



Canadian Society of Value Analysis 2008 Conference Introduction to Value Management

Scot McClintock, PE, CVS-Life, PVM, FSAVE
Head of Value Management



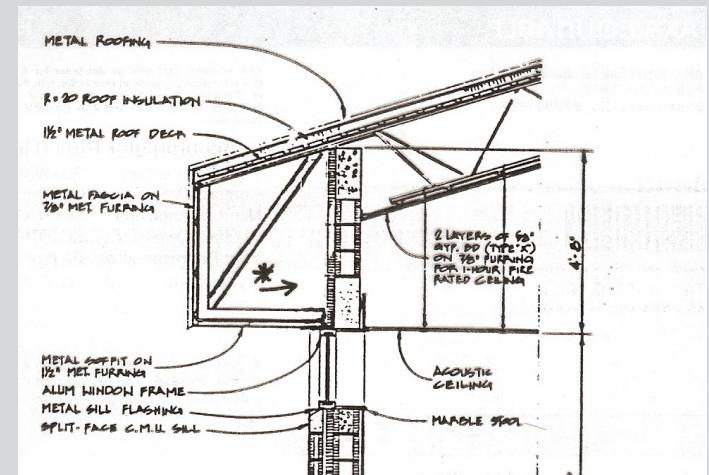
Value Management (VM)

Value Management (VM) is a systematic, organized system of investigation, using trained, multi-disciplined teams to analyze the functional requirements of a project for the purpose of achieving the essential functions at the lowest total cost (capital, operating and maintenance) over the life of the project.



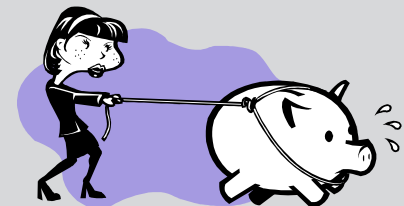
Value Management (VM)

By using creative techniques and current technical information on new materials and methods, alternative solutions are developed for specific functions, eliminating or modifying components and their costs that are not essential to required performance.



Value Management is NOT

- What a good designer “does already”.
- An effort to trade off essential functions to cut costs.
- Merely a review to eliminate “Gold Plating”.
- A method for reducing costs through degrading performance and reliability.
- In any way intended as a reflection on the competence of the designer.
- An effort to cheapen the design.
- Only done at end of design or start of construction to return project to budget



The Philosophy of VM

- We can improve project value.

$$\text{VALUE} = \frac{\text{WORTH}}{\text{COST}} = \frac{\text{FUNCTION}}{\text{COST}} = \frac{\text{BENEFIT}}{\text{COST}}$$

$$\text{VALUE} = \frac{\text{TOTAL PROJECT/FACILITY PERFORMANCE}}{\text{LIFE CYCLE COST}}$$

- We are not in competition with one another.
 - Design and VM Teams – What's best for client?
- As above average people we should expect above average results.
 - Trained, experienced, knowledgeable professionals
- Challenge everything...



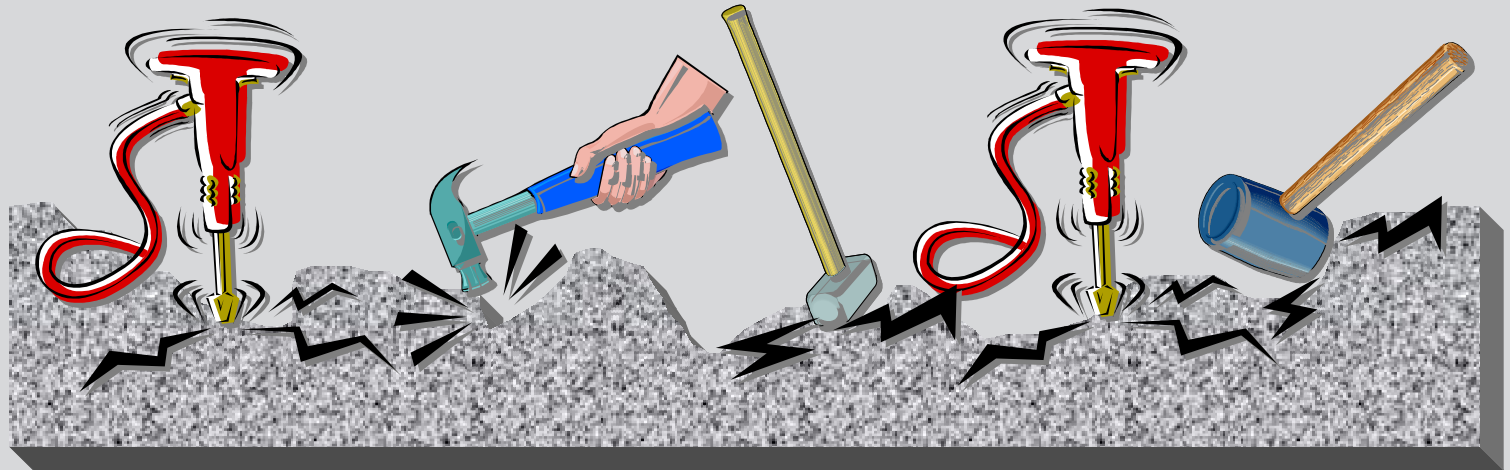
Top 10 Reasons for Predictable Success of VM...

- ⑩ Freedom to be creative
- ⑨ Freedom to challenge
- ⑧ Focused team effort on limited targets
- ⑦ Team of different disciplines and viewpoints
- ⑥ Positive reinforcement of suggestions
- ⑤ Appreciating the power of the mind
- ④ Understanding goals & limitations of each discipline
- ③ Encouragement to excel individually & as a team
- ② Motivation of each individual within team
- ① Function Analysis



Teamwork

The Crowd



The Team



The History of VM



- 1947** Developed by Larry Miles as Value Analysis
- 1953** Miles Presents VA to US Navy
- 1954** Navy Adopts Process as Value Engineering
- 1958** Society of American Value Engineers (SAVE) Founded
- 1964** Corps of Engineers Trains Staff in VE
- 1972** USEPA - VE for All Projects Over \$10 M
- 1985** Miles - Japan's Highest Award to Foreigners
- 1988** US OMB Issues Circular A-131
- 1996** President Clinton signs Public Law 104-106
Each executive agency to establish VE process
- 2008** You get trained in VM

Rene Descartes

Discourse on Methods, 1605

- Avoid preconception
- Divide problem
- Think orderly
- Enumerate completely, review generally



Descartes

Marcus Vitruvius Pollio

Roman Architect (30BC-46)

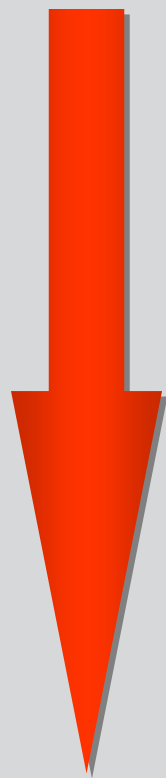
- Design with regard to economy and construction technology (Firmity).
- Design to accommodate program and function (Commodity).
- Design with careful attention to aesthetics, with the goal of creating an enriching environment (Delight).

Why Use VM?

- To save money! Get essential functions at the minimum life cycle cost.
- Obtain new ideas from a fresh perspective to improve project.
- Combine ideas of owner, designer and VM Team to improve project.
- Make complex decisions or solve difficult design problems.
- Get project back within budget constraints.
- For concept development.
- For quality assurance.
- Achieve sustainability goals (LEED).
- Return on Investment (ROI) of 10:1 or greater. USEPA: 18:1 since 1972. 100:1 possible.



Why Use VM?



Capital Cost

Life Cycle Cost

Design Time

Decision Time

Schedule

Risk



Quality

Value

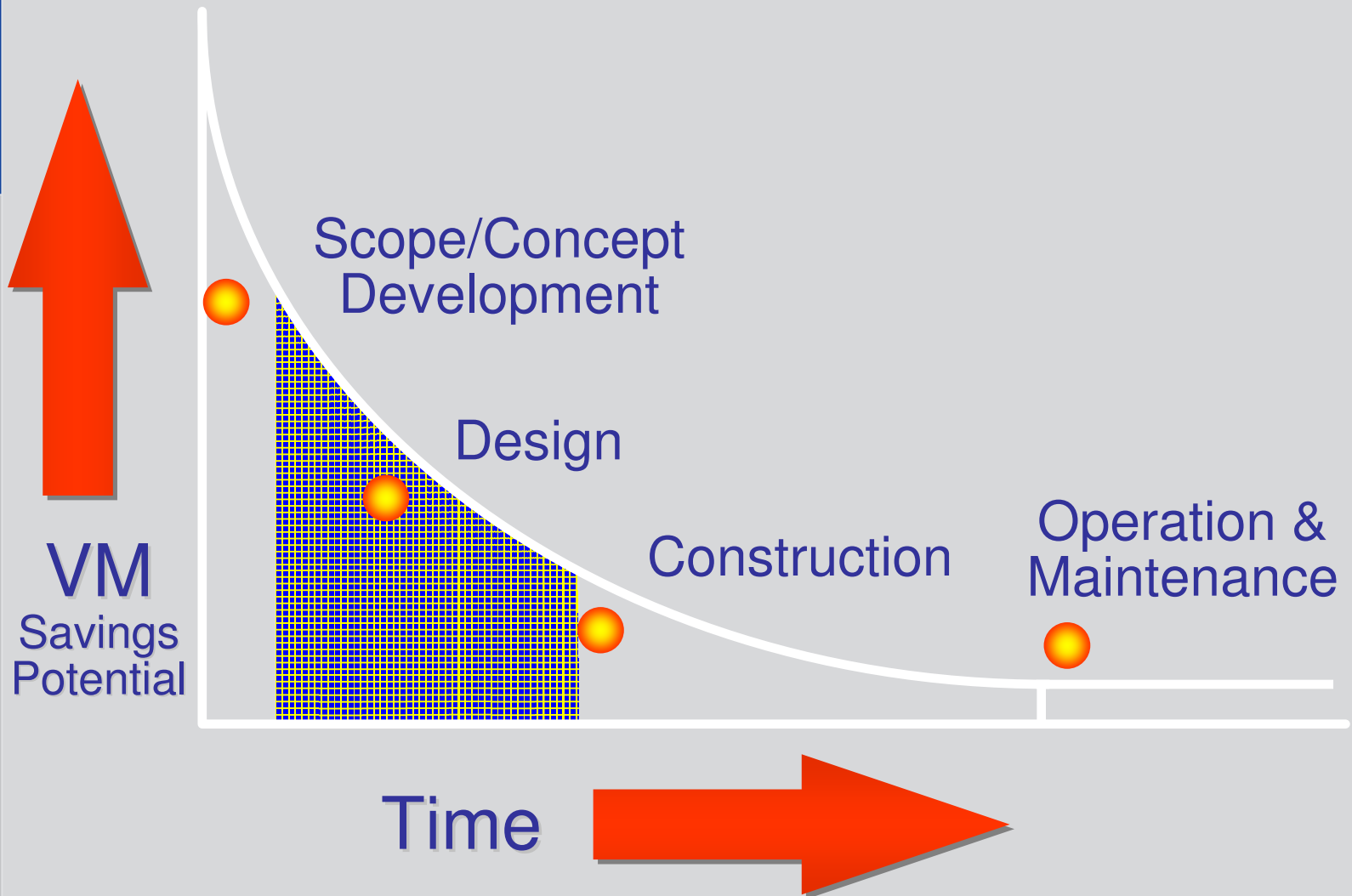
Sustainability

Ideas

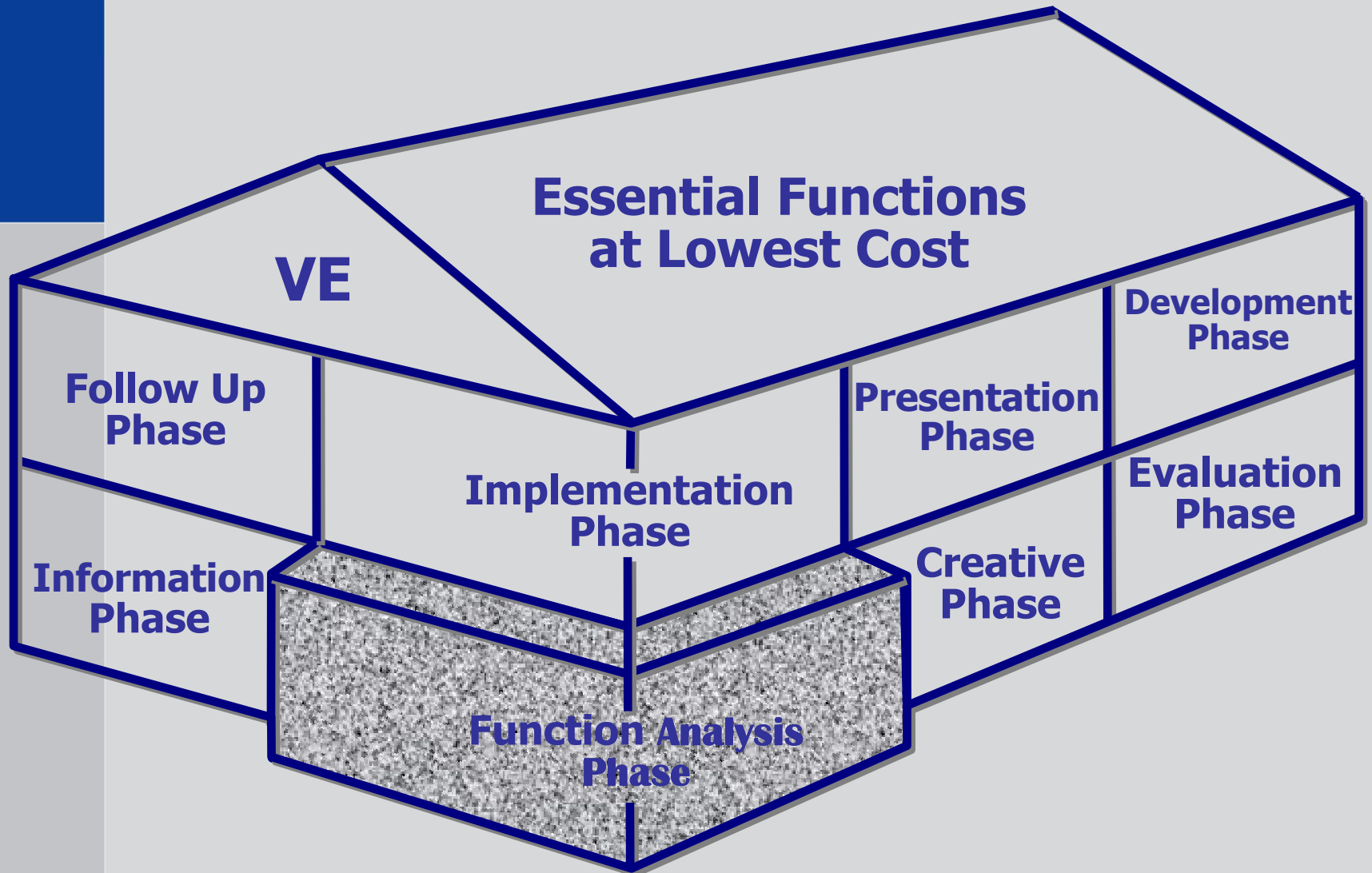
Consensus

Performance

When to use VM...



VM Job Plan



Information Phase

- Gather factual information to answer, “what...”

- Is the project?
- Is the project scope?
- Are the design criteria/requirements?
- Are the design assumptions?
- Are the reasons for the project?
- Are the components of the project?
- Are the component costs of the project?



Information Phase

- Pre-workshop activity to obtain latest drawings, design reports, specifications, standards & criteria, cost estimates, etc.
- Site visit (if required and not done pre-workshop).
- Explain VM to designers to promote cooperation.
- Have Owner state goals & objectives of project & VM study.
- Have design team present design including assumptions and decisions made to date.
- Q & A after design team presentation.
- Include significant stakeholders such as users, operators, maintenance staff, regulators, etc.



Information Phase

- If estimates aren't available, develop them.
- Prepare/review cost model (s) from estimate.
- In workshop, contact government, commercial & educational sources.
- Consult project criteria, planning documents, past experience, commercial & historic data.
- Consider worth of the project & its components.
- List project issues, risks, objectives, & constraints.
- Prepare **qualitative** risk register (as appropriate).
- Select value target areas from issue discussion, considerations of worth, cost models, and the qualitative risk register.



Information Phase

**Worth = The Lowest Cost Required
to Perform a Specific Function**

Example



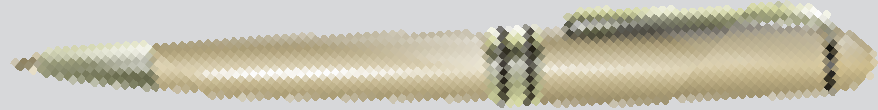
	<u>Cost</u>	<u>Cost/Worth*</u>
Piece of graphite	\$.02	\$.02/.02 = 1
#2 Pencil	\$.20	\$.20/.02 = 10
Plastic Mech. Pencil	\$2.00	\$2.00/.02 = 100
Chrome Mech. Pencil	\$20.00	\$20.00/.02 = 1000

*Worth of something which marks paper with graphite = \$.02

Value = $\frac{\text{Cost}}{\text{Worth}}$ Where 1 = Maximum Value

Information Phase

Types of Value



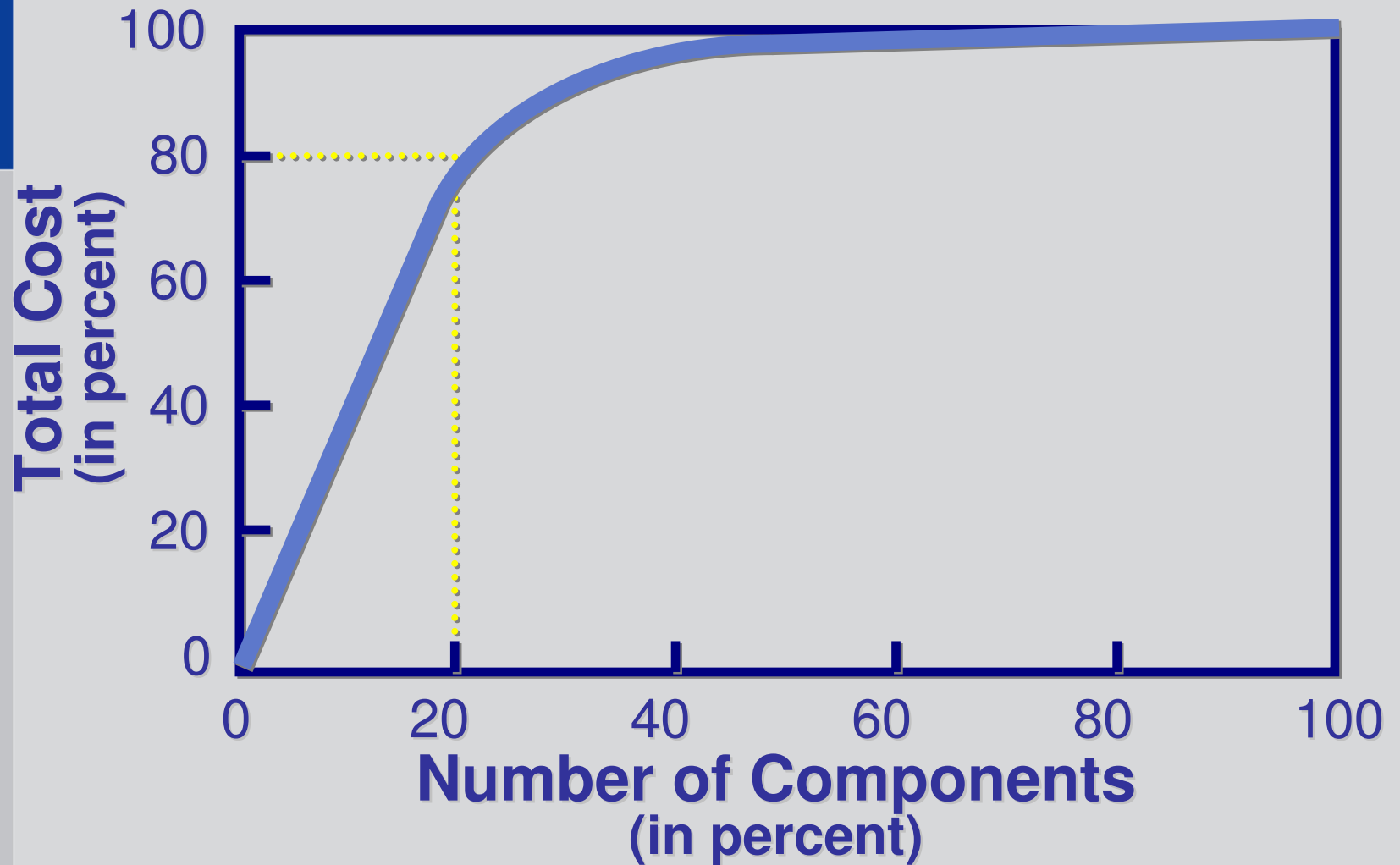
Cost Value = labor, materials, overhead & other cost elements measured through cost analysis to produce product.
(Say \$12.00)

Exchange Value = \$ amount component can be sold for, as determined by marketplace.
(\$20.00)

Use Value = value attributed to specific function performed by the component.
(\$.02)

Esteem Value = \$ amount user is willing to pay for properties or features providing aesthetics, prestige, commercial appeal, excessive performance, etc.
(\$19.98?)

Pareto's Law of Distribution



Risk Register



PROJECT RISK REGISTER

FULLY INTEGRATED BAGGAGE SCREENING SYSTEM - B/C AREA

BWI Airport

Date:

RISKS OF CONCERN

No action vs Risk

Action vs Risk

RISK NO	RISK	RISK MANAGEMENT	No action vs Risk			Action vs Risk			MAXIMUM COST	MAXIMUM WEIGHTED COST
			PROB.	COST CONS.	TOTAL	PROB.	COST CONS.	TOTAL		
3	A poor return on investment on the money spent for FIBSS, Fail to achieve full eligibility for federal funding	Spend money wisely, LCC, include features which can boost ROI, VE, commission system properly and include user in process	5	5	25	3	4	12	\$18,000,000	\$18,000,000
7	Project cost grows too much to go forward	Design cost-effectively; move project along to minimize escalation, LCC	5	5	25	2	2	4	\$13,000,000	\$13,000,000
8	Potential of BWI is not realized due to baggage limitations	Meet required baggage screening throughput, verify projections	5	5	25	1	1	1	\$100,000,000	\$100,000,000
9	Sort system fails to get bags where they're supposed to be (as high as 5%?)	Select proper technology, Conduct intensive testing of system to insure it works properly; have system monitored daily	5	5	25	1	1	1	\$130,000,000	\$130,000,000
12	Contractor does not properly administer project	Performance based construction contracts	3	5	15	2	3	6	\$10,000,000	\$6,000,000

Information Phase

Target Selection

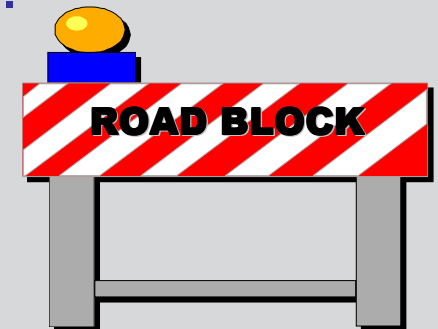
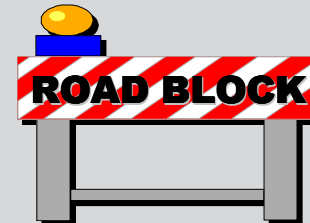
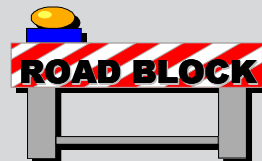


- Value mismatches where:
Cost >> Worth
- Items within Pareto's 20%.
- Items with risk to mitigate.
- Interviews with owners, users, design team, & other stakeholders.

Information Phase

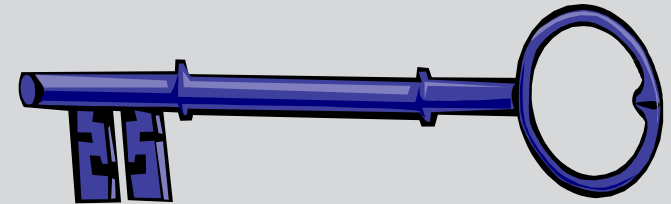
Documentation

- Use forms as tool not restriction.
- Complete forms for VM studies within workshop.
- Describe item under study.
- Provide sketches, drawings and catalog cuts to document present design.
- Provide cost estimate and backup cost data for present design.
- Record where you've obtained info.
- Use good human relations.
- Anticipate



Function Analysis

- Cornerstone of VM.
- Key to VM.
- The language of VM.
- The big difference between VM and other forms of cost control.



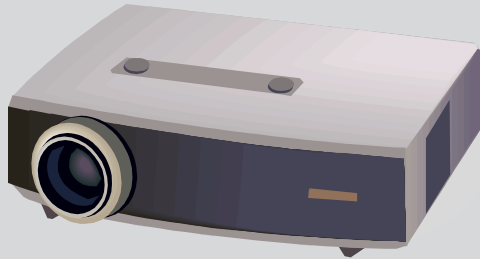
Function Analysis

- Assures thorough communication & understanding among team members.
- Forces clarity of thought and conciseness.
- Avoids confusion & combination of functions.
- High level of disassociation from specifics.



Function Analysis

- **Function** = An expression of what something needs to do without defining how it should be done.



- **Example:**
 - The function of this slide is to **present information** to you. By identifying the slides function, my mind is now open to considering other options to present information: overhead, handout, video, slide projector, etc.

Function Analysis

- **Define functions with 2 words.**
 - Active verb
 - Measurable noun



Item

Mechanical Pencil
Coffee Cup
Fire Wall
Bridge
Entrance/Exit Ramp

Function

Make Marks
Hold Liquid
Contain Fire
Span Obstacle
Permit Access

Function Analysis

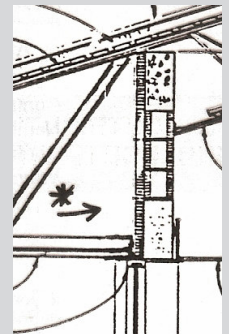
Classification of Functions

- To clarify project or design and isolate unnecessary functions.
- **Basic function** = Primary purpose of design or component which must remain to do the job.
- **Secondary function** = Functions existing due to or in support of the basic function.
- **Required secondary function** = Secondary function essential to provide basic function.
- **Highest order function** = Reason for basic function beyond scope of project or design.

Function Analysis

Remaining secondary functions, supporting the basic function or required secondary functions can be:

- Modified, improved and even eliminated without threatening basic function.
- Unnecessary with unnecessary cost attached, i.e. prime targets for VM Team.
- Functions which happen at the same time or are caused by another function.
- Functions which happen all the time.
- Design objectives.



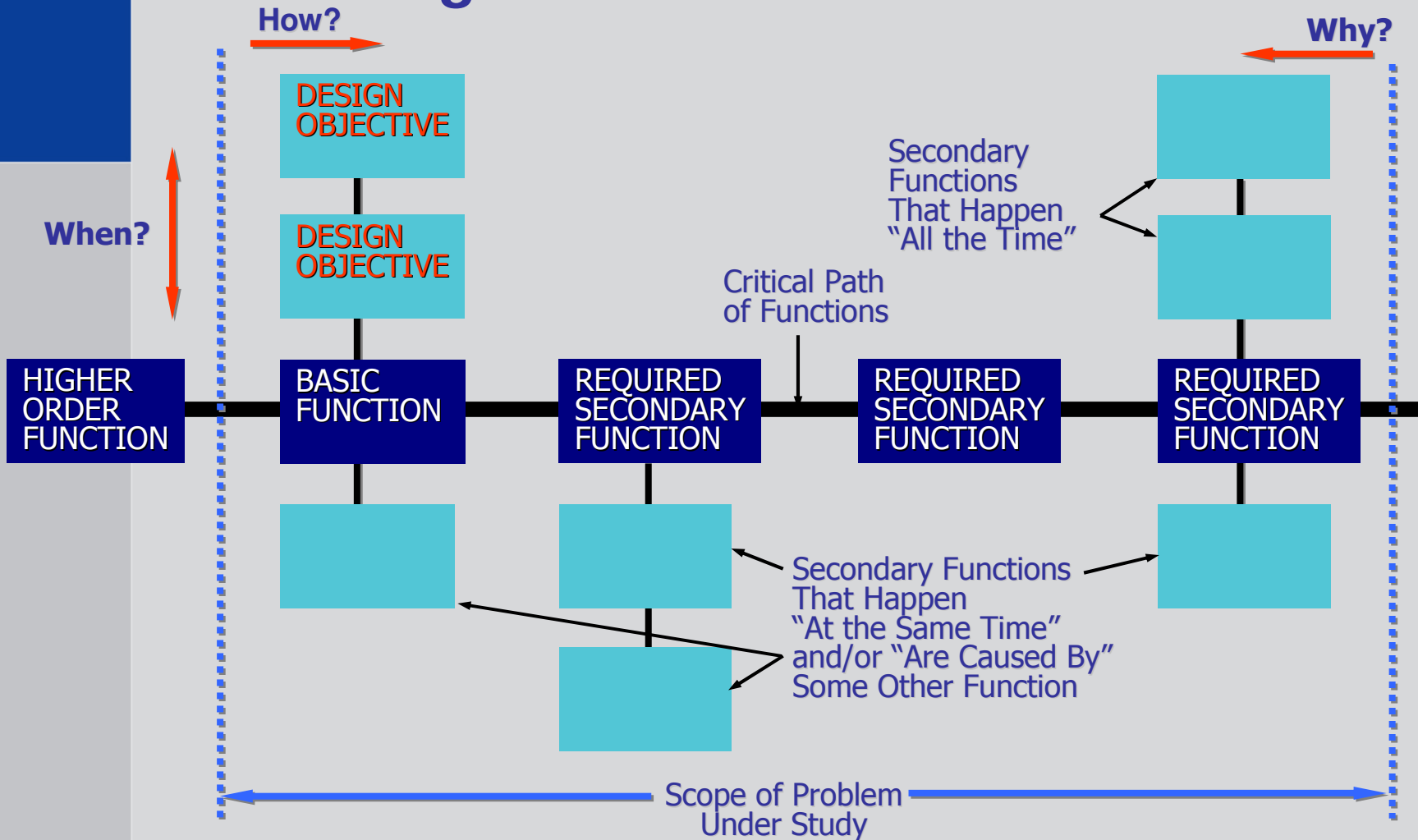
Function Analysis

Function Analysis Systems Technique - The FAST Diagram

- Shows specific relationships of all functions with respect to each other.
- Tests validity of functions under study.
- Deepens understanding of problem to be solved.
- Enables multidisciplinary team to understand system thoroughly and quickly.
- Is an excellent foundation for creativity.
- Based on function sequence, **not** time.
- Developed by Charles Bytheway in 1964.

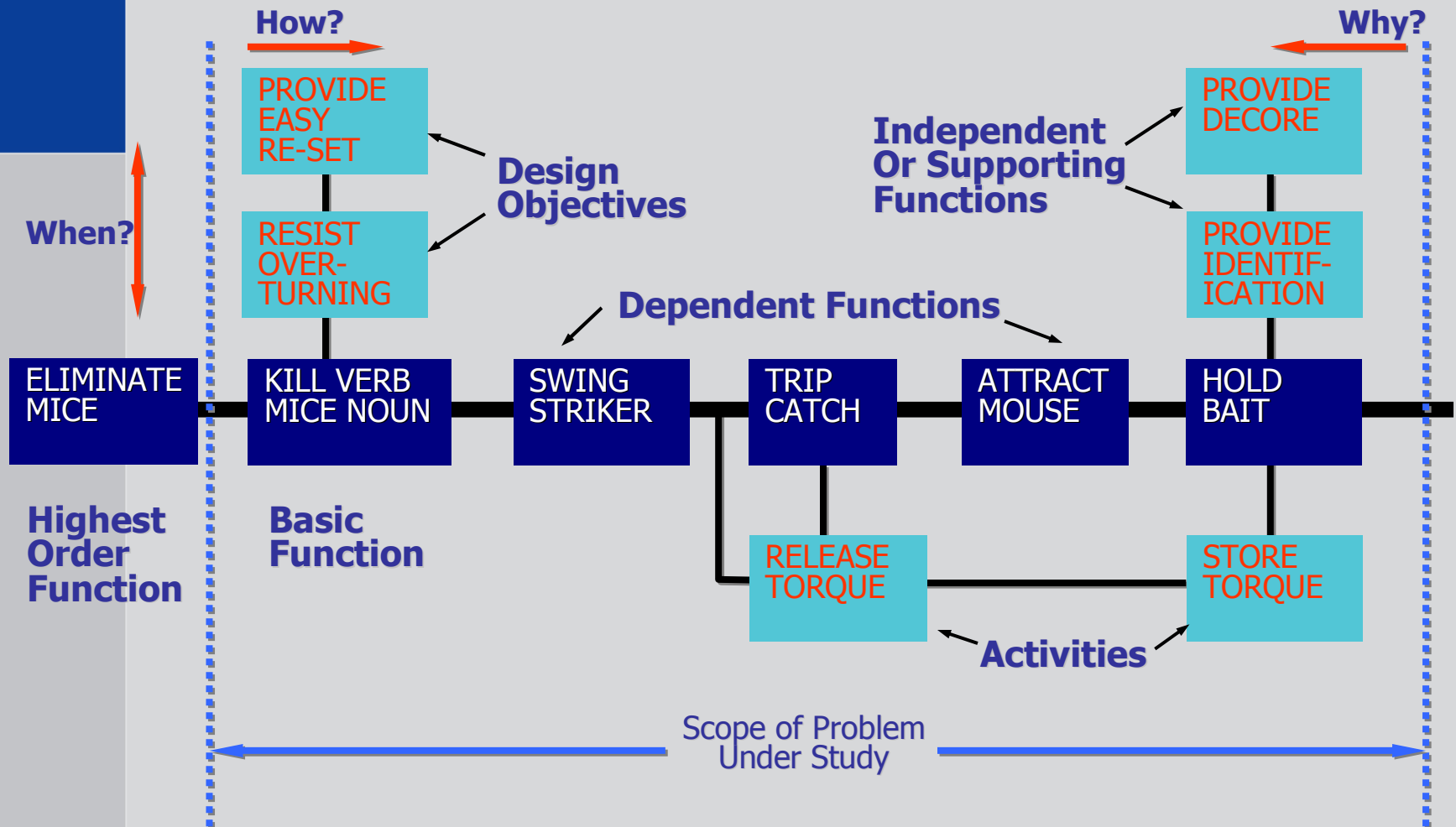
Function Analysis

FAST Diagram – Ground Rules

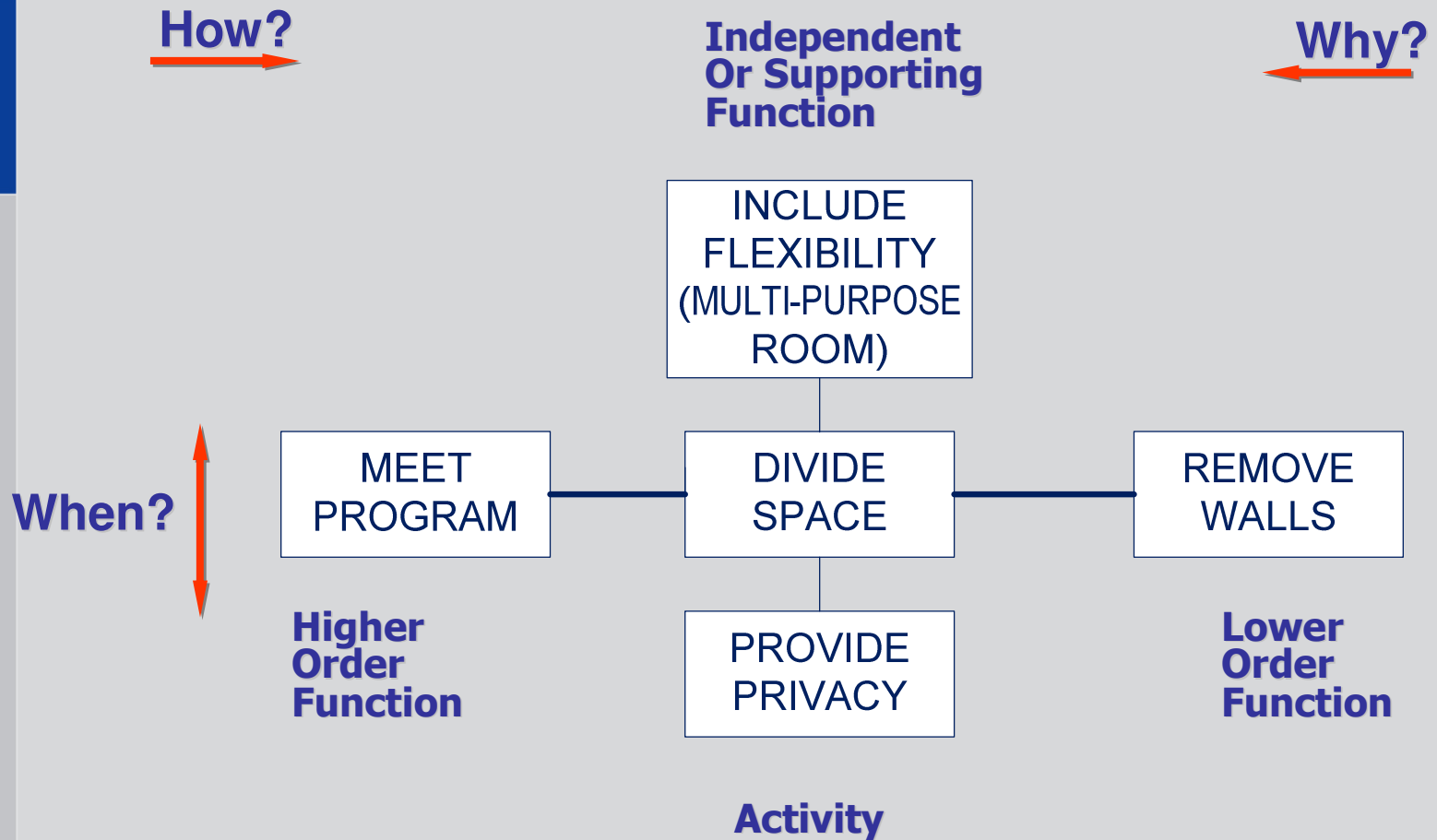


Function Analysis

FAST Diagram – Mouse Trap



FAST Logic

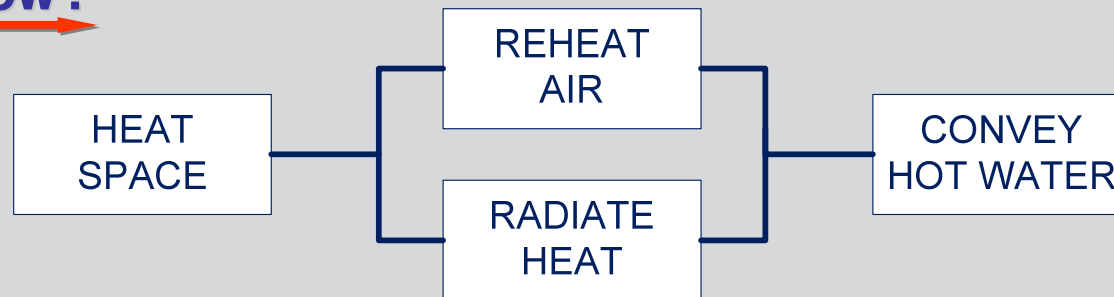


FAST Logic

How? →

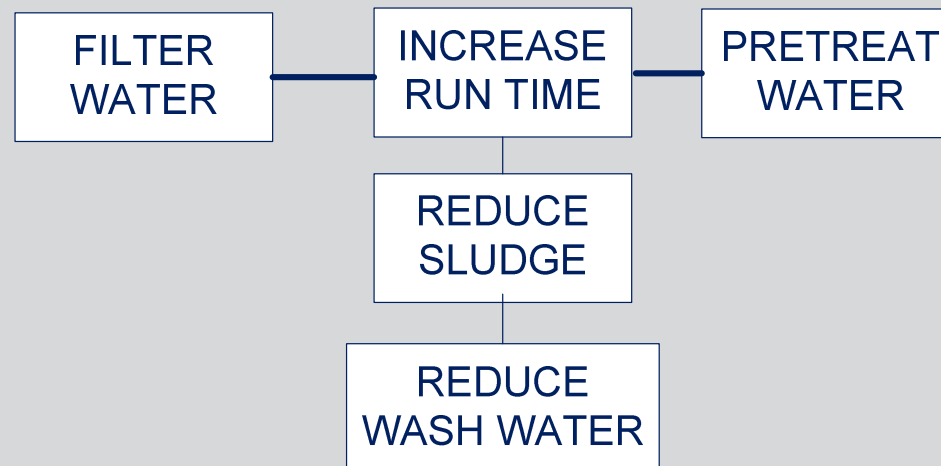
AND (Equally Important)

← Why?



When? ↑↓

AND (Less Important)

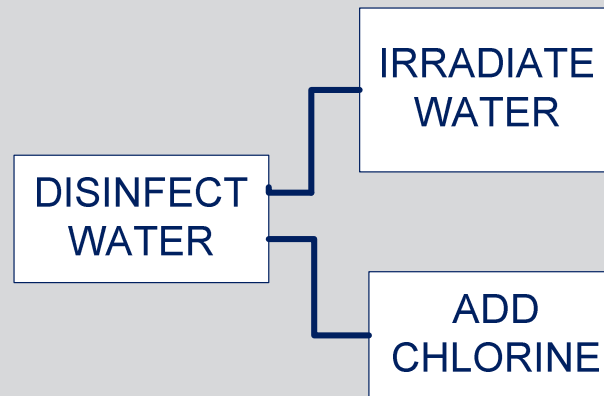


FAST Logic

How? →

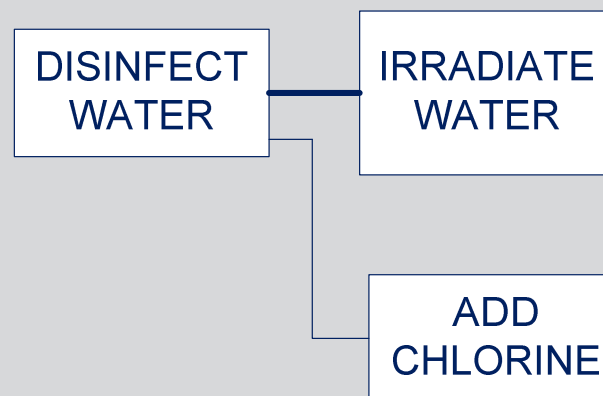
OR (Equally Important)

← Why?



When? ⇕

OR (Less Important)

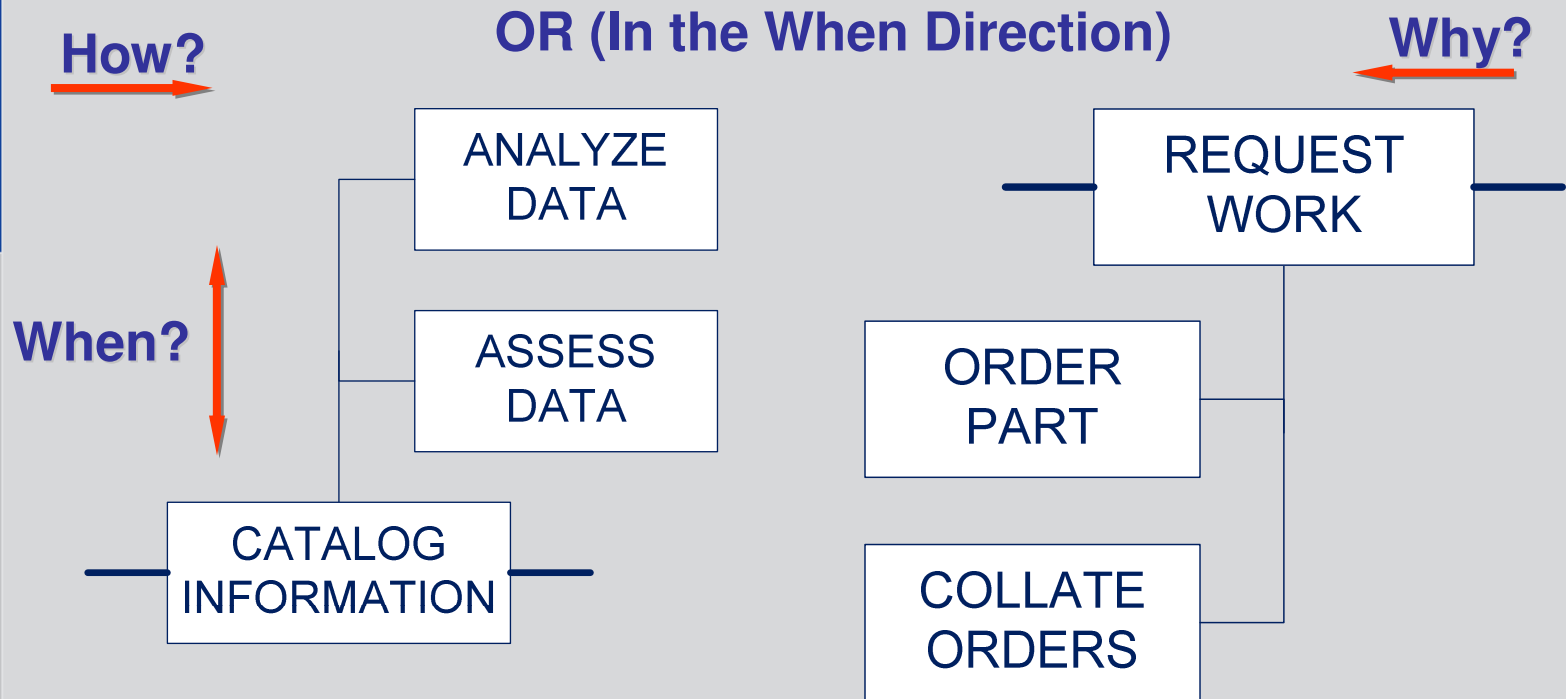


FAST Logic



The closer to the critical path, the more important.

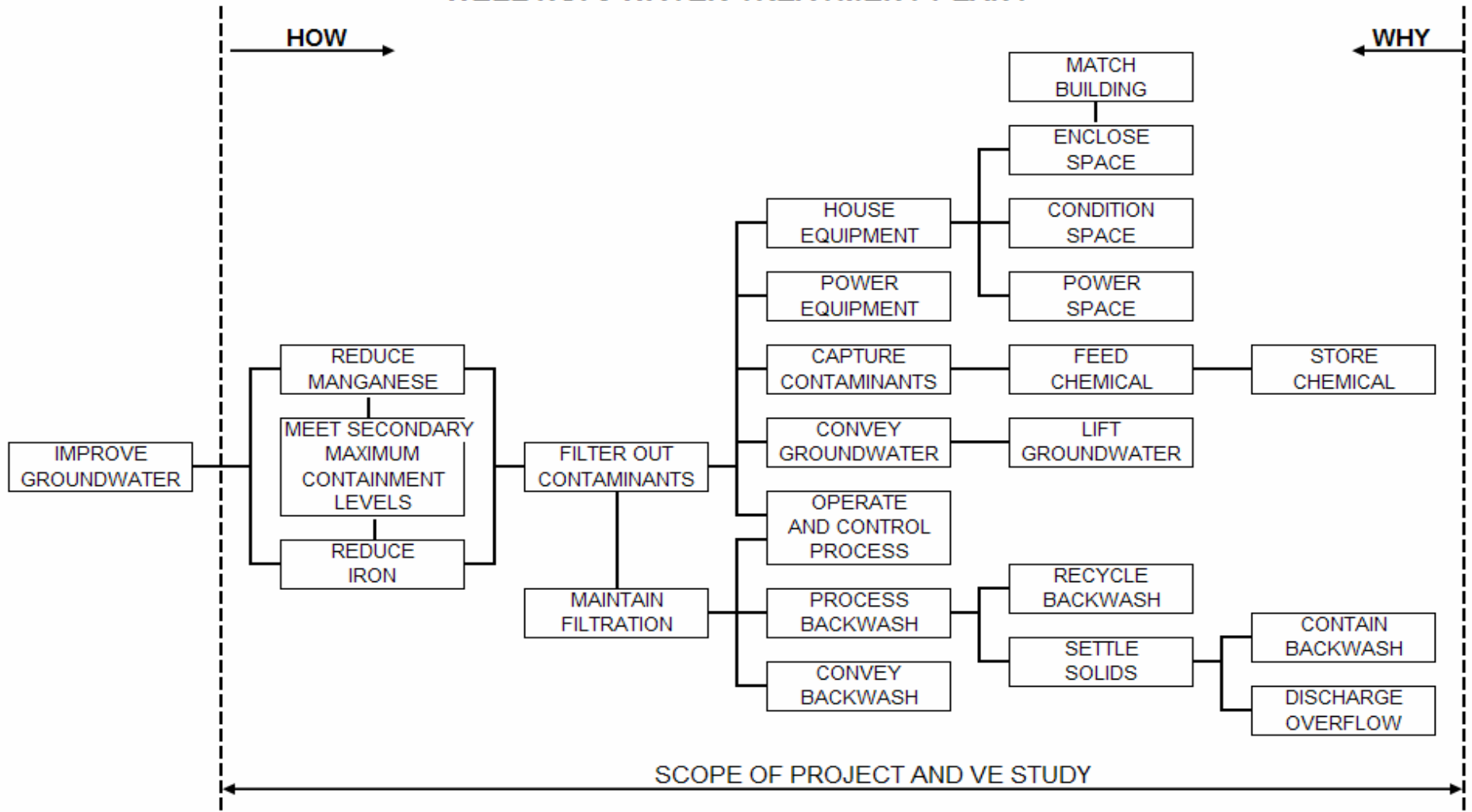
FAST Logic



Location left or right of vertical line depends on how functions relate to the critical path function. HOW do you CATALOG INFORMATION? You ANALYZE DATA or ASSESS DATA. WHY do you ANALYZE DATA or ASSESS DATA? So you can CATALOG INFORMATION.

FAST Diagram

FAST DIAGRAM TOWN OF HOLLISTON, MA WELL NO. 6 WATER TREATMENT PLANT



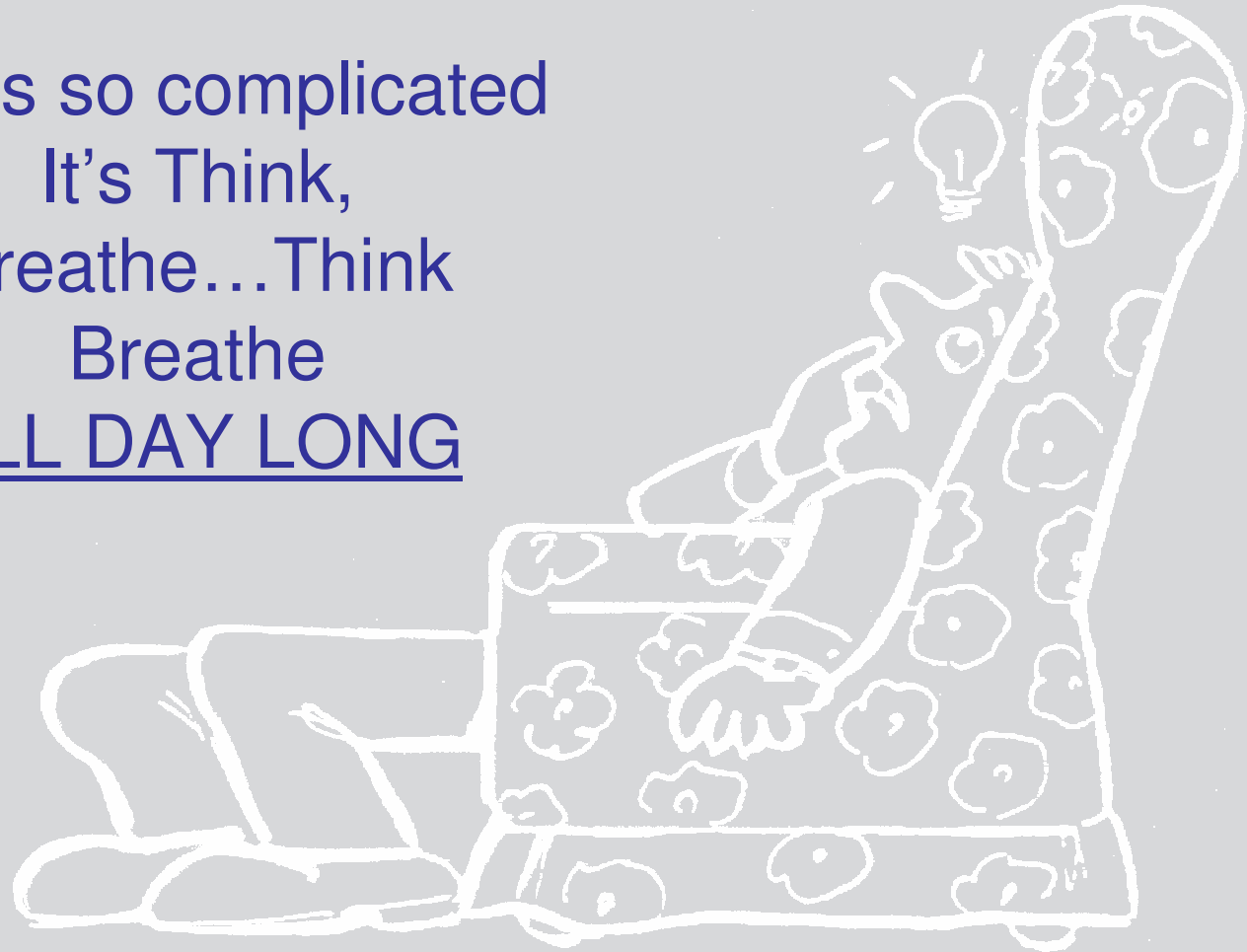
Function Analysis

Procedures Summarized

- Identify functions of project & components.
- Classify functions as basic (essential), secondary, highest order, etc.
- Create/review FAST diagram to understand functional relationships.
- Assign worth to cost model and evaluate function-cost-worth relationship where necessary (most common with products).
- Select additional targets for VM review.

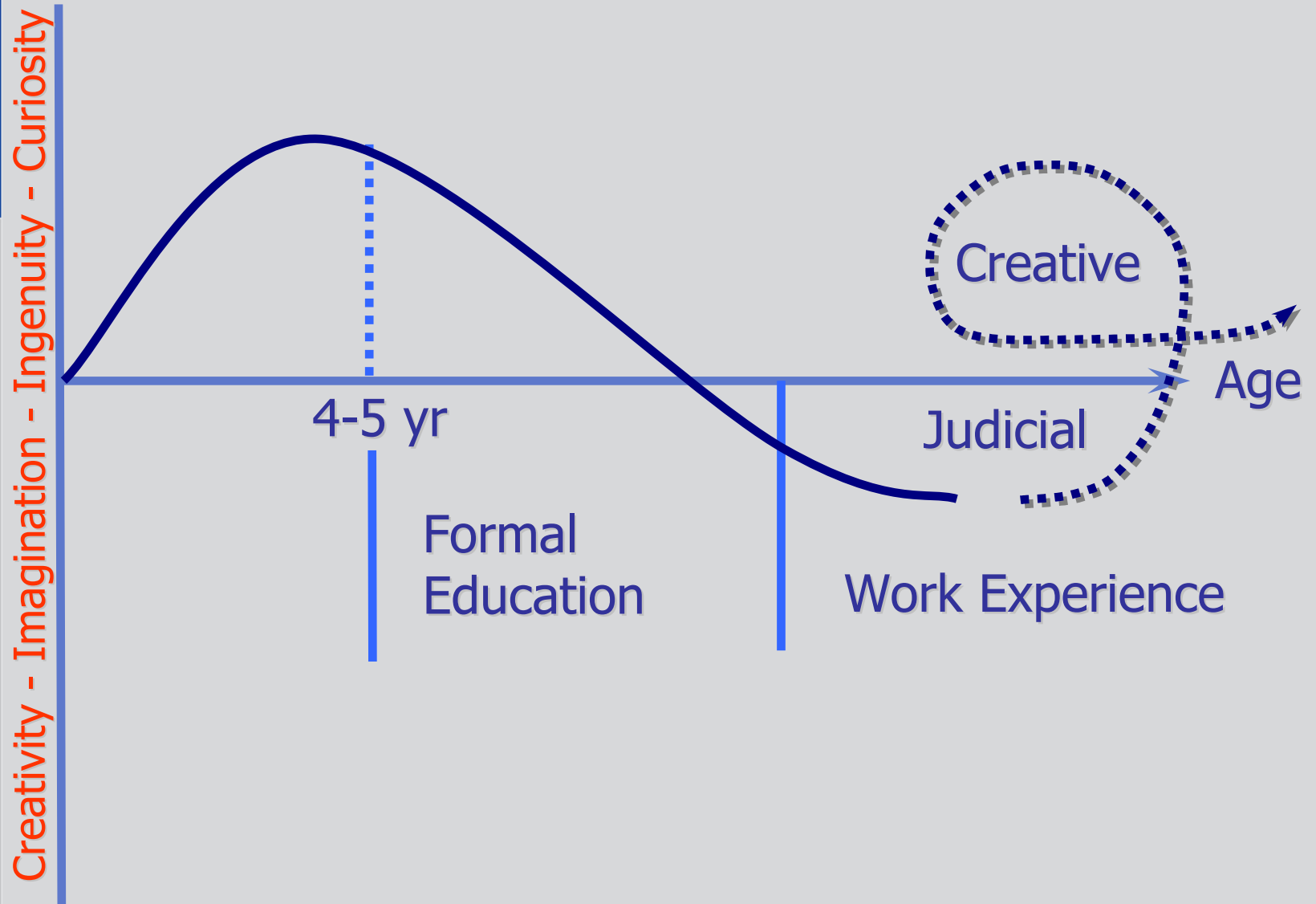
Creative Phase

Life is so complicated
It's Think,
Breathe...Think
Breathe
ALL DAY LONG



Fight the ruts of dailiness

Creative Phase

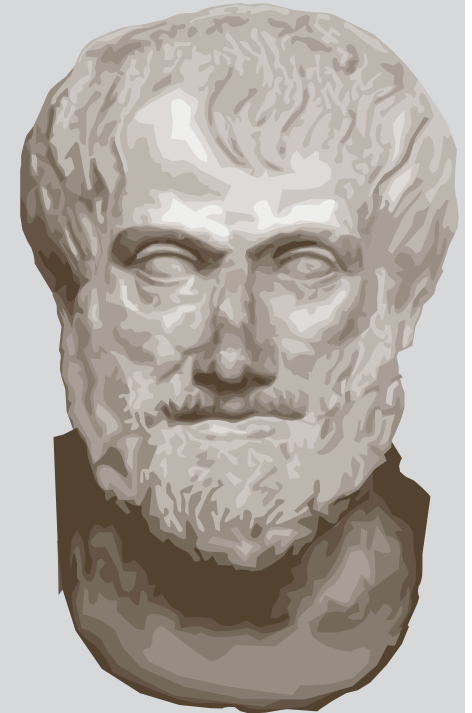


Creative Thinking

Aristotle:

The psychological basis of creative thinking is the association of ideas applied under three laws:

- Similarity or a like idea.
- Contiguity or adjoining idea.
- Contrast or opposite idea.



Creative Phase

Generate ideas by asking what else will perform the function



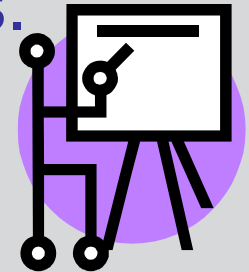
- Procedures

- Brainstorming
- Premise Plateau
- Blast, create, refine
- Build on ideas
- Oversimplify
- Modify - combine ideas
- Freewheel
- Use creative thinking
- Use good human relations
- No negative feedback allowed

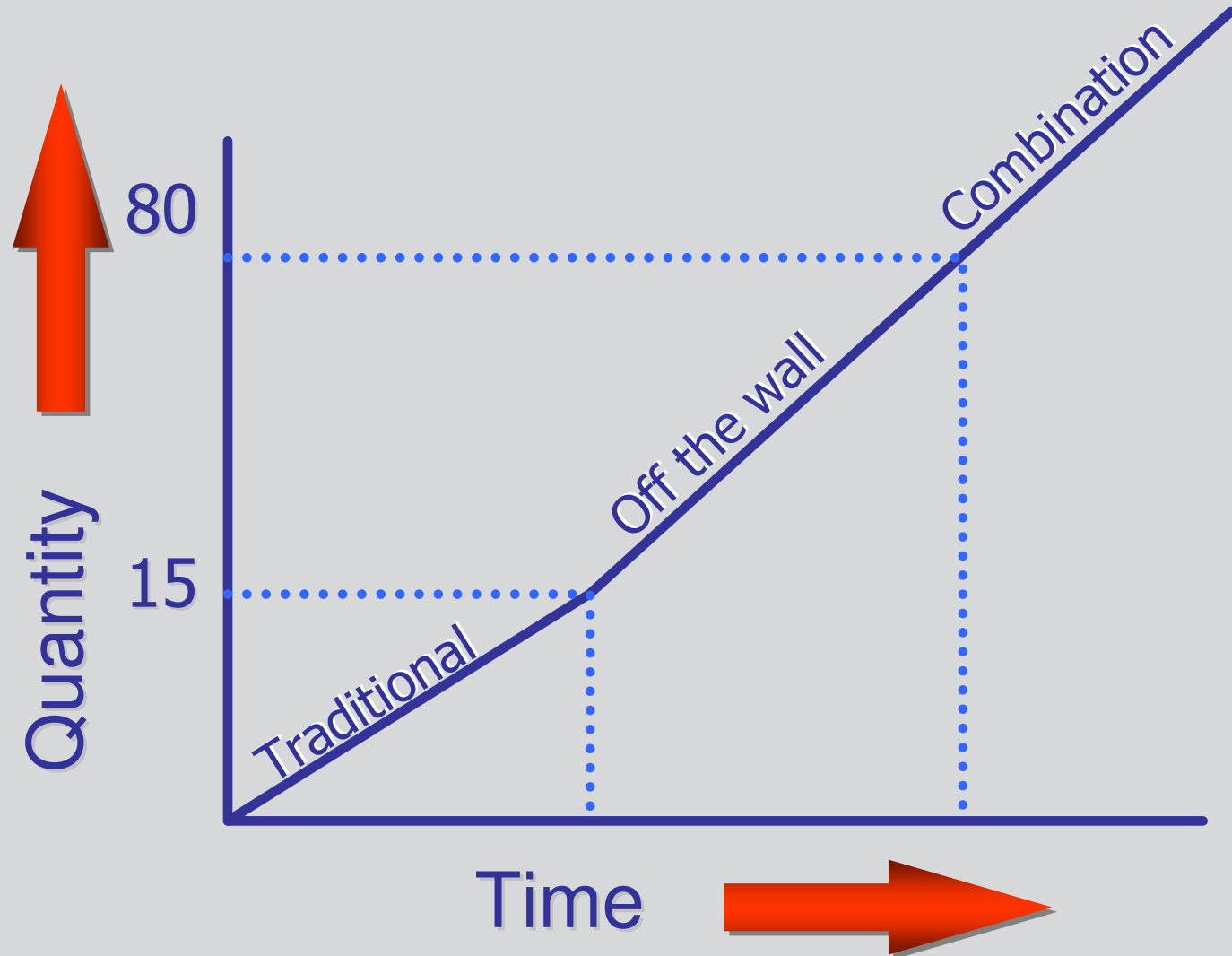
Creative Phase

Brainstorming

- Foremost approach in VM activity.
- Spontaneous production of ideas to perform required function.
- Rules:
 - No criticism allowed.
 - “Freewheeling” encouraged.
 - Go for quantity of ideas.
 - Try to combine and improve ideas.
 - “Principle of Deferred Judgment”
 - Record ALL ideas.



Creative Phase



Creative Phase

Action Verbs - Applied to Automobile

● Adapt

● Combine

● Magnify

● Minify

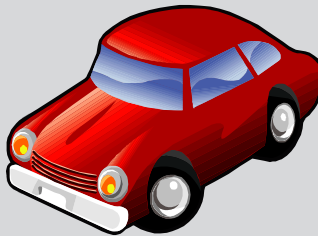
● Modify

● Put to other uses

● Rearrange

● Reverse

● Substitute



● Fork Lift

● El Camino

● Stretch SUV

● Smart Car

● Truck

● Golf Cart

● Front Wheel Drive

● Mail Truck

● Convertible



Creative Phase

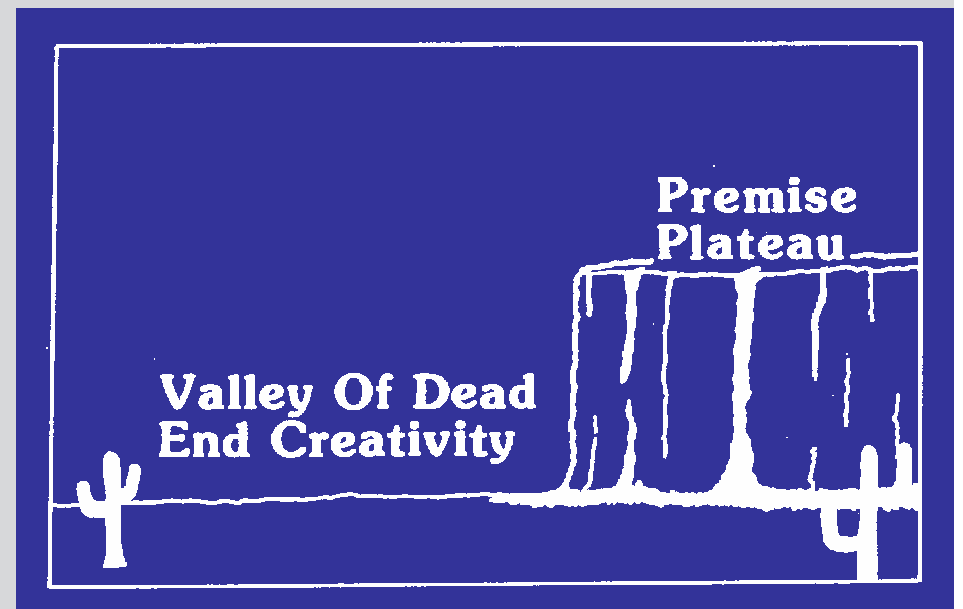


“Hannibal got elephants over the Alps. Bearing that in mind, somebody think of something”

Creative Phase

Premise Plateau

- A creative thought process started when someone forces you to make a specific idea (premise) work.
- Used when VE Team jumps to a solution too soon or enters the...

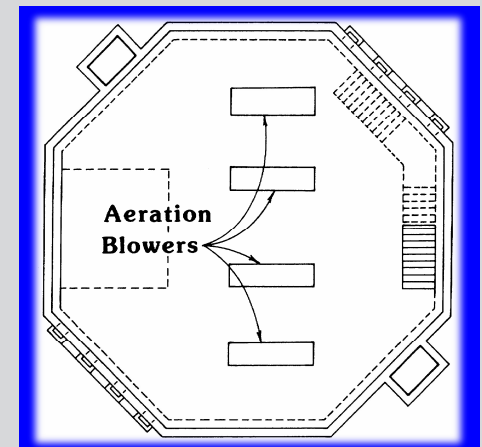
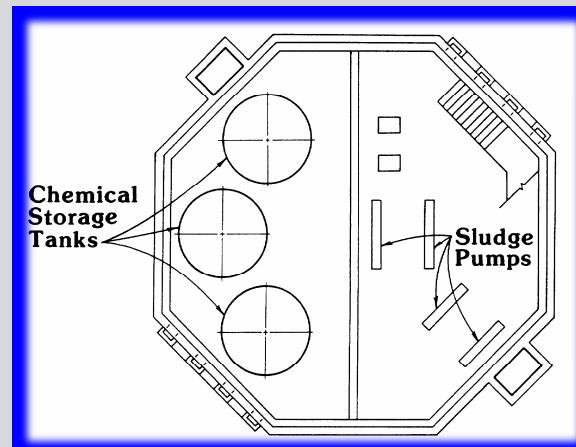
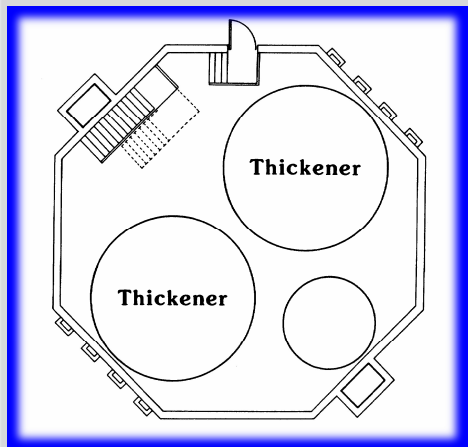
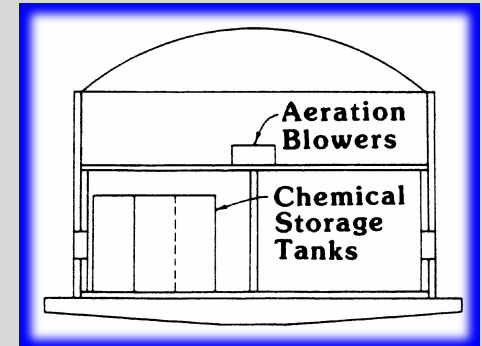


Creative Phase

Premise Plateau





Sample Premises:

- Reuse all buildings.
- Use walls of trickling filter during construction.



Creative Phase

Blast  **Create**  **Refine** 

-  Define the basic function.
-  Identify that which performs the basic function.
-  Remove all other portions
-  Creatively refine by adding only that which is necessary to make it work and sell.

Evaluation Phase

Sort, rank and evaluate creative ideas to select the best ideas for development by asking:

- How feasible is each idea?
- Will each idea perform the function?
- What are the chances for implementation?
- How does it compare to alternatives? Existing design?
- Can any be modified or combined with another?
- Did you retain all feasible alternatives?
- What are their benefits?
- Who or what might be affected?
- Will it be relatively difficult or easy to make change?
- Will each idea satisfy user needs?



Consider Everything! Be Fair! Be Reasonable!

Evaluation Phase

Progressive Tools

To select deserving creative ideas for further development

- Simple elimination of obvious bad ideas.
- Team scoring - numeric, colored dots, etc.
- Consensus team scoring – active discussion among entire VM team
- Idea comparison form.
- Feasibility ranking form.
- Determining weights for evaluation and evaluation matrix forms.



Evaluation Phase

EVALUATION PHASE	DETERMINING WEIGHTS FOR EVALUATION	
PROPOSAL NO.		
GOALS, DESIRED CRITERIA, FUNCTIONS, FEATURES	RAW SCORE	ASSIGNED WEIGHT
A.		
B.		
C.		
D.		
E.		
F.		
G.		
H.		
I.		

HOW IMPORTANT

- 3 - MAJOR PREFERENCE
- 2 - MEDIUM PREFERENCE
- 1 - MINOR PREFERENCE

INSTRUCTIONS:

1. LIST GOALS, DESIRED CRITERIA, FUNCTIONS, FEATURES IN TABLE ABOVE
2. DO SCORING MATRIX COMPARING A TO B, A TO C, B TO C, ETC. (ie. IF YOU HAVE MEDIUM PREFERENCE FOR A OVER B, ENTER A2 IN BOX)
3. ADD ROW AND COLUMN FOR EACH LETTER; ENTER IN TABLE ABOVE AS RAW SCORE FOR EACH LETTER
4. USE COMMON DENOMINATOR TO GET ASSIGNED WEIGHTS

SCORING MATRIX

	B	C	D	E	F	G	H	I
A								
B								
C								
D								
E								
F								
G								
H								
I								

This method is known as Paired Comparison. It can be used to rank:

- Evaluation Criteria for idea selection
- Functions to rank importance
- Performance Criteria for overall project Scenarios as will be discussed

Discussion generated can be very helpful in gaining consensus to make tough decisions.

Evaluation Phase



EVALUATION PHASE		EVALUATION MATRIX											
PROPOSAL NO.	LIST GOALS, DESIRED CRITERIA, FEATURES ↓												
1. HOW WELL DOES IDEA SATISFY CRITERIA (CIRCLE E, VG, ETC.)													
2. ENTER ASSIGNED WEIGHT TIMES VALUE (E=5, VG=4, ETC.) IN SUB TOTAL													
3. SUM ACROSS AND RANK													
IDEAS	WT.	ASSIGNED WEIGHT										TOTAL	
PRESENT WAY:	5	E	E	E	E	E	E	E	E	E	E	E	RANK
	4	VG	VG	VG	VG	VG	VG	VG	VG	VG	VG	VG	
	3	G	G	G	G	G	G	G	G	G	G	G	
	2	F	F	F	F	F	F	F	F	F	F	F	
	1	P	P	P	P	P	P	P	P	P	P	P	
	SUB TOT.												
IDEA 1:	5	E	E	E	E	E	E	E	E	E	E	E	RANK
	4	VG	VG	VG	VG	VG	VG	VG	VG	VG	VG	VG	
	3	G	G	G	G	G	G	G	G	G	G	G	
	2	F	F	F	F	F	F	F	F	F	F	F	
	1	P	P	P	P	P	P	P	P	P	P	P	
	SUB TOT.												
IDEA 2:	5	E	E	E	E	E	E	E	E	E	E	E	RANK
	4	VG	VG	VG	VG	VG	VG	VG	VG	VG	VG	VG	
	3	G	G	G	G	G	G	G	G	G	G	G	
	2	F	F	F	F	F	F	F	F	F	F	F	
	1	P	P	P	P	P	P	P	P	P	P	P	
	SUB TOT.												
IDEA 3:	5	E	E	E	E	E	E	E	E	E	E	E	RANK
	4	VG	VG	VG	VG	VG	VG	VG	VG	VG	VG	VG	
	3	G	G	G	G	G	G	G	G	G	G	G	
	2	F	F	F	F	F	F	F	F	F	F	F	
	1	P	P	P	P	P	P	P	P	P	P	P	
	SUB TOT.												
IDEA 4:	5	E	E	E	E	E	E	E	E	E	E	E	RANK
	4	VG	VG	VG	VG	VG	VG	VG	VG	VG	VG	VG	
	3	G	G	G	G	G	G	G	G	G	G	G	
	2	F	F	F	F	F	F	F	F	F	F	F	
	1	P	P	P	P	P	P	P	P	P	P	P	
	SUB TOT.												
IDEA 5:	5	E	E	E	E	E	E	E	E	E	E	E	RANK
	4	VG	VG	VG	VG	VG	VG	VG	VG	VG	VG	VG	
	3	G	G	G	G	G	G	G	G	G	G	G	
	2	F	F	F	F	F	F	F	F	F	F	F	
	1	P	P	P	P	P	P	P	P	P	P	P	
	SUB TOT.												
SEEK THE BEST - NOT PERFECTION													

Can use the value method shown, i.e.
 E=5, VG=4, G=3,
 F=2, and P=1
 Or
 Substitute a more project specific measurement for each Performance Criteria when overall project Scenarios are being evaluated as will be discussed.

Development Phase

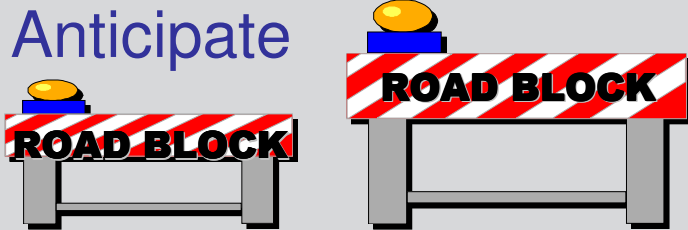
Develop selected ideas to provide necessary costs, sketches and other information to allow for implementation by decision makers.

- VE Workbook provided for documentation.
- Describe element of present design to be changed.
- Describe specific changes in proposed design.
- Provide present and proposed design sketches, drawing mark-ups, CADD redesigns, and/or catalog information as necessary to be clear.
- Provide back-up calculations as required.
- Determine capital cost implications.
- Determine life cycle cost implications.



Development Phase

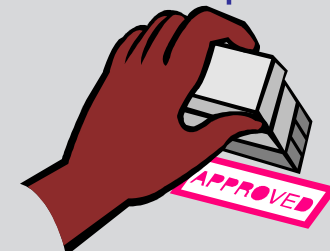
Development Continued

- List advantages, disadvantages, and how to overcome disadvantages.
- Present convincing discussion and verification to support your recommendations.
- Use entire VE team as resource.
- Consult outside experts/sources as needed.
- Be detailed enough for design team to implement.
- Use good human relations.
- Anticipate  to implementation and suggest how to mitigate.

Development Phase

Development Checklist

- Does it provide essential functions?
- Will it satisfy the user's needs?
- Has technical adequacy been determined?
- Have design and cost calculations been checked?
- Has life cycle impact been considered?
- Is any testing or development needed?
- Has cost of testing or development been estimated?
- Are there any changeover problems?
- Does it have any impact on:
 - Quality
 - Safety
 - Procurement
 - The Handicapped
 - The Environment
 - Code and Standard Compliance
 - Operations
 - Maintenance
- Would you approve it?



Development Phase

Cost Estimation

- Try to use same unit cost as design team.
- If unit costs are flawed, document the “correct” unit cost and apply it to both present and proposed design estimate.
- For new items, document where costs came from - bid tabs, client cost data base, supplier, means, etc.
- Be sure to apply all project specific mark ups and multipliers to both present and proposed design estimates to identify impact on total project cost.
- Estimate as completely and accurately as possible in limited time available.
- Design team should verify all costs.

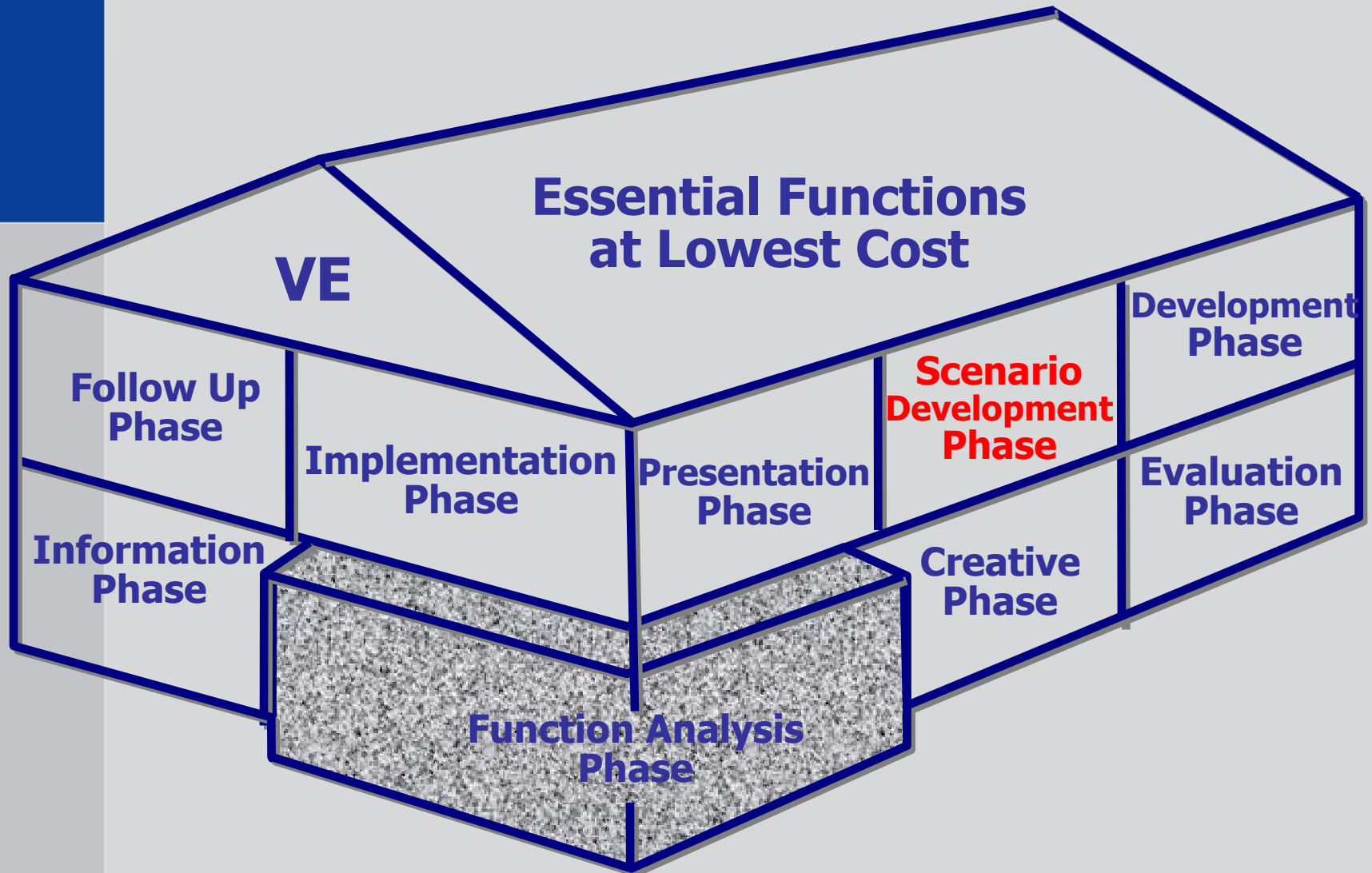


Development Phase

Total Life Cycle Cost

Cost category	Initial costs	Annual recurring costs	Non-recurring costs
	<ul style="list-style-type: none"> • Capital • Development • Implementation • Equipment 	<ul style="list-style-type: none"> • Operation • Maintenance • Equipment • Support 	<ul style="list-style-type: none"> • Repair • Replace • Salvage
Present worth no inflation	Proposed design cost estimates for same yr as present design - no Present Worth Factor (PWF) required.	<p>c = Annual cost n = # of years i = Interest rate</p> $PWF = c \left(\frac{1 - (1 + i)^{-n}}{i} \right)$	<p>n = year cost incurred i = Interest rate</p> $PWF = \frac{1}{(1 + i)^n}$
Present worth with inflation	Same as above	<p>e = Inflation rate</p> $r = \frac{1 + e}{1 + i}$ $PWF = \frac{r(1 - r^n)}{1 - r}$	<p>e = Inflation rate</p> $PWF = \frac{(1 + e)^n}{(1 + i)^n}$

VM Job Plan for Performance Criteria and Measures Workshop



Scenario Development Phase



- Some agencies (CALTRANS, MTO) use project specific Performance Criteria and Measures to evaluate total project “scenarios”.
- Performance Criteria must be project specific and clearly defined, along with a means of measuring how well various scenarios meet the criteria
- Performance Criteria and Measures are drafted pre-workshop and tweaked throughout the workshop to be objective, measurable within the confines of the workshop, and able to differentiate scenarios.
- Cost is **not** a performance criteria but is considered in the following familiar formula:

$$\text{VALUE} = \frac{\text{TOTAL PROJECT/FACILITY PERFORMANCE}}{\text{LIFE CYCLE COST}}$$

Scenario Development Phase



- In Performance Criteria and Measures workshops, the Development Phase ends with the VM Team presenting individual VM Proposals to the team.
- The VM Team then creates scenarios by combining compatible VM proposals for project components into total project Scenarios that make sense.
- Overlaps between individual VM proposals must be resolved to remove double counting of cost impacts.
- Scenarios are then compared to the present design for the project (Base Case) and each other using the Performance Criteria and Measures.
- The resulting Scenario Evaluation Matrix is valuable in selection of a recommended scenario and a tool for obtaining its implementation

Presentation Phase

Present proposed design to decision makers to promote understanding of the changes and to increase the potential for implementation.

- VM Team will develop 1-5 minute presentation for each significant VM recommendation.
- Each will be supported by clear visual aids.
- VM study presentations will be coordinated in a logical manner among VM Team members.
- Each presenter will be supported by the completed VM workbook for that recommendation.
- VM recommendations will be presented by primary developer of the recommendation.



Presentation Phase

The Presentation

- The VM Team Leader starts with introductions and a brief summary of the VM process used.
- Team members “Sell” VE recommendations to decision makers present based on:
 - Capital cost implications
 - Life cycle implications
 - Function/performance/quality benefits
 - Other advantages
 - How to overcome disadvantages & roadblocks
- Be clear, concise, positive and strong.
- Use good human relations.
- VM Team Leader wraps up and calls for Q&A.



Presentation Phase

- Overall potential savings can be tabulated and presented if desired by the Owner.
- In some cases, implementation decisions may be made and captured during the presentation and the Q&A session that follows.
- When the Owner needs quick decisions, this is labeled the Discussion or Decision Phase.
- A copy of the VM workbooks will be given to the Owner and design team at the end of the presentation so implementation considerations can begin while awaiting the VM Study Report.
- Preliminary and Final VM Study Reports are prepared in following weeks as required.

Implementation Phase

Encourage implementation of proposed design by working with decision makers and design team post-workshop to incorporate changes.

- VM Team Leader will answer questions that arise from review of VM workbooks and/or the VM Study Reports.
- VM Team Members will be consulted as required.
- VM Team Leader and select Team Members may be asked to attend an implementation meeting.
- Firmly support your recommendations and urge their adoption.
- Use good human relations.



Implementation Phase

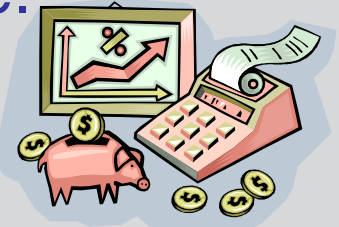
- Work with decision makers and design team to develop an implementation plan which addresses:
 - Implementation responsibilities.
 - Deadlines for completed action.
 - Exactly what is to be changed and how.
 - The source of implementing funds.
- VM Team will help modify recommendations to satisfy all parties.
- Be available to clear up misconceptions, resolve problems, and assist in implementation.



Follow-Up Phase

VM personnel are not always part of the Follow-Up Phase. That role is usually filled by the Project Manager or an organization's internal VM person. In that role, one would:

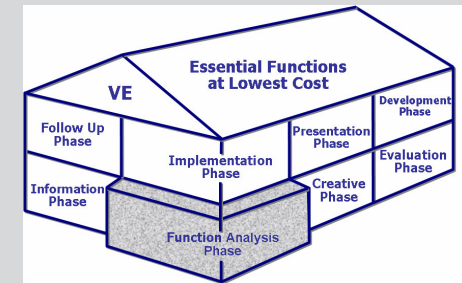
- Monitor implementation of VM recommendations as design proceeds.
- Document changes that have been made.
- Determine the actual savings of the VM recommendations.
- Ensure successful VM recommendations are made known and implemented on future projects or in organization standards as applicable.
- Keep track of the organization's success in VM.



How to Approach a “Typical” VM Study

Basic Steps in F+G VM Approach

- Selection of the VM Team
- Assembly and dissemination to the VM Team of all relevant and available information about the VM project.
- Pre-workshop review by VM Team members to become familiar with the project; site visit as required
- Determination of Client objectives
- Identification of key project issues and risks
- Function Analysis
- Generation of ideas
- Evaluation of alternatives
- Selection and in-depth development of preferred options
- Presentation of the developed proposals to the client
- Preparation of VM Study Report
- Finalizing approved alternatives



Pre-Workshop Activities



- Discuss and agree with Owner:
 - Study timescales (2-5 days), format, and venue
 - Project objectives, 'constraints' & interfaces (internal & external)
 - Define 'scope' lines (or boundaries) of study
 - Identify existing Owner / Design team involvement
 - Discuss Owners 'Risks'
- Assemble relevant and available information about VM project and disseminate to VM Team.
- VM Team members review disseminated information to become familiar with project.
- Review of current estimate – Pareto analysis
- Prepare **draft FAST Diagram** (VM Team Leader)
- Obtain graphics for use during the workshop
- Site visit as required (can be during workshop)

Typical 5-day VM Workshop

Day 1

- Introductions
- Review VM Workshop Agenda
- Information Phase
 - Owner's objectives for project
 - Setting value objectives
 - Review documents and drawings
 - Review and/or prepare cost models
 - Prepare qualitative risk register
 - Site Visit if not done pre-workshop
 - Presentation of project by designer



Day 2

- Function Analysis Phase
 - Identify / classify project functions
 - Review and/or prepare FAST diagram
 - Select value target areas
- Creative Phase
 - Idea generation and listing



Day 3

- Evaluation Phase
 - Determine evaluation criteria
 - Complete idea evaluation
- Development Phase
 - Develop VM proposals - narrative, costs, sketches, advantages, disadvantages

Day 4

- Development Phase, continued
 - Complete VM proposals

Day 5

- Presentation Phase
 - Complete proposals and check details
 - Prepare presentation of study results
 - Rehearse presentation
 - Oral Presentation of results
 - Collect VM proposals for VM Report



Post-Workshop Activities



- VM Team Leader will prepare Preliminary VM Report summarizing activities, analyses, and results of VM Workshop and submit it to the Owner and Designer for review within 5 days of the workshop.
- Owner and Designer will review the Preliminary VM Report and provide comments/requests for clarification to VM Team Leader.
- The Designer will also verify the costs and technical assumptions made by the VM Team.
- Owner may hold Implementation Meeting with Designer, VM Team Leader, and selected VM team members to determine disposition of VM recommendations.
- VM Team Leader will prepare Final VM Report in response to Owner and Designer comments and the Implementation Meeting within one week.

Examples of Successful VM Studies

Fairfax City Library

Fairfax County, VA



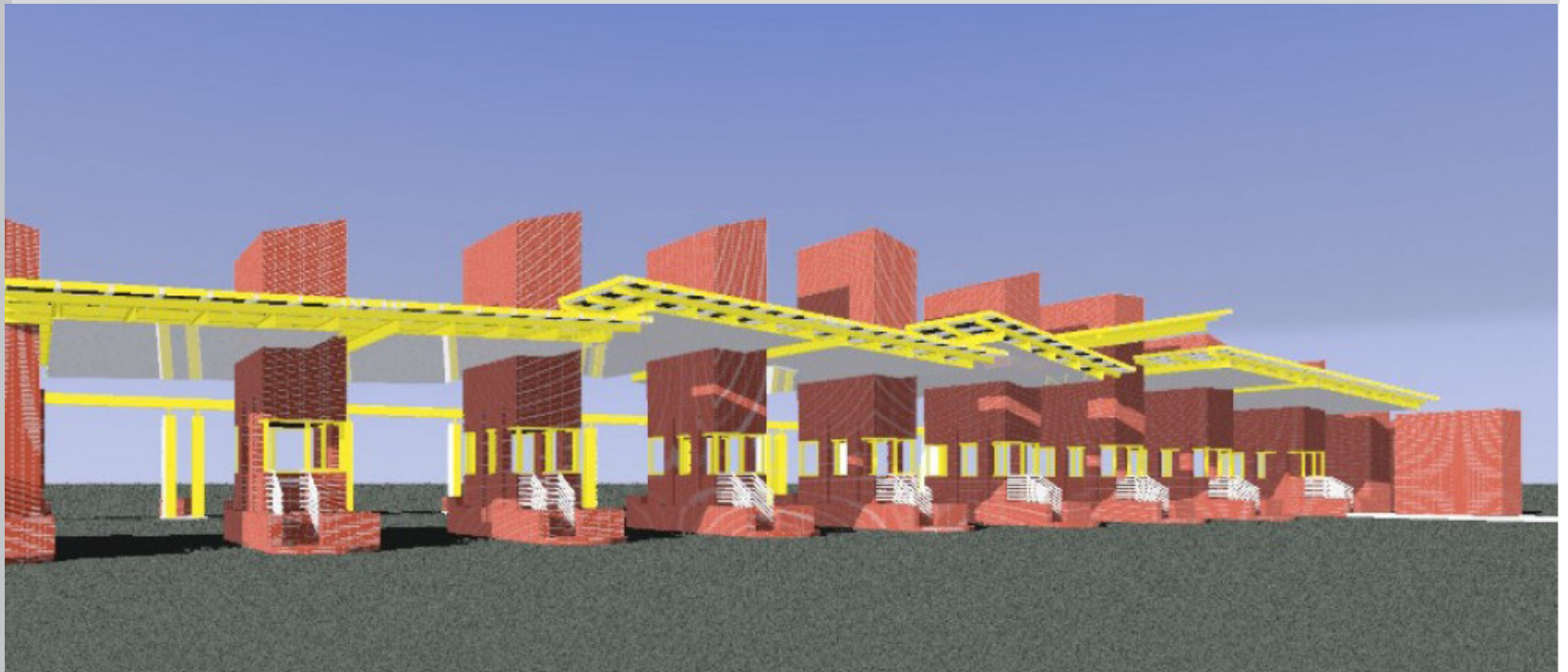
- VE workshop on design development submission for new 44,450 gsf, two-story library facility constructed over two levels of parking, fitted to a 50,000 sf “gateway” site.
- The library must house an 180,000 volume regional collection as well as a 39,000 volume Virginia collection, including a rare book collection.
- Additional space was generated by centrally grouping workstations, grouping staff toilets with main toilets, combining electrical closets on the first floor, and relocating the electrical closet on the second floor.
- “Line of sight” for library staff was improved by moving the information desk further back in the same location and relocating the quiet study room to the area behind the information desk, relieving congestion between the information desk and the staircase



U.S. Port of Entry Expansion Ysleta Border Station, El Paso, TX



- VE study on \$13.6 M expansion of the existing full-service Port for commercial and non-commercial vehicles and pedestrians.
- 78 creative ideas yielded 20 proposals for alternate design solutions, 18 Design Suggestions and 3 Phasing Suggestions.
- The collective impact of compatible VE Proposals a potential saving of \$1,142,405.



Midwood High School Modernization and Addition



- VE workshop at 60% design for new 55,000 gross square feet addition (and associated site work) and modernization.
- 70-year-old Brooklyn school - National Register of Historic Places
- NYCBOE and School Construction Authority designated the addition as a “Lab 21 project” for sustainable design.
- While respecting sustainable design elements, VE Team understood compromise might be required in to meet the VE objective, i.e., maximize the value of the project by reducing cost and/or improving quality or function.
- 167 creative ideas resulted in 86 VE proposals and 29 design suggestions
- A maximum potential saving of nearly \$4.4 M was identified.



Delores Dore' Eccles Fine Arts Center Dixie State College, St. George, UT



The \$14,500,000 project included asbestos removal and demolition of the existing 45-year old Graff Performing Arts building, which is functionally obsolete and not cost-effective for rehabilitation. A new 76,000 GSF of new and replacement space will be constructed on the same site. The new facility will house Dixie State College's Theater and Music Departments as well as an art gallery. 50% of the facility is single story with the remainder in two floors.

The objective of the workshop was primarily improving project quality and performance (value). The VM/LCC Review Group generated 91 creative ideas that offered value improvement to the project and/or initial cost savings for budget control.



Virginia Institute of Marine Science Seawater Research Laboratory Yorktown, VA



The Seawater Research Lab contains a multi-purpose seawater lab which, among other functions, contains holding tanks for aquatic life. Other labs include a dry lab, biosafety lab levels 1, 2, and 3, and a toxicology lab, all connected to a seawater system originating at the end of a 600' pier which protrudes into the York River. A coral reef lab is also part of this facility. An entrance suite includes offices for a building manager and engineer, an exhibit area for visitors, conference and lounge space, vending area and toilets. An 8,000 gallon storage tank is housed here for full-strength, artificial, or salinity adjusted seawater.

The Water Treatment/Storage Building contains equipment for pumping and processing seawater for the Seawater Research Lab and also storage for miscellaneous items including aquatic tanks. 800 gpm of river water will be treated to provide a "nominal" quality water suitable for general marine aquatic research and aquaculture.



Michelson-Chauvenet Halls Renovation United States Naval Academy Annapolis, MD



The \$ 34 M project consists of a complete, major renovation of the four-story, 73,000 SF Michelson Hall. The building interior is being entirely removed, including essentially all interior walls, to create a completely restacked, reorganized, and rejuvenated state-of-the-art learning facility for Chemistry and Computer Science. Most MEP systems are also being removed and replaced. Exterior glazing is being replaced and upgraded and insulation added to the roof to improve the building's energy efficiency.

Michelson–Chauvenet Halls were completed in 1968 and there have been no significant changes or modifications since then. Education has changed over this time and significant change is warranted. By renovating Michelson Hall for a chemistry department currently in Chauvenet Hall, chemistry functions will never be relocated to temporary space, avoiding a difficult, expensive proposition. The VM Team found sufficient saving to return project to within budget.



Manning Road Widening, Highway 401 to Highway 3, Windsor, Ontario



- A five-day VE workshop was held on the \$102 M conceptual design to widen 13 km of Manning Road from two to four lanes and widen 3 km of County Road 22 from four to six lanes.
- Achieved objectives of the VE workshop included:
 - Life cycle cost savings and/or improved project performance while maintaining functional requirements of the project (i.e., best value for the money spent).
 - Combine VE Proposals into overall project scenarios to evaluate vs. base case concept design to assist design team in selecting a preferred alternative to take forward.
 - Build consensus among many stakeholders.
 - Provide new perspectives and creative ideas to the design.
 - Identify project risks and how they can be mitigated.
 - Identify and remove unnecessary costs from the project.

Manning Road Widening, Highway 401 to Highway 3, Windsor, Ontario



Page 1 of 1		EVALUATION MATRIX								
1. HOW WELL DOES THE SCENARIO SATISFY THE PERFORMANCE CRITERIA (ENTER RATING FROM 1-10, 10=BEST) 2. ENTER ASSIGNED WEIGHT TIMES RATING IN SUB TOTAL 3. SUM ACROSS AND RANK	Performance Criteria - Performance Measure	Property Impacts	Constructability	Sustainability	Convenience of Access	Traffic Operations	Safety	Total Performance (P)	Construction Cost - \$ M (C)	P/C
	SCENARIOS	Weight →	13	3	18	14	33	19		
Base Case	Rating 1-10	5.0	5.0	5.0	5.0	5.0	5.0			
	Sub Total	65	15	90	70	165	95	500	102	4.90
Scenario 1: Minor Modifications to Base Case	Rating 1-10	3.0	4.8	5.4	5.5	5.5	7.0			
	Sub Total	39	14	97	77	182	133	542	101.9	5.32
Scenario 2: Major Modifications to Base Case	Rating 1-10	4.0	5.8	5.7	6.0	5.8	9.0			
	Sub Total	52	17	103	84	191	171	618	96.2	6.43
Scenario 3: Enhanced Sustainability	Rating 1-10	5.0	5.0	6.0	6.0	5.0	8.0			
	Sub Total	65	15	108	84	165	152	589	100.8	5.84
Scenario 4: Moderate Modifications to Base Case	Rating 1-10	4.5	6.0	5.9	6.0	6.1	6.8			
	Sub Total	59	18	106	84	201	129	597	94.1	6.35
SEEK THE BEST - NOT PERFECTION										

Scenario Evaluation Matrix

Manning Road Widening, Highway 401 to Highway 3, Windsor, Ontario



Sample Performance Criteria and Measure

Property Impacts	Definition and Rating	Measurement:										
	<p>Property impacts to include acquisition as well as impacts both during construction and long term. Acquisition considerations need to include the ease or difficulty of acquisition, i.e. buyout, relocation, expropriation, etc. Business impact considerations are based on businesses to remain in their current locations.</p> <p>Weighted Property Impact based on weighted average of following two factors:</p> <p>PA = Weighted property area (ha) based on type of properties to be acquired and difficulty in resolving acquisitions using following scale:</p> <ul style="list-style-type: none"> 10 = Easy to buy 7 = Easy but costly 4 = Costly with negotiation 1 = Costly and difficult (court expected) <p>Area symbols, property types and difficulty factors:</p> <table border="0"> <tr><td>A1 – Residential</td><td>1</td></tr> <tr><td>A2 – Agricultural</td><td>9</td></tr> <tr><td>A3 – Vacant Future Development</td><td>7</td></tr> <tr><td>A4 – Commercial</td><td>4</td></tr> <tr><td>A5 – Industrial</td><td>7</td></tr> </table> <p>Note: If no property is required, PA = 10</p> <p>BI = A subjective assessment of the number of remaining businesses and the difficulty of resolving business claims that may arise where:</p> <ul style="list-style-type: none"> 10 = Agreement reached easily 7 = Protracted negotiations 4 = Litigation possible 1 = Litigation likely 	A1 – Residential	1	A2 – Agricultural	9	A3 – Vacant Future Development	7	A4 – Commercial	4	A5 – Industrial	7	<p>Determine PA term based on definitions & difficulty factors to left and formula below:</p> $PA = \frac{\sum (\text{Difficulty} \times \text{Areas})}{\sum \text{of Areas}}$ $PA = \frac{1(A1)+9(A2)+7(A3)+4(A4)+7(A5)}{\sum \text{of Areas}}$ $PA = \frac{A1+9A2+7A3+4A4+7A5}{A1+A2+A3+A4+A5}$ <p>Assess impacts on remaining businesses based on definitions to left and formula below:</p> $BI = \frac{\sum \text{of All Property Scores}}{\text{Total \# Properties Scored}}$ <p>Overall Measurement</p> <p>PI = Property Impact</p> $PI = \frac{F_{PA}PA + F_{BI}BI}{F_{PA} + F_{BI}}$ $PI = \frac{3PA + 1BI}{4}$ <p>Where F_{PA} and F_{BI} are relative weighting factors for these two property impacts</p> <p>For VE Proposal scoring, if present and proposed designs have same property impact, each were given a PI = 5.</p>
A1 – Residential	1											
A2 – Agricultural	9											
A3 – Vacant Future Development	7											
A4 – Commercial	4											
A5 – Industrial	7											

Highway 400/Highway 401 Interchange, Toronto, ON



- A five-day VE workshop held on \$80 M Highway 400/Highway 401 Interchange known as the “crossroads of Ontario” to recommend viable alternative designs based on a weighted performance criteria and measures evaluation to achieve functional objectives at a high level of performance and a reasonable life cycle cost.
- The goals for the VE Study included:
 - Determine the most viable long-term improvements to the Highway 400/Highway 401 Interchange to meet capacity needs for a 20 year planning horizon.
 - Determine the most desirable “blue sky” configurations for the Highway 400/Highway 401 Interchange if not constrained by existing components and configurations.
- The VE Team developed five viable alternative designs for design team consideration in their Concept Design Study.

Harlem River Drive Bridge at East 127th Street, Manhattan, NY



- A VE workshop held on the \$64 M Harlem River Drive Bridge Replacement, an existing 11-span structure spanning E 127th St. on and off ramps.
- This 46-year old structure will be replaced with a new elevated viaduct approximately 320 meters long or twice the length of the existing.
- The new structure will meet current seismic requirements and provide proper sight distances.
- Entrance ramp from 3rd Avenue will "flyover" the 3rd Avenue Bridge; merge onto southbound Harlem River Drive south of the 2nd Avenue exit; and eliminate existing adverse weaving conditions.
- All lane widths will increase from 3.3m to 3.6m.
- 24 fully developed formal VE proposals were prepared.



Southwest Connector Calgary, Alberta



- A Value Planning / Value Analysis (VP/VA) Study was held by the City of Calgary on the Southwest Connector to subject consider various options arising from completion of a Network Analysis Report on the Glenmore Trail Corridor.
- The planning objective agreed to by session participants was a “new North-South route West of 14th Avenue and South of Glenmore Trail to facilitate travel for all Calgarians”.
- The VP/VA Study had a three-fold purpose:
 - Identify, discuss, and better understand issues surrounding planning and implementation of a Southwest Connector.
 - Identify creative ideas that could be incorporated into ultimate solutions for the Southwest Connector.
 - Establish multiple alternative solutions for the Southwest Connector and evaluate based on plan specific performance criteria and measures, for future consideration in a functional planning study.
- The workshop served as an effective tool for cooperation between the Province, the City, and the Tsuu T’ina Nation.

Highway 11 Four Laning, Burk's Falls to South River, Burk's Falls, Ontario



- A VE Study on preliminary design of Highway 11 Four-Laning from 1.8 km North of Ontario Street at Burk's Falls, northerly 28.5 km to 4.4 km North of Ottawa Avenue at South River using Performance Criteria & Measures.
- The recommended scenario offered a saving of \$14.8 M while increasing interchange spacing on divided Highway 11 and improving the visibility of South River businesses to the traveling public.
- The interchange recommended for elimination by the VE Team was shown to offer poor value with adverse environmental impacts, difficult construction including steep slopes and a deserted landfill, and a significant increase in traffic through a school zone.