An Introduction to Value Engineering (VE) for Value Based Design Decision-Making

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ASCE | KNOWLEDGE & LEARNING

VE Workshop Ground Rules

- No “bad” idea (record all ideas)
- No criticism of other team member ideas
- Follow the VE process per SAVE
- Let everyone participate (one at a time)
- Avoid “group think”
- Stay focused (no cell phones, side conversations, checking of e-mail, etc.)
- Have a good time!

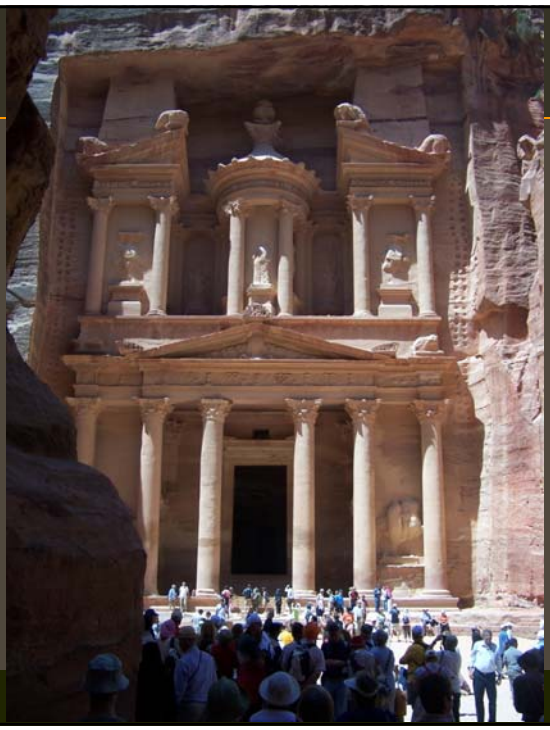
VE Briefing Outline

- What is …?/ Why Do …?
- Value Engineering Process
- Team
- Tools/ Models
- Examples
- Life Cycle Costing
- Recommendations
- Next Steps

Petra Inspiration

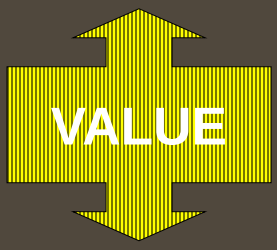
Petra

Petra



Value Engineering is….

Performance

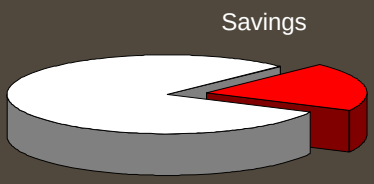


Cost & Risk

Definition:

"VE is a creative, function-oriented, organized, team approach whose objective is to optimize the cost and performance of a project"

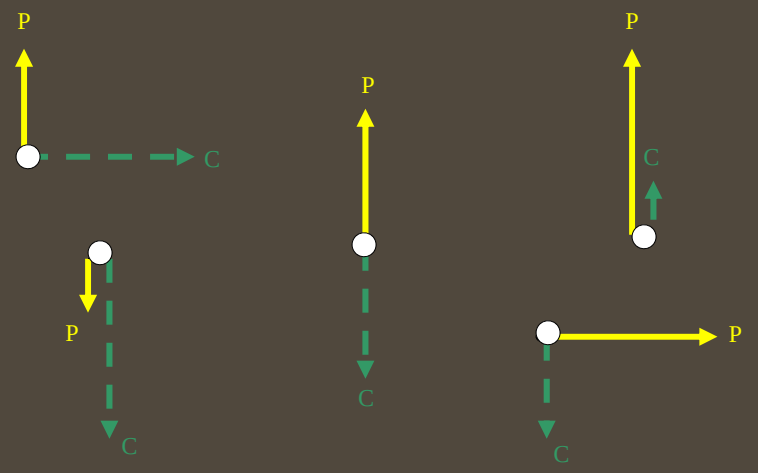
Why do Value Engineering…..?



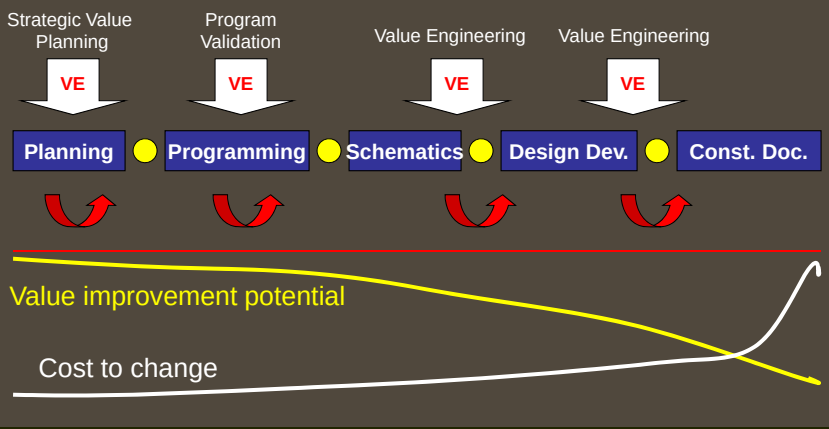
- Innovative/ New Technology
- Risk Mitigation
- Maintainability/ Sustainability
- Operational Improvement
- Construction Time Saving
- Functions (Owner Requirements) Achieved
- Significant initial cost savings
- Lower life cycle costs

5 Ways to Add Value

P = Performance (Benefits or Advantages) C = Cost (Life Cycle Costs)

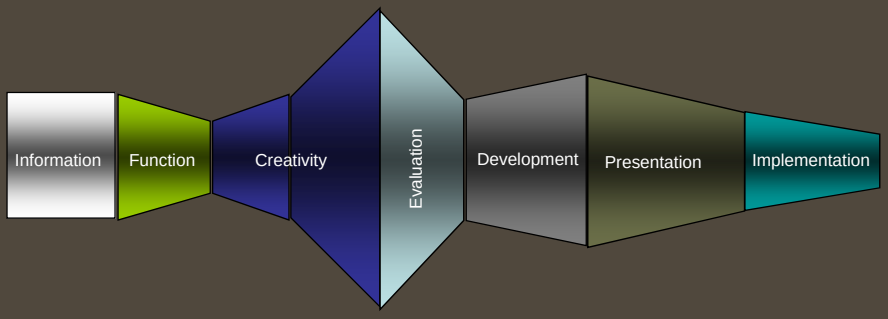


VE Project Stages of Application



VE Workshop Steps

VE Phases & Decision-making Dynamics

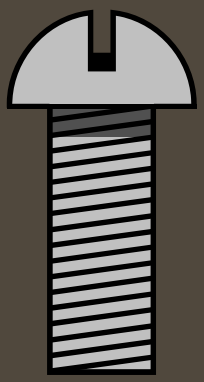


VE History

Lawrence D. Miles:

- Began at GE early 1940's
- 1947 - Value Analysis
  - Lawrence D. Miles
  - "Father of VM"
- 1954 - Value Engineering, US Navy
- Society of American Value Engineers (SAVE)
  - Formed in 1959
  - SAVE International 1996
- Value Management, Value Control, Value Improvement
- Many Laws Requiring VM
- Value Based Decision-Making with emphasis on Performance
- Sustainability/ LEED New Initiative

Value Methodology



What is it?
What does it cost?
What does it do?
What must it do?
What else will perform the function?
What will that cost?

VE Personal Example

Eyeglasses

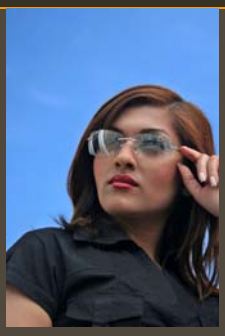
Options?

VE Personal Example

Eyeglasses

Functions?

Options?



VE Example: Bridge

Bridge Design

Before

After

Description of Change:

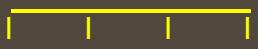
Redesign highway bridge to simplify structural framing from 4 primary beams to 3.

Benefits:

- Improved construction
- Savings $1,000,000
- Improved maintainability
- Better aesthetics

VE Example: Bridge

Bridge Design



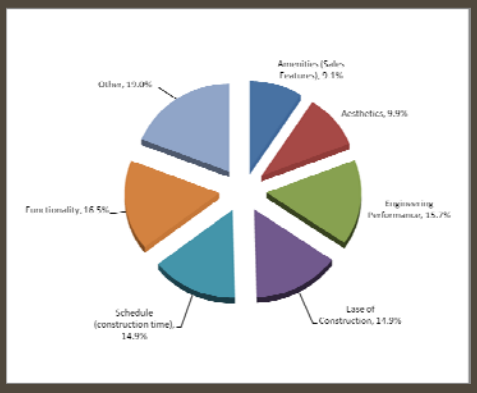
Before

After

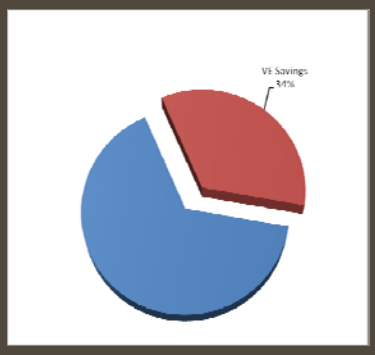
U.S. 131 near Niles, MI

VE Results ~ Resort Project

Infrastructure Works
VE Workshop :120 Ideas, 26 Proposals



Performance Improvements



Construction Cost Savings

Street Lighting Example

Original Design

The present design specifies a designer type roadway lighting fixture (high end) and pole as described in Option 1 of the street lighting narrative.

Proposed Design

This proposal replaces the high end design type fixtures with aesthetically pleasing, high efficiency, low energy LED fixtures on a reduced number basis with the exception of the 9m poles with two fixtures per pole ilo of the total number of poles and fixtures in the original design. The reduction in fixtures and poles is due to the ability of the proposed units to meet the street lighting criteria with larger spaces between poles. The 9m poles with one fixture each are spaced at 46m ilo 31m; the 6m poles with one fixture each are spaced at 30m ilo 26m. The spacing for the 9m poles with two fixtures each remain unchanged.

Advantages:

- Initial cost savings
- Energy savings
- Long life (18 years)
- Reduced lamp inventory
- Meets dark sky standards
- No delay when activated

Life Cycle Costs

	Initial Cost	Life Cycle Cost
Original Design	2,282,600	3,076,700
Proposed Design	1,026,300	1,380,600
Potential Savings	1,256,300	1,696,100

Water Demand Example

Original Design

The original design has the following features :

1. No Diversity applied in calculations
2. Piping losses is estimated to 15%
3. Peaking factors (PDD) is ranging between 1.35-1.43 and (PHD) ranging between 2-2.3
4. Hotels guests demand is 500 l/d/person (assuming 2 persons per key)
5. Central laundry demand is included in calculations
6. STP cleaning/washing demand is included in the calculations

Proposed Design

The Proposal has the following features :

1. 0.92 Diversity applied on PDD and PHD
2. Piping losses is limited to 3%
3. Peaking factors kept as is
4. Hotels guests demand is 500 l/d/key (the min is 200 l/d/key as per Institute Of Plumbing -IOP)
5. Central laundry demand is excluded as advised by SDG on 27-April-2010
6. STP cleaning/washing demand is taken out, as it is maintenance load that can easily planned in low-flow periods

Life Cycle Costs

	Initial Cost	Life Cycle Cost
Original Design	15,288,700	26,727,174
Proposed Design	11,791,300	21,106,036
Potential Savings	3,497,400	5,621,138

Lighter Steel Roof Example

Original Design

Heavy construction

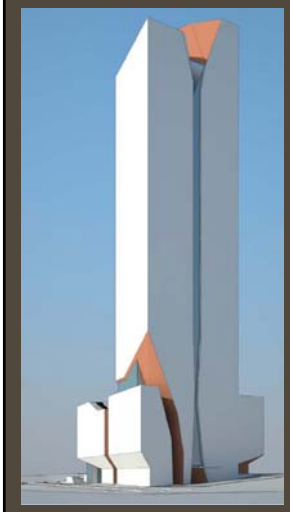
Proposed Design

Lighter steel

Life Cycle Costs

	Initial Cost		Life Cycle Cost
Original Design	18,659,300	in QAR	18,659,300
Proposed Design	3,225,800	in QAR	3,225,800
Potential Savings	15,433,500	in QAR	15,433,500

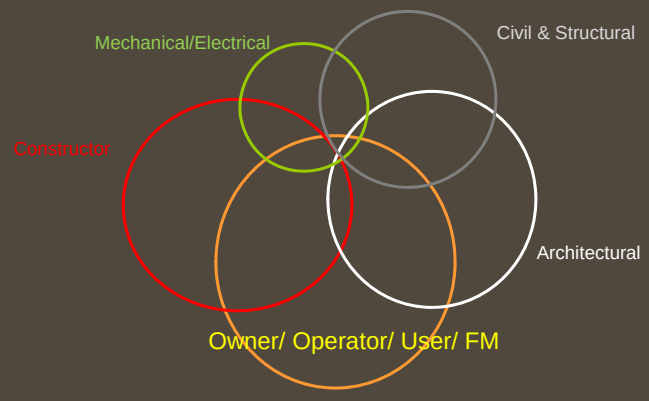
Saraya Project



Value Study Objectives

- COST REDUCTION OPPORTUNITIES
- ASSESSMENT OF DESIGN DOCUMENTS
- ASSESSMENT OF DESIGN PARAMETERS APPROPRIATENESS
- TECHNICAL DESIGN
- CONSTRUCTABILITY
- ONGOING MAINTENANCE & ASSOCIATED
- OPERATING EFFECIENCY & ENERGY COST
- STACKING & SPACE PROGRAMMING

VE Subject Matter Experts



Independent Peer Review

Function Analysis

- Shifts focus away from an item toward the functions of an item
- Permits experts to develop new insights about the item with which they are intimately familiar

Functions Defined

Active VERB

A Measurable NOUN

Verb – Noun listing

Verbs	
Absorb	Generate
Actuate	Improve
*Allow	Increase
Attach	Limit
Attract	Maintain
Conduct	Position
Connect	Prevent
Contain	Protect
Control	*Provide
Convert	Reduce
Create	Regulate
Decrease	Resist
Direct	Rotate
*Facilitate	Transmit

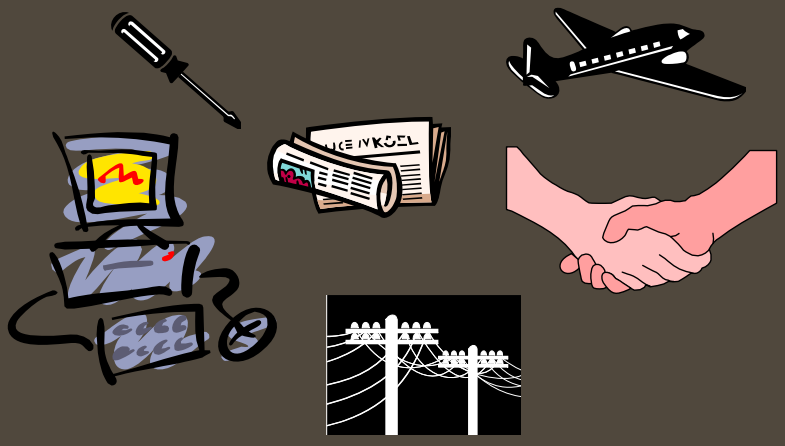
Nouns	
Access	Friction
Air	Heat
Appearance	Impact
Circuit	Mass
Cold	Moisture
Component	Noise
Corrosion	Light
Current	Parts
Deflection	Path
Dirt	Performance
Energy	Stability
Entry	Surface
Flow	Travel
Fluid	Vibration

*Try to avoid use of these verbs

Benefits of Two Word Definition

- Forces conciseness
- Avoids combining functions and defining more than one simple function at a time
- Aids in achieving the broadest level of disassociation from specifics

Name Functions



Basic Function

- That which is essential to the performance of a user function
- The function describing the primary utilitarian characteristic of a product to fulfill a user requirement
- Also called primary or essential function

Characteristics of a Basic Function

- Once defined, a basic function will not change
- The cost contribution of the basic function is usually a small portion of its total cost
- The loss of the basic function(s) causes the loss of the market value and worth of the product or service

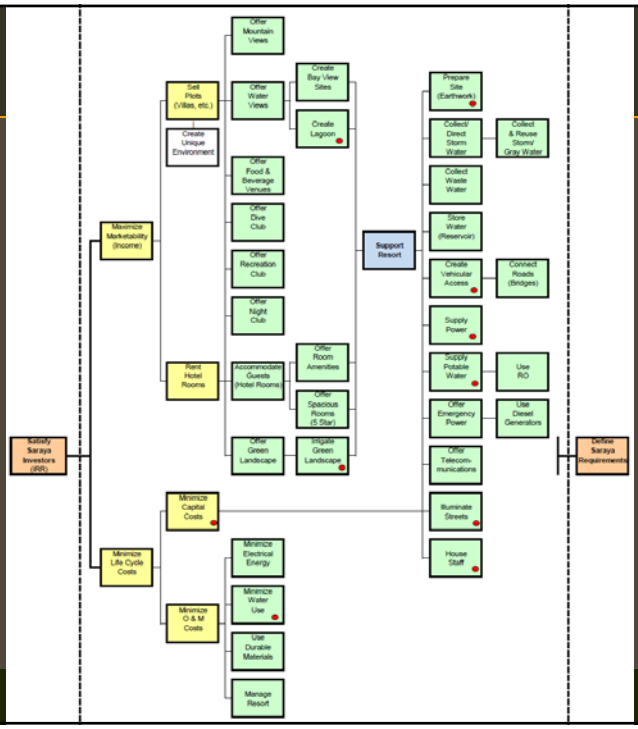
Secondary Function

- The manner in which the basic function was implemented
- A function indicating quality, dependability, performance, convenience, attractiveness, and general satisfaction beyond that needed to satisfy minimum user needs
- Includes supporting, unwanted, unnecessary, and required secondary

Tools – Function Analysis

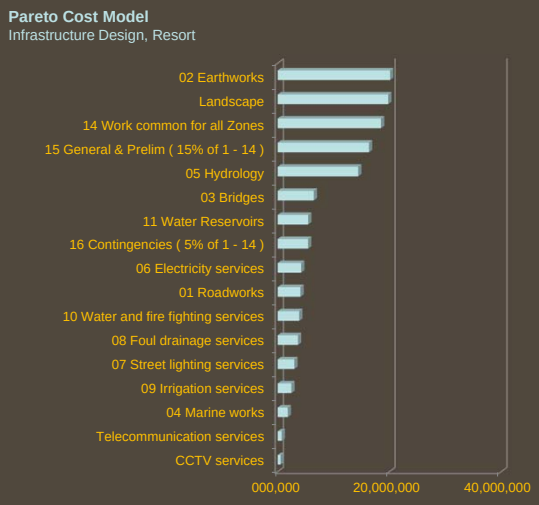
Tools

Function Analysis



Value Engineering Briefing

Pareto Cost Model



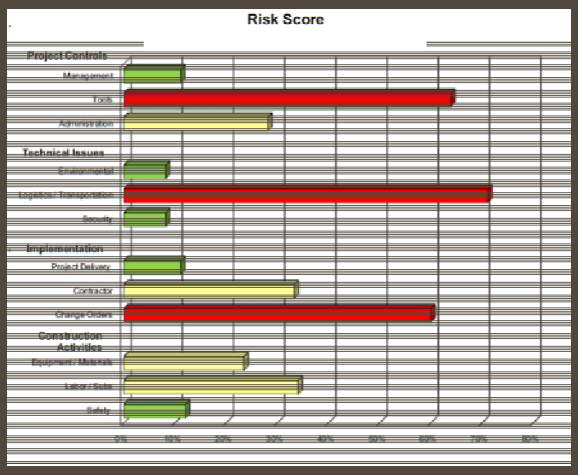
Value Engineering Briefing

Kirk Associates

Risk Model

Target for brainstorming

- How can the project risks be reduced?
- Can the rules be changed?

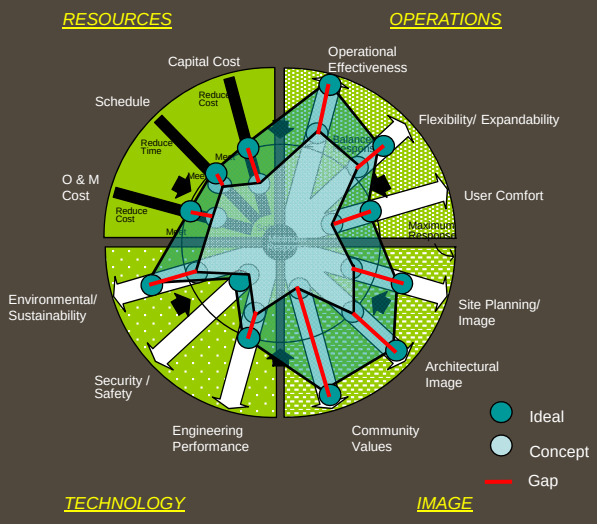


Quality Model

Visioning
Key Element

- categorize
- evaluation
- prioritization

to
"**set (validate) expectations" and Define Project Drivers**



Additional VE Models

- Pareto Space Model
- Cost Benchmark Model
- Space Benchmark Model
- Time Model
- Constructability Model
- Maintenance Model
- LCC Model
- Proforma Model
- LEED Sustainability Model

Creativity ….VE is about *ideas*

Great Smoky Mountains Insect

Creativity …. Is Quantity of *i-deas*

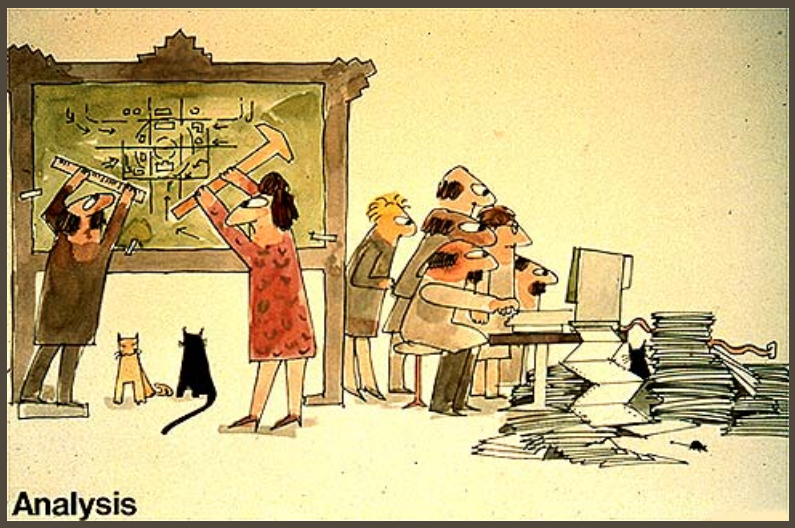
Creativity Questions…..

1. What is the basic function of this facility?
2. What must it do vs. what would be good to do?
3. Why must it be done here? Can it be done elsewhere?
4. Must it be done now? Can it be added later?
5. Can it be done w/ outside space vs. indoor space?
6. What are you willing to forgo to ensure you have a successful project?
7. Can it be smaller? Combine functions?

Osborne Thought Starter Questions

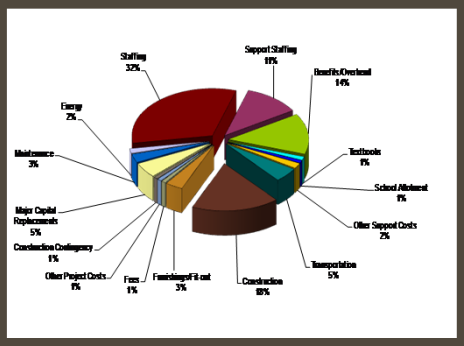
1. **Put to other uses?** New ways to use object as is? Other uses if modified?
2. **Adapt?** What else is like this? What other idea does this suggest? Any idea in the past that could be copied or adapted?
3. **Modify?** Change meaning, color, motion, sound, odor, taste, form, shape? Other changes? New twist?
4. **Magnify?** What to add? Greater frequency? Stronger? Larger? Higher? Longer? Thicker? Extra value? Plus ingredient? Multiply? Exaggerate?
5. **Minify?** What to subtract? Eliminate? Smaller? Lighter? Slower? Split up? Less frequent? Condense? Miniaturize? Streamline? Understate?
6. **Substitute?** Who else instead? What else instead? Other place? Other time? Other ingredient? Other material? Other process? Other power source? Other approach? Other tone of voice?
7. **Rearrange?** Other layout? Other sequence? Change pace? Other pattern? Change schedule? Transpose cause and effect?
8. **Reverse?** Opposites? Turn it backward? Turn it upside down? Turn it inside out? Mirror-reverse it? Transpose positive and negative?
9. **Combine?** How about a blend, an assortment, an alloy, an ensemble? Combine purposes? Combine units? Combine ideas? Combine functions? Combine appeals?

Evaluation & Development Phases



Life Cycle Cost is….

"Life cycle costing is the development of all significant cost of ownership of an item, system, or facility, over a specified length of time"



Life Cycle Cost

- Initial Cost
  - Cost associated with initial development of a facility, including project costs as well as construction costs.
- Recurring/Cyclic Costs
  - Costs that recur on a periodic basis throughout the life of a project.
- Annual Cost
  - Operations
  - Maintenance
  - Staffing
  - Energy
  - Water

Recommendation Phase

- Review Decisions
- Make Recommendations
- Summarize
- Wrap-up

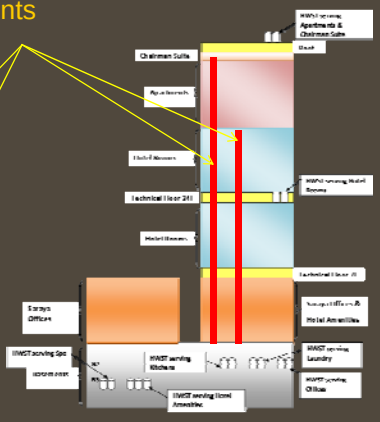
VE Recommendation: Elevator

Separate core for hotel & apartments

Functions:

- Connect Levels
- Separate People

Hotel Plan

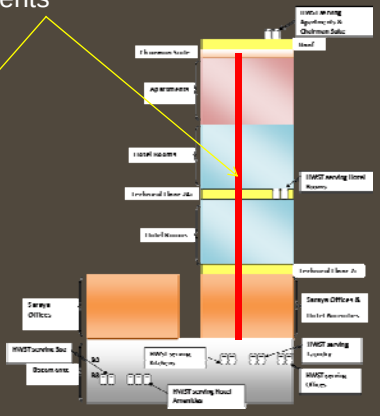


Section

VE Recommendation: Elevator

Combined core for hotel & apartments
Savings: $670,000 & lower LCC
Bonus: additional suite/ floor
Net Income: $6.5 million PW
Achieved functions by technology

Hotel Plan



Section

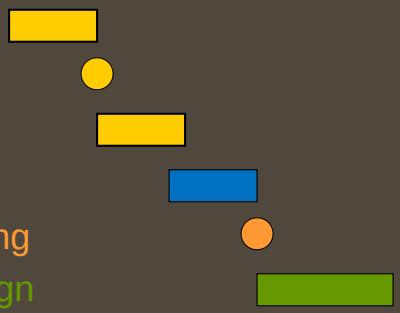
Implementation

Occurs outside the workshop and provides for implementation of accepted VE proposals.

- Follow Through
- Documentation
- Monitoring

Next Steps

Value Workshop
Present Recommendations
Finalize Value Report
Review Recommendations
Hold Implementation Meeting
Incorporate Results in Design



More Information

- SAVE International
  www.value-eng.org
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Questions