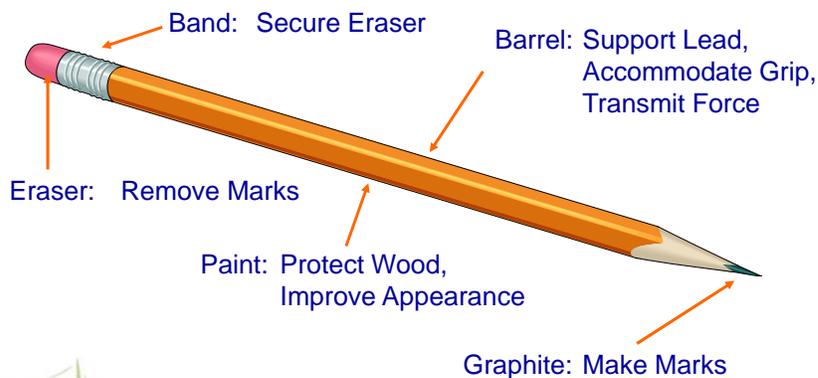
WHAT DOES IT DO IT TO?



Function Analysis Phase

What is the function of this pencil?

“make marks”



Function Analysis Phase

Random Function Generation

ITEM	VERB	NOUN
Door	Control	Access
Fence	Enclose	Area
Electric Switch	Interrupt	Current
Screwdriver	Transmit	Torque
Column	Support	Load
Light	Illuminate	Area
Guardrail	Re-direct	Vehicle
Landscaping	Improve	Appearance



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Creative Phase

Brainstorming

- ◆ A technique to get bigger and better ideas
- ◆ Free flow of creative ideas not bound by barriers
- ◆ Challenges traditional thinking

WHAT ELSE CAN DO IT?



Creative Phase

Brainstorming Rules

- ◆ Ideas flow freely
- ◆ No debating or evaluating ideas
- ◆ Build on other ideas
- ◆ Think of new ways
- ◆ Be humorous and creative
- ◆ Everyone participates
- ◆ There are no bad ideas



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Evaluation Phase

What is It?

- ✓ Evaluate the ideas generated during the Creative Phase

Why is it important?

- ✓ Not enough time to develop all ideas generated during Creative Phas



Evaluation Phase

- ◆ **Eliminate ideas**
- ◆ **Combine ideas**
- ◆ **Evaluate remaining ideas**
 - ✓ **Weighted Matrix**
 - ✓ **Team Consensus**



Evaluation Phase

- ◆ **Typical Criteria:**
 - ✓ **Costs**
 - ✓ **Operations**
 - ✓ **Constructability**
 - ✓ **Maintenance**
 - ✓ **Environmental**
 - ✓ **Aesthetics**



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Development Phase

Write-up Ideas

- ◆ **Descriptions**
- ◆ **Sketches**
- ◆ **Calculations**
- ◆ **Advantages & Disadvantages**
- ◆ **Cost Analysis (Life Cycle Costs)**



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Presentation Phase

- ◆ **Present results to management**
- ◆ **Either last day of study or scheduled separately by District VE coordinator**
- ◆ **Document results in report**



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Report Results

- ◆ **Results are reported at the Monthly Performance Meeting**
- ◆ **Results are reported on an Annual Basis to FHWA**
- ◆ **Annual Report is developed with Statewide and District Results**



Report Results

VE PROGRAM: PROJECT COST AVOIDANCE IN DESIGN (VE)

PROJECT COST AVOIDANCE IN DESIGN (VE) FOR FY 2013 PERFORMANCE REVIEW FOR MAY 16, 2013									
	D1	D2	D3	D4	D5	D6	D7	TE	SW
FY 2013 2013-2015 LETTINGS- AVERAGE MONTHLY PER DISTRICT ACCUMULATED THRU 03/13	154.1	189.6	201.7	173.9	159.1	118.7	126.5	235.0	1358.6
# VE STUDIES	1	1	4	4	2	2	1	0	15
ANNUAL APPROVED COST AVOIDANCE/SAVINGS ADOPTED RECOMMENDATIONS									
\$M RECOMMENDED	\$16.13	\$8.60	\$68.00	\$23.93	\$31.04	\$116.91	\$2.56	\$0.00	\$287.15
*\$M APPROVED	\$31.58	\$0.00	\$66.00	\$8.13	\$14.75	\$17.23	\$2.56	\$0.00	\$140.25
ANNUAL APPROVED VALUE ADDED ADOPTED RECOMMENDATIONS									
\$M RECOMMENDED	\$0.22	\$0.00	\$0.00	\$0.06	\$2.01	\$46.08	\$0.00	\$0.00	\$48.37
\$M APPROVED	\$0.22	\$0.00	\$0.00	\$0.05	\$0.10	\$27.15	\$0.00	\$0.00	\$27.52
ANNUAL ADOPTION RATE (TARGET 40% - 60%)									
# RECOMMENDED	7	1	18	11	29	34	3	0	103
# APPROVED	5	0	16	5	15	14	3	0	58
% APPROVED	71%	0%	89%	45%	52%	41%	100%	0%	56%
PERCENT PROJECT SAVED									
% PROJECT SAVED (VE SAVINGS DIVIDED BY COST OF PROJECTS VE'D)	14.55%	0.00%	16.40%	4.50%	5.59%	0.96%	7.91%	0.00%	4.75%
% PROGRAM SAVED (VE SAVINGS DIVIDED BY * 3 FY'S LETTINGS- MONTHLY AVERAGE FOR THE DISTRICT ACCUMULATED TO DATE)	20.49%	0.00%	32.72%	4.67%	9.27%	14.52%	2.02%	0.00%	10.32%



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Expo

Report Results

Value Engineering

FY 2011 Value Engineering Accomplishment Report

Legend:

Return On Investment = Value of Approved Recommendations/Total Cost of VE Studies
 % of Costs Saved = Value of Approved Recommendations/Estimated Costs of Projects Studied
 Total Savings Achieved = Value of Approved Recommendations + Value of Approved VE Change Proposals
 All costs shown are millions of dollars

State	VE Study Data			VE Recommendation Data						VE Change Proposal Data			Total Savings Achieved		
	Number of VE Studies In-House	Consultant	Total	Cost of VE Studies	Estimated Costs of Projects Studied	Number of VE Recommendations	Value of VE Recommendations	Number of Approved Recommendations	Value of Approved Recommendations	Recommendation Acceptance Rate	Return On Investment	% of Project Costs Saved		Number of Approved VE Change Proposals	Value of Approved VE Change Proposals
Alabama	3	7	10	\$0.272	\$451.24	55	\$84.76	14	\$4.17	25%	15	0.9%	3	\$0.04	\$4.21
Alaska	0	8	8	\$0.506	\$409.43	173	\$143.85	57	\$18.15	33%	31	4.4%	2	\$1.50	\$19.65
Arizona	0	5	5	\$0.160	\$433.00	62	\$32.00	29	\$9.80	47%	61	2.3%	4	\$0.10	\$9.90
Arkansas	7	0	7	\$0.045	\$309.10	23	\$34.23	2	\$0.43	9%	9	0.1%	0	\$0.00	\$0.43
California	0	59	59	\$2.710	\$4,783.59	329	\$424.50	161	\$192.31	49%	71	4.0%	40	\$4.48	\$196.79
Colorado	2	2	4	\$0.120	\$356.53	33	\$4.50	20	\$2.74	61%	23	0.8%	3	\$0.15	\$2.89
Connecticut	2	3	5	\$0.188	\$172.25	60	\$71.18	11	\$2.62	22%	14	1.5%	1	\$0.20	\$2.82
Delaware	1	0	1	\$0.004	\$26.20	3	\$0.32	3	\$0.32	100%	92	1.2%	0	\$0.00	\$0.32
District of Columbia	0	0	0	\$0.000	\$0.00	0	\$0.00	0	\$0.00	N/A	0	0.0%	0	\$0.00	\$0.00
Florida	8	13	21	\$1,000	\$4,400.00	90	\$338.00	54	\$142.00	60%	142	3.2%	15	\$4.72	\$146.72



Report Results

**Value Engineering
Annual Report
FY 2011/2012**



Team Member Role

- ✓ Review pre-study information
- ✓ Fully participate during study
- ✓ Review & comment study report



Project Manager Role

Pre – Study Activities :

- ✓ **Provide input during Project Selection Phase.**
- ✓ **Provide input during Team Selection Phase.**
- ✓ **Provide all available information on the project prior to study.**



Project Manager Role

Study Activities :

- ✓ **Brief the team on first day of the study.**
- ✓ **Be available during the week to answer questions.**
- ✓ **Attend team presentation of recommendations.**



Project Manager Role

Post – Study Activities :

- ✓ **Participate in the resolution of recommendations.**
- ✓ **Inform everyone involved in the project, *in writing*, of all accepted recommendations.**



2011 AASHTO Value Engineering Awards

Pre-Construction Engineering >\$75 M

... And the Winner is ...

FDOT – District 4

Crosstown Parkway Extension



National Value Engineering Award

Most
Value Added
Proposal



Pre-Construction
Engineering
\$100 million or
Greater

Florida Department of Transportation
District Four
Crosstown Parkway Extension

*For Demonstrating Outstanding Value Engineering Achievements
in Teamwork, Cost Savings, Enhanced Performance, or Expedited Project Delivery
That Resulted in an Overall Improved Project*

Presented by the AASHTO Value Engineering Technical Committee
July 9, 2013

Project Description

- Extend Crosstown Parkway from Manth Lane to US 1
- Provide relief to 2 existing crossings of the North Fork St Lucie River
- Final 2 mile segment of corridor



Major Project Elements

- ◆ Parkway design features, significant green space, longitudinal park feel
- ◆ Construction of 6 lane divided highway
- ◆ Construction of twin 66 foot wide bridges approximately 4000 feet long
- ◆ Shared use pathway on both sides of the Parkway



Design Training Expo

Proposed Typical Sections

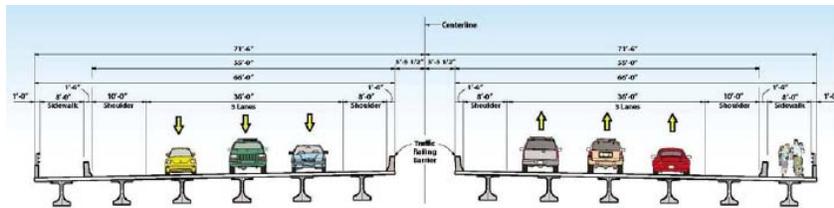


Figure 2. Typical Bridge Section

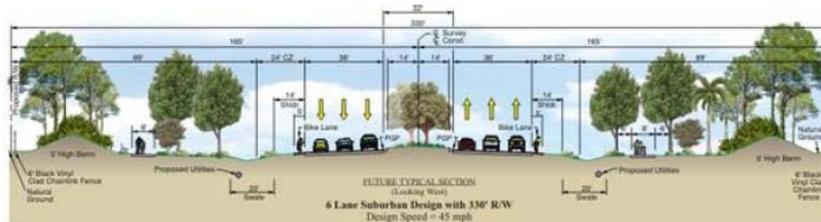


Figure 3. Future Typical Section

2013 Design Training Expo

Cost Estimate

- ◆ **Construction Cost - \$121M**
- ◆ **ROW - \$18.6M (no CSX)**
- ◆ **Utility Relocations - \$4.7M**
- ◆ **Design & Contingencies - \$10.7M**
- ◆ **Total Project Cost - \$155M**



VE Recommendations

- ◆ **Utilize 11 foot lane widths - \$27 M**
- ◆ **Utilize “Thirsty Duck” technology to reduce detention areas - \$3.3M**
- ◆ **Provide pedestrian access - \$50K Value added**
- ◆ **Utilize the Design/Build Method of delivery**
- ◆ **Total Project Cost Avoidance - \$30M +**



VE Study Highlights

- ◆ **Participation on the team by the City of Port St. Lucie developing a synergy between City & State**
- ◆ **Team embraced a Practical Design philosophy during the study by challenging traditional standards to identify solutions**
- ◆ **Conducted a Qualitative Risk Analysis to identify potential project risks**



Cost Risk Analysis/ Value Engineering

- ◆ **CRA Process & VE Process are complimentary**
 - ✓ **Use the VE process to develop risk response strategies**
 - ✓ **Use the CRA process on the VE recommendations to evaluate the risks and their impact on the cost & schedule**



Practical Design/ Value Engineering

- ◆ **Practical Design focuses on developing solutions that satisfy the Purpose & Need**
- ◆ **Value Engineering focuses on developing solutions that satisfy the project's basic function**



SAVE International

- ◆ **Professional Society dedicated to the advancement of VE**
- ◆ **Certifying organization**
 - ✓ **Associate Value Specialist (AVS)**
 - ✓ **Value Management Professional (VMP)**
 - ✓ **Certified Value Specialist (CVS)**



Reference

- ◆ **FDOT Value Engineering Procedure 625-030-002**

- ◆ **FDOT VE Web Site**

<http://www.dot.state.fl.us/officeofdesign/ProjectReview/ValueEng/>

- ◆ **FHWA VE Web Site**

<http://www.fhwa.dot.gov/ve/>

- ◆ **SAVE International Web Site**

<http://www.value-eng.org/>



Questions



Thank You

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