Florida Department of
TRANSPORTATION

Value Engineering

Bobby Bull, P.E.
State Value Engineer
2024 South Florida Symposium

Objectives

- Background
- What is VE?
- Why, When, What, & How to VE?
- 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
- 2014 Updated Federal Regulation

SAVE
Adding Value. Enhancing Ideas.

FDOT

U.S. Department of Transportation
Federal Highway Administration

Background

- **FHWA Requirements – 23CFR 627**
  - **NHS Federal-Aid projects**
  - **$50 million projects**
  - **$40 million bridge projects**
  - **Federal-Aid Major project on or off the NHS**
  - **Not Design Build**
  - **Any project FHWA determines appropriate**

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.

What is Value Engineering?

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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.

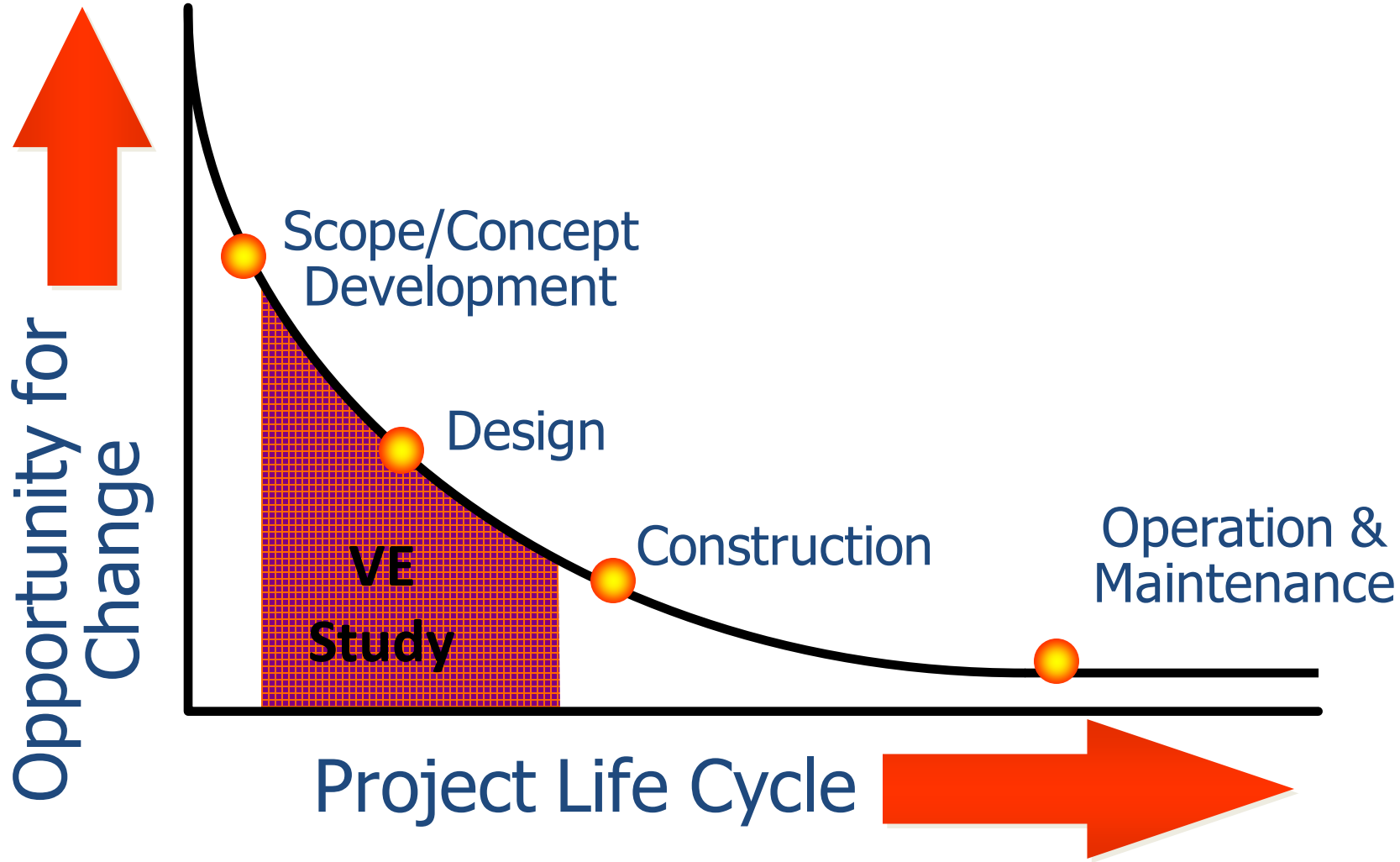
Why use VE?

- **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
- Introduce Innovation

When to apply VE



When to apply VE

Planning

Typical Information Required :

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

When to apply VE

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 to apply VE

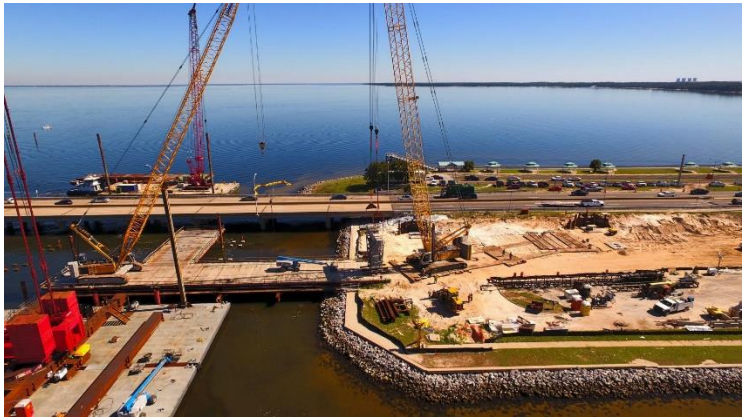
- **Design**

  Typical Information Required :

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

When to apply VE

- **Design/Build Projects**
  - **23 CFR 627.5 – FHWA Encourages**
  - **23 CFR 627.9 - Conducted prior to release of RFP document**



Typical Information Required :

- **RFP Package**

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

Projects Selected for VE (What)

- All projects over $50/$40 million
- 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

Team Selection (Who)

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

Pre-Study Activities

- Team Notifications
- Schedule room/platform
- Distribute study material
- Review study material
- Develop project cost model/pareto chart
- Reserve van/vehicles if performing field review
- Schedule Design Team for presentation
- Supplies (in person)– flipcharts, markers, post-its, masking tape
- Virtual – templates.

How is VE Done?

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VE Team Study

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Post-Study

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5 QUESTIONS

ASK 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?

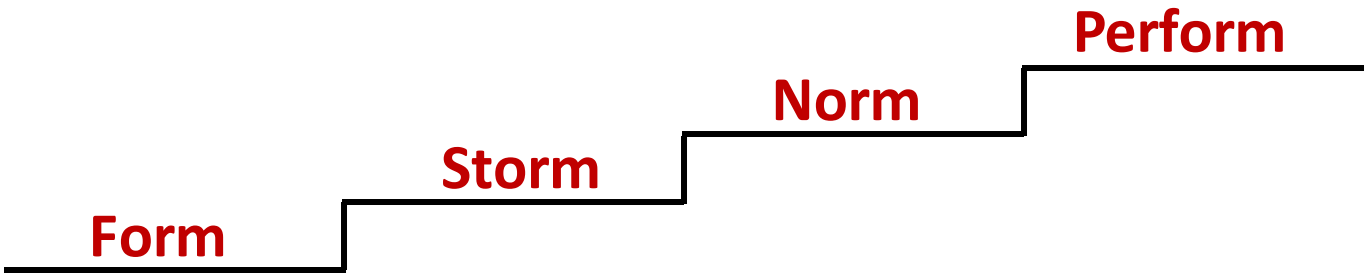
Stages of Team Development

Stage 1: Forming - Monday

Stage 2: Storming - Tuesday

Stage 3: Norming - Wednesday

Stage 4: Performing – Thursday/Friday



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**

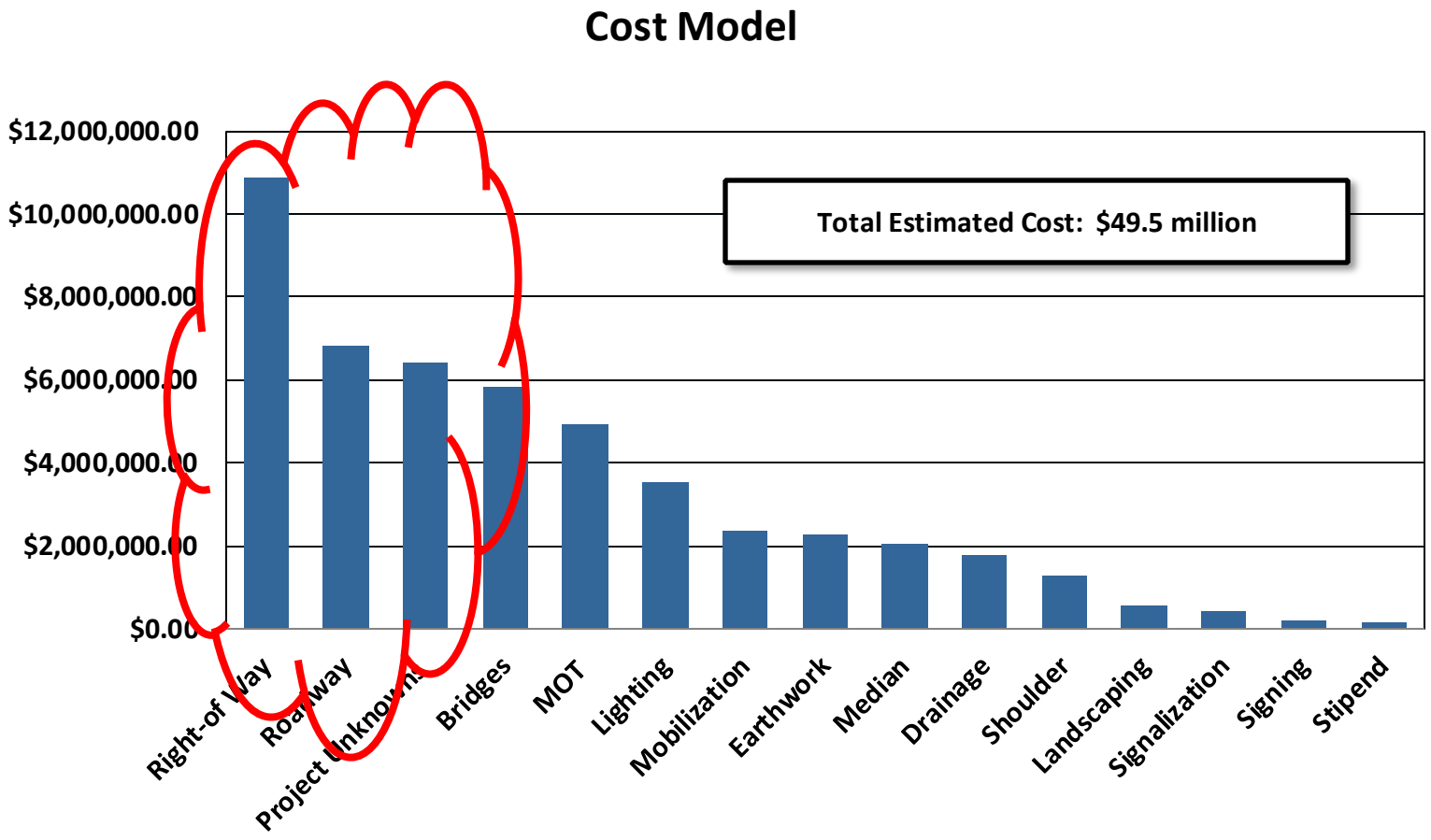
- **Team Briefing – Design Team contact info**

Information Phase

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

Cost Model Pareto

20% of functions contain 80% of cost



Function Analysis

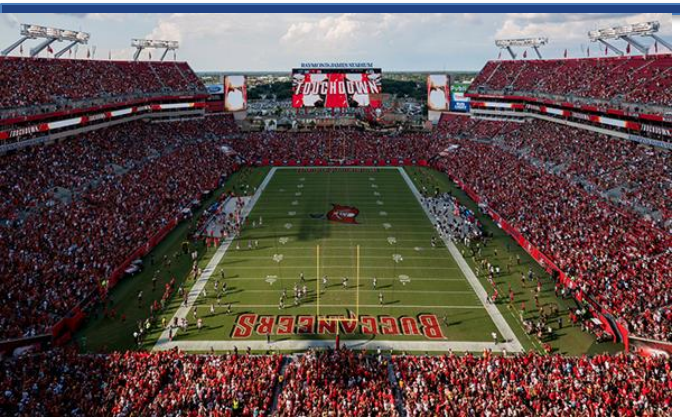
What is Function?

- **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



Calling ‘timeout’ in football results in various actions.

Function Analysis

Time out
How many reasons (Functions) are behind any timeout call by either player, coach or officials?

Function Analysis

ACTION VS. FUNCTION

Stop Clock
Substitute Players
Change Play

1. Conserve Time
2. Convey Strategy
3. Avoid Errors
4. Modify Strategy

Function Analysis

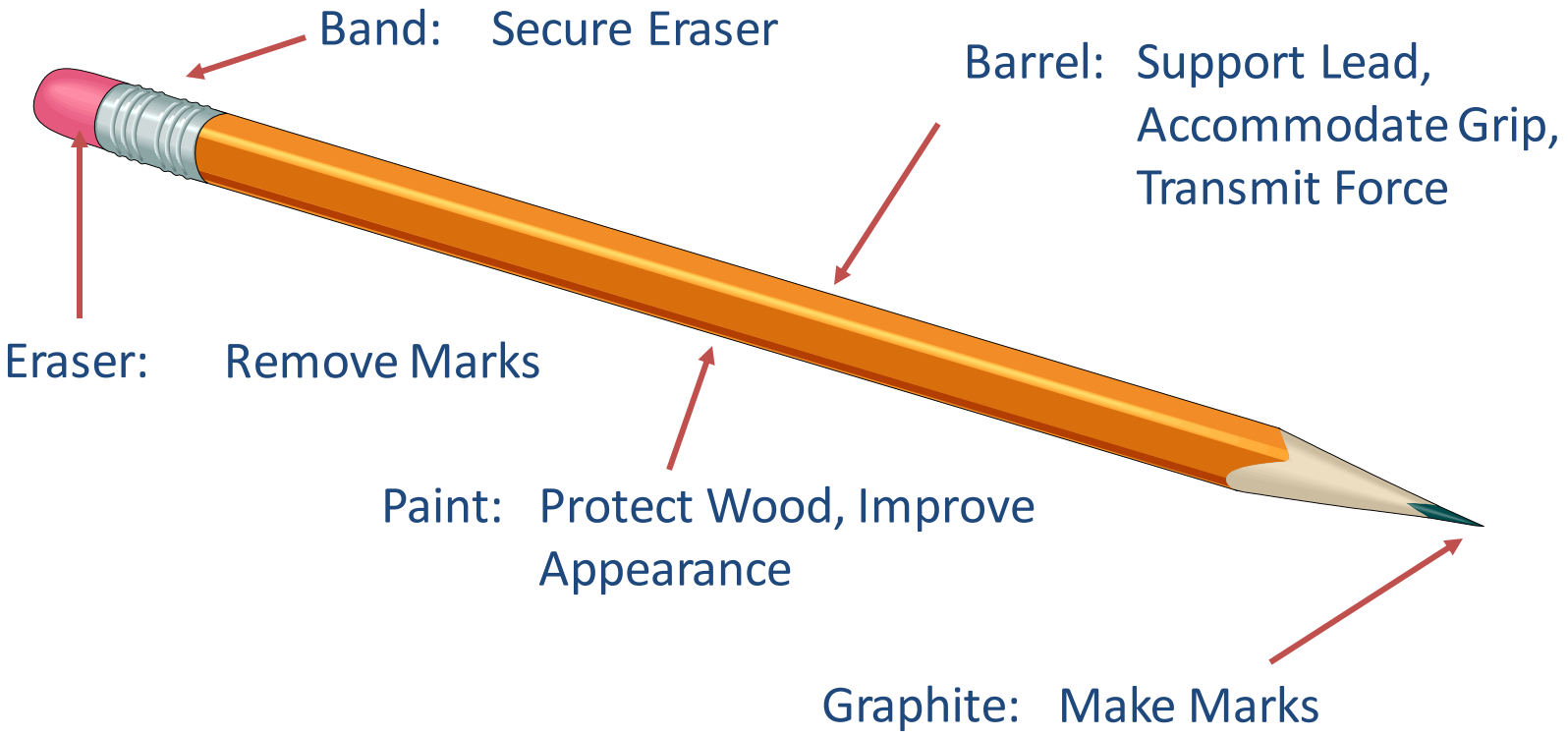
Random Function Generation

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

Function Analysis

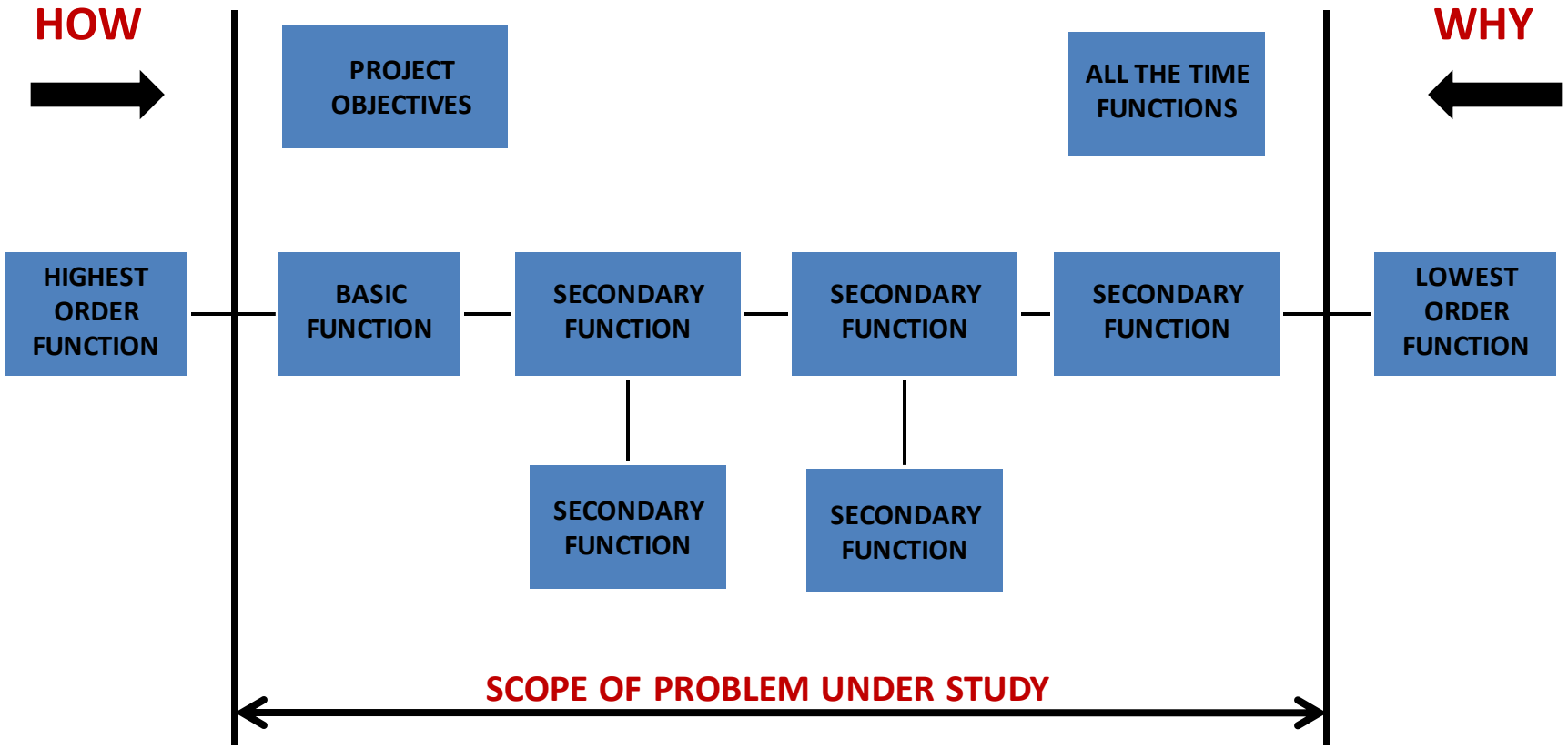
What is the function of this pencil?

"make marks"



Function Analysis

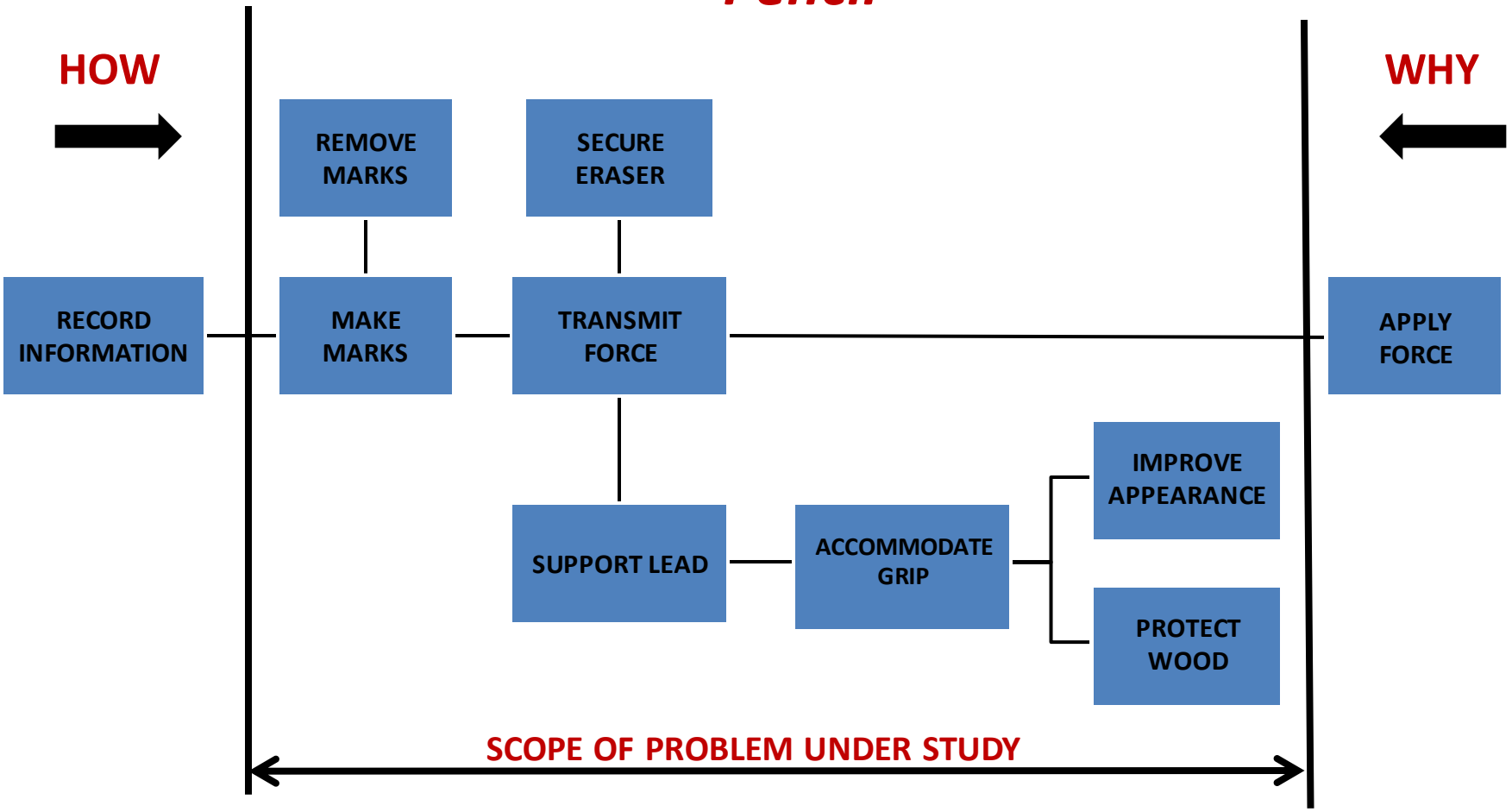
Function Analysis System Technique (FAST)



Function Analysis

Function Analysis System Technique (FAST)

Pencil



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

- 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

Evaluation Phase

- Eliminate ideas
- Combine ideas
- Evaluate remaining ideas
  - Weighted Matrix
  - Multi-Voting
  - Team Consensus

Evaluation Phase

What is an Evaluation Matrix?

Matrix used to evaluate ideas against the proposed design using the same criteria.

Project: Mega Mousetrap Car		Design Matrix				
		Designs				
Criteria/Specification	Weight	1 Trap	2 Trap	1 Trap & CD Wheel	Duel Drive	Special Axle
Cost	1	5	4	4	3	2
Time to build	2	5	2	3	2	2
Time to test	1	5	5	5	4	3
Time to redesign	2	5	3	4	3	2
Peak speed (5 ft/sec.)	2	2	5	2	2	4
Distance (30 ft. min.)	4	2	4	3	5	4
Totals		42	45	39	41	37
						5 = best, 1 = worst

Evaluation Phase

- **Determine Evaluation Criteria**
- **Use paired comparison to weight criteria.**
- **Evaluate each alternative/idea based on criteria**

Evaluation Phase

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

Evaluation Phase

Paired Comparison

	Costs (A)	Operations (B)	Constructability (C)	Maintenance (D)	Aesthetics (E)
Costs (A)		(B)	(C)	(A)	(A)
Operations (B)			(B)	(B)	(B)
Constructability (C)				(C)	(C)
Maintenance (D)					(D)
Aesthetics (E)					

Evaluation Phase

Criteria Weightings

Costs (A)	3 = (2)
Operations (B)	5 = (4)
Constructability (C)	4 = (3)
Maintenance (D)	2 = (1)
Aesthetics (E)	1 = (0)

Evaluation Phase

Weighted Matrix

RATINGS: EXCELLENT – 4 GOOD - 3 FAIR – 2 POOR - 1	COSTS		OPERATIONS		CONSTRUCTABILITY		MAINTNANCE		AESTHETICS		TOTALS
ALTERNATIVES/ WEIGHTING	**3**		**5**		**4**		**2**		**1**		
AS PROPOSED	4	12	3	15	2	8	1	2	5	5	42
VE ALTERNATIVE 1	3	9	5	25	2	8	3	6	2	2	50

Evaluation Phase

Multi-Voting

What is it?

- **A decision-making tool that enables a team to reduce a long list of ideas to a manageable number of ideas.**

	Round 1 4 Votes per person	Round 2 3 Votes per person	Round 3 2 Votes per person	Round 4 1 Votes per person
Idea 1	~~0~~			
Idea 2	3	4	4	1
Idea 3	1	~~0~~		
Idea 4	2	2	~~0~~	
Idea 5	~~0~~			
Idea 6	2	~~0~~		
Idea 7	1	~~0~~		
Idea 8	~~0~~			
Idea 9	4	4	4	3
Idea 10	~~0~~			
Idea 11	2	3	2	1
Idea 12	1	~~0~~		
Idea 13	~~0~~			
Idea 14	1	2	~~0~~	
Idea 15	1	~~0~~		
Idea 16	~~0~~			
Idea 17	~~0~~			
Idea 18	1	~~0~~		
Idea 19	~~0~~			
Idea 20	1	~~0~~		
Total	20	15	10	5

Evaluation Phase

Team Consensus

What is it?

- As a group decide:
  1. Which ideas to move forward for development
  2. Which ideas to combine
  3. Which ideas to eliminate

"Then we are agreed nine to one that we will say our previous vote was unanimous!"

Development Phase

Write-up Ideas

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

Development Phase

Write-up Ideas

- **Descriptions**

Clear Descriptions of both the proposed design and the VE alternative

Development Phase

Write-up Ideas

- **Descriptions**
- **Sketches**

Sketches to help visualize the VE alternative that is being presented

Development Phase

Write-up Ideas

- Descriptions
- Sketches
- Calculations

Calculations that help support the VE Alternative

Development Phase

Write-up Ideas

Advantages and Disadvantages of the VE Alternative

- **Advantages & Disadvantages**
- **Cost Analysis (Life Cycle Costs)**

Development Phase

Write-up Ideas

Life Cycle Cost Analysis

- **Advantages & Disadvantages**
- **Cost Analysis (Life Cycle Costs)**

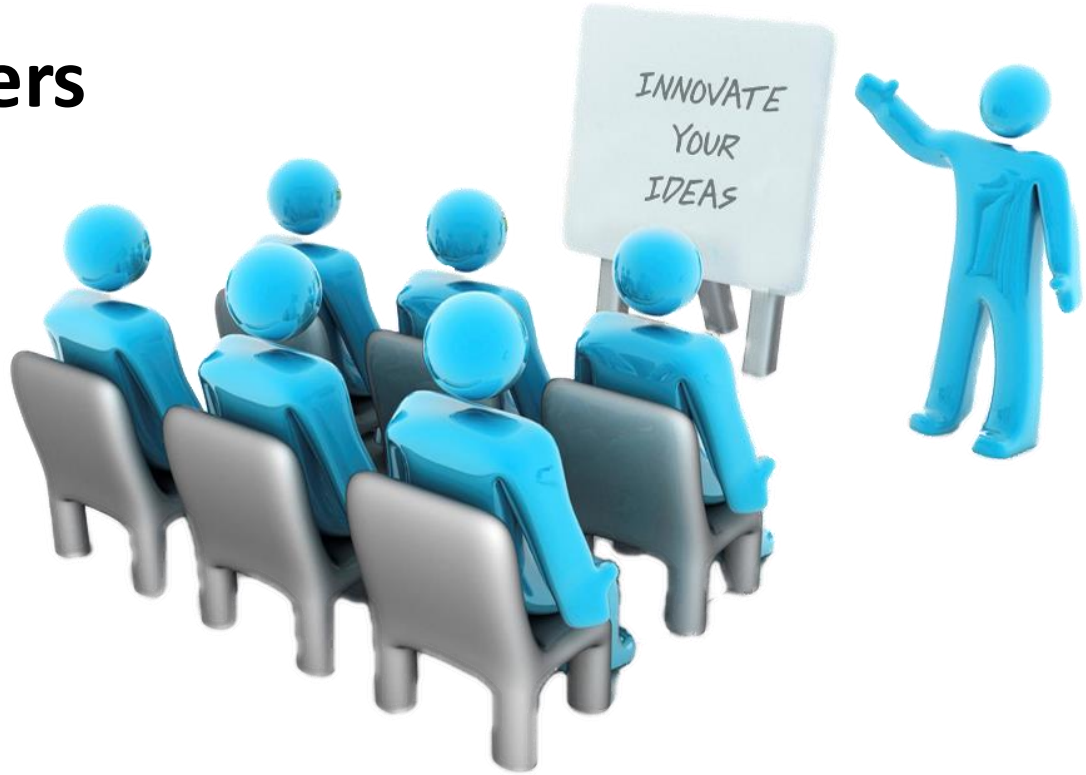
Development Phase

What is Life Cycle Cost Analysis?

A tool to determine the most cost-effective option among different competing alternatives to purchase, own, operate, maintain and finally dispose of an object when each is equally appropriate to be implemented. All the costs are typically discounted to Net Present Value (NPV).

Presentation Phase

- Present results to management
- Either last day of study or scheduled separately by District VE coordinator.
- Multiple presenters
- Dress rehearsal



Report Results

- Team Leader responsible for developing and distributing report.
- Collect write-ups from team members.
- Include presentation, agenda & sign-in sheets in appendices.
- Distribute draft report to team for comments.
- PE sign & seal final report.

Report Results

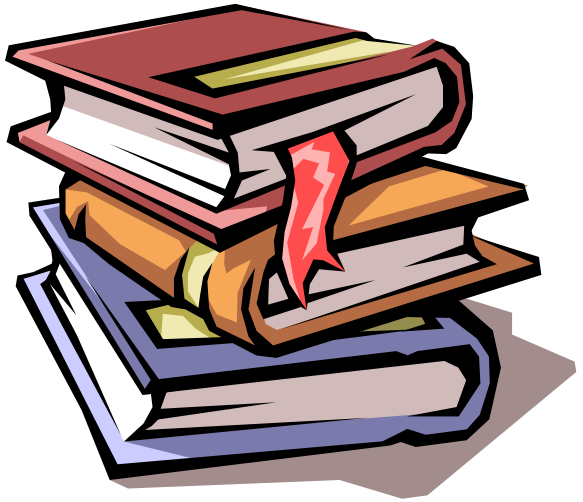
- **Results are reported quarterly at the Performance Meeting**
- **Results are reported on an Annual Basis to FHWA**

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**

References

- FDOT Value Engineering web site
- FDOT Value Engineering Procedure 625-030-002
- FHWA Value Engineering web site
- SAVE International web site



Questions

Thank you

Bobby Bull, P.E.

State Value Engineer

Bobby.Bull@dot.state.fl.us

(850) 414-4348