RISK MANAGEMENT TRAINING

2014 Design Training Expo

Agenda

- Risk Overview
  - ✓ Risk Assessment
- Risk Management
  - ✓ Risk Response
  - ✓ Risk Allocation
  - ✓ Risk Monitoring & Controlling
- Risk Modeling
  - ✓ Pre-Mitigated Results
  - ✓ Post-Mitigated Results

Presented By Tim Brock, PE

RISK MANAGEMENT OVERVIEW

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What is Risk?

- "An uncertain event or condition that, if it occurs, has a positive or negative effect on the project's objectives."

Risk Analysis – The Register

Risk Register for I-4

Risk Information						Initial Risk Quantification												
							Cost Risk Information (Millions $)						Schedule Risk Information (Months)					
Record #	Risk ID	Risk Agenda Category	Activity Impacted	Risk Name	Description	Initial Probability of Occurrence (%)	Initial Low Cost	Initial Most Likely Cost	Initial High Cost	Initial P(L) Cost	Initial P(M) Cost	Initial P(H) Cost	Initial Low Schedule	Initial Most Likely Schedule	Initial High Schedule	Initial P(L) Schedule	Initial P(M) Schedule	Initial P(H) Schedule
1	18	21	22	23	24	29	30	31	32	34	35	36	38	39	40	42	43	44
1	DES 01	Design, Structures, and Geotech Risks	118	Add South Street Modification	Need mod to make plan work. Additional construction cost. Related ROW is being purchased separately. From URS estimate, $93.4M plus ROW (which is already captured in the base ROW numbers). Includes related utility risk (FDOT is paying, so unlikely to significantly affect schedule).	100%	$93.40	$93.40	$93.40				0	0	0			
12	PS-A	Design, Structures, and Geotech Risks	115, 116, 117, 118, 119 (Cost), 104 (Schedule)	Delay in obtaining agreements with local governments (A)	For example, agreement re: aesthetics and maintenance agreements / fire protection on bridges (excluding streets near new arena, Grand National overpass, South St/Anderson, which are captured separately). Delay in procurement to achieve agreement, and/or save costs if no agreement (down to 1% of construction costs). Potential (mutually exclusive) scenarios: A. as planned B. no agreement (save costs) and no delay C. delay in agreement D. delay and then no agreement (save costs)	85%	$0.00	$0.00	$0.00				0	0	0			

Initial Risk Quantification

	Cost Risk Information (Millions $)						Schedule Risk Information (Months)					
Initial Probability of Occurrence (%)	Initial Low Cost	Initial Most Likely Cost	Initial High Cost	Initial P(L) Cost	Initial P(M) Cost	Initial P(H) Cost	Initial Low Schedule	Initial Most Likely Schedule	Initial High Schedule	Initial P(L) Schedule	Initial P(M) Schedule	Initial P(H) Schedule
29	30	31	32	34	35	36	38	39	40	42	43	44
100%	$93.40	$93.40	$93.40				0	0	0			

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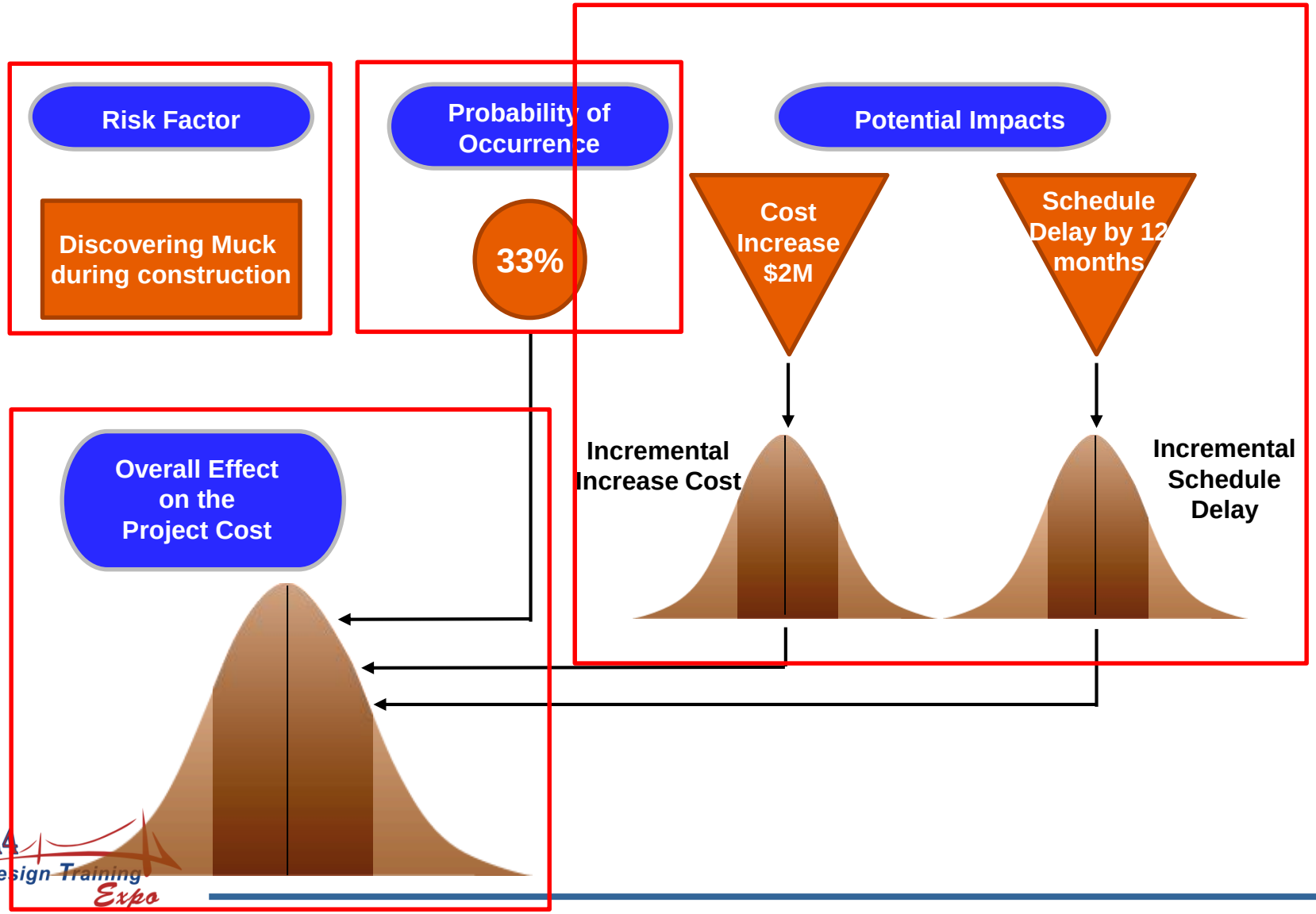
Risk Assessment



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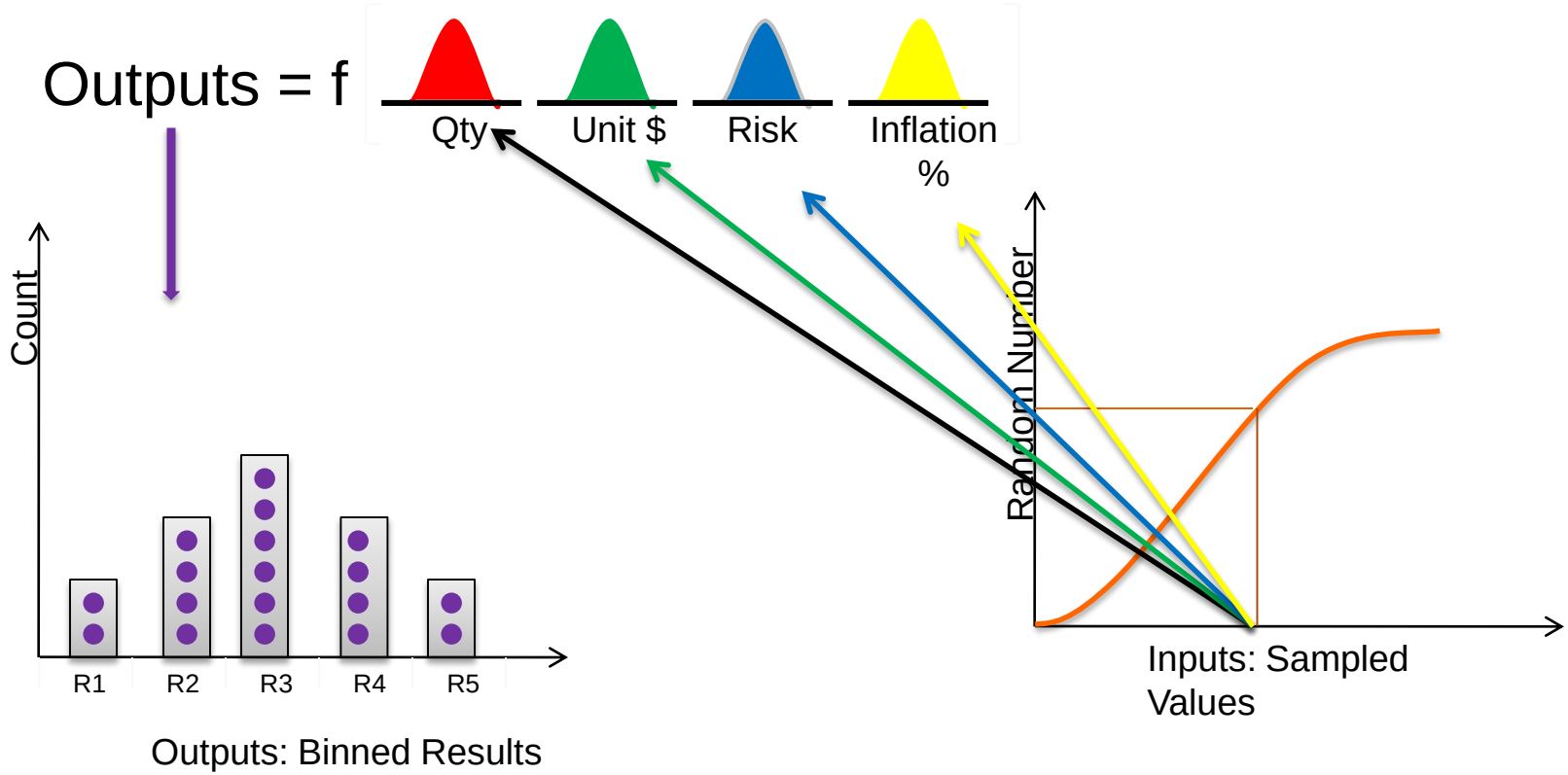
Risk Analysis

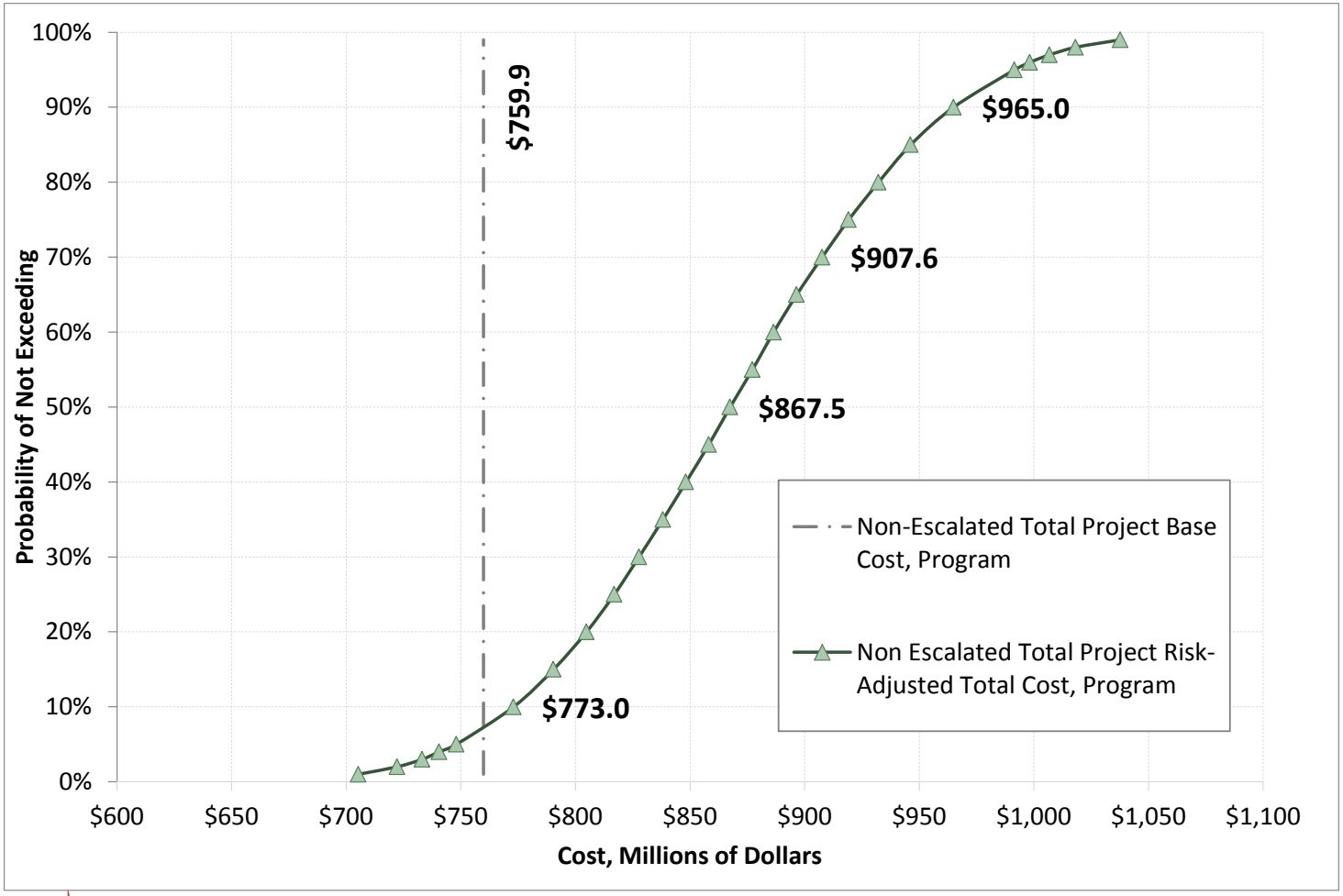
Monte-Carlo Simulation

y = f(x) or “y” is a function of “x”



Source: FHWA

Risk Analysis – Pre-Mitigated Results



Risk Analysis – The Register w/ Responses

Risk Register for I-4

Risk Information						Initial Risk Quantification														
							Cost Risk Information (Millions $)						Schedule Risk Information (Months)							
Record #	Risk ID	Risk Agenda Category	Activity Impacted	Risk Name	Description	Initial Probability of Occurrence (%)	Initial Low Cost	Initial Most Likely Cost	Initial High Cost	Initial P(L) Cost	Initial P(M) Cost	Initial P(H) Cost	Initial Low Schedule	Initial Most Likely Schedule	Initial High Schedule	Initial P(L) Schedule	Initial P(M) Schedule	Initial P(H) Schedule
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1	DES 01	Design, Structures, and Geotech Risks	118	Add South Street Modification	Need mod to make plan work. Additional construction cost. Related ROW is being purchased separately. From URS estimate, $93.4M plus ROW (which is already captured in the base ROW numbers).	100%	$93.40	$93.40	$93.40				0	0	0			

Risk Response			Mitigation Risk Quantification								
				Cost Risk Information (Millions $)				Schedule Risk Information (Months)			
Review Frequency	Risk Response Strategy	Response Comments	Probability of Occurrence (%)	Low Cost (Response)	Most Likely Cost (Response)	High Cost (Response)	Expected Value Cost (Response)	Low Schedule (Response)	Most Likely Schedule (Response)	High Schedule (Response)	Expected Value Schedule (Response)
54	55	56	57	58	59	60	61	66	67	68	69
	Reduce	See if Turnpike construct the bridge instead (TP may not need to replace bridge, may be able to get vertical clearance exception).	25%	$1.00	$1.50	$2.50	$0.40				
	Reduce	Conduct soil borings where ponds would be to get a better idea of the type of soil. Cost for boring test: for a 10 acre drainage pond, around $50k per test for 10 tests.	40%	$3.00	$4.50	$6.00	$1.80				

12	PS-A	Design, Structures, and Geotech Risks	115, 116, 117, 118, 119 (Cost), 104 (Schedule)	Delay in obtaining agreements with local governments (A)	area, Grand National Overpass, South Wyndemere, which are captured separately). Delay in procurement to achieve agreement, and/or save costs if no agreement (down to 1% of construction costs). Potential (mutually exclusive) scenarios: A. as planned B. no agreement (save costs) and no delay C. delay in agreement D. delay and then no agreement (save costs)	85%	$0.00	$0.00	$0.00				0	0	0			

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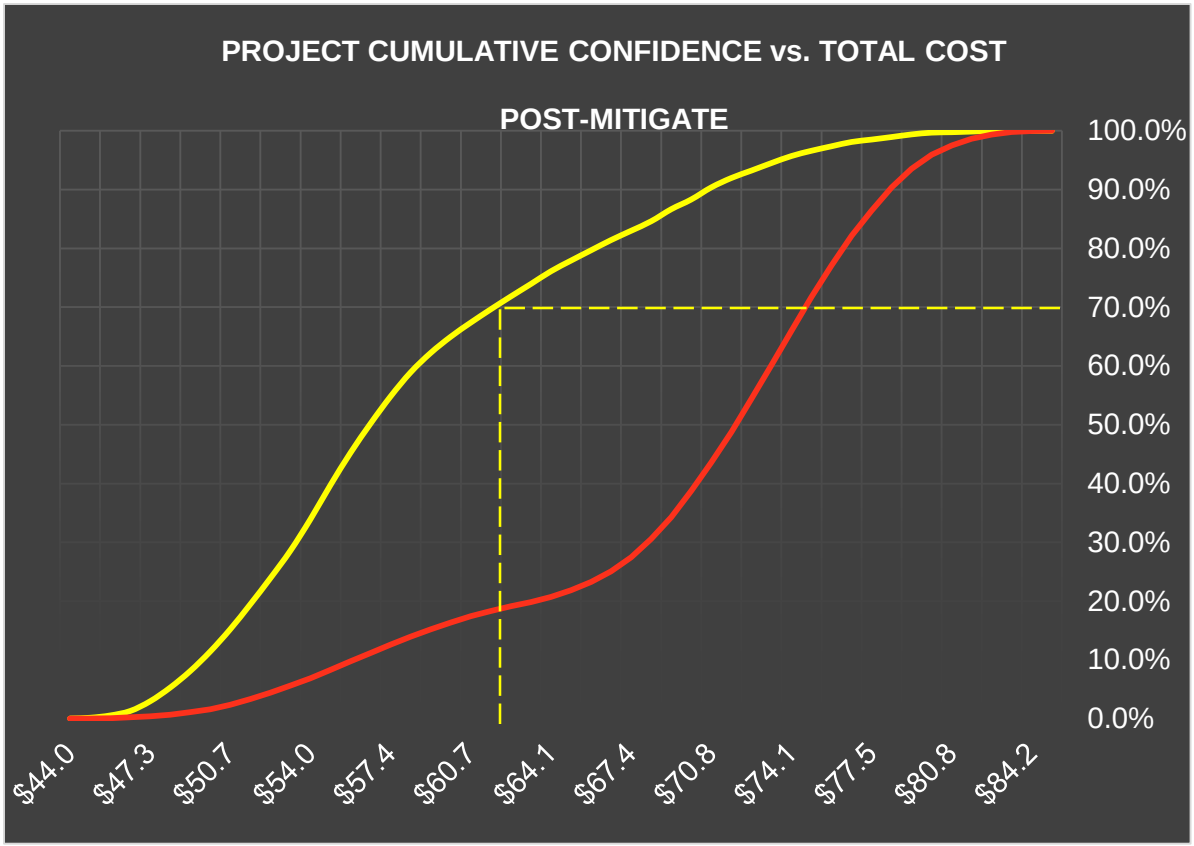
Risk Analysis – Post-Mitigated Results

Confidence	Cost	
	Pre-Mit.	Post-Mit.
5%	$55.2	$54.5
10%	$56.5	$55.6
25%	$59.4	$57.9
50%	$67.1	$61.0
70%	$73.5	$64.4
80%	$75.3	$71.5
90%	$77.4	$75.3
95%	$78.8	$77.4



Presented By Robert Quigley, PE

RISK MANAGEMENT

RISK RESPONSE
RISK ALLOCATION
RISK MONITORING & CONTROLLING

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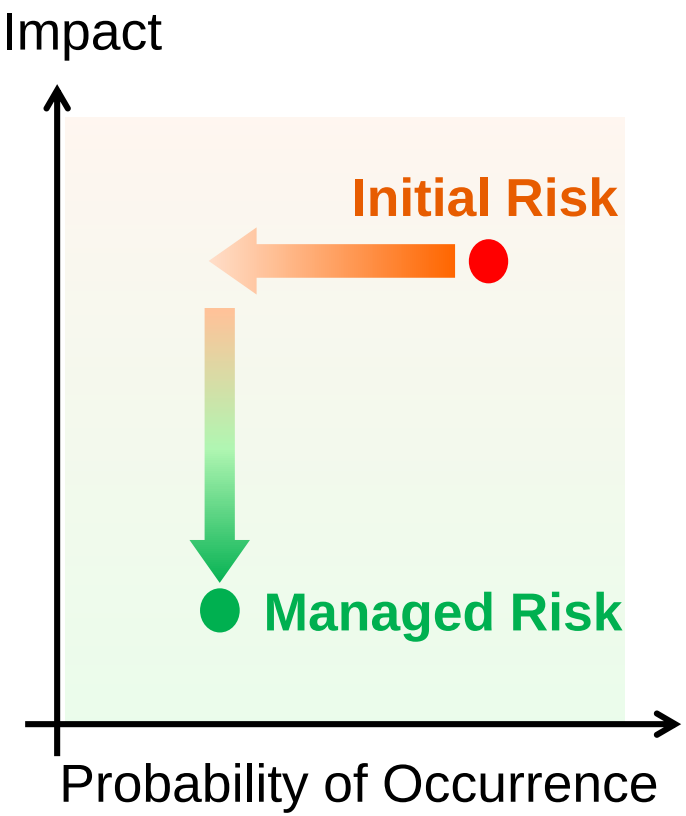
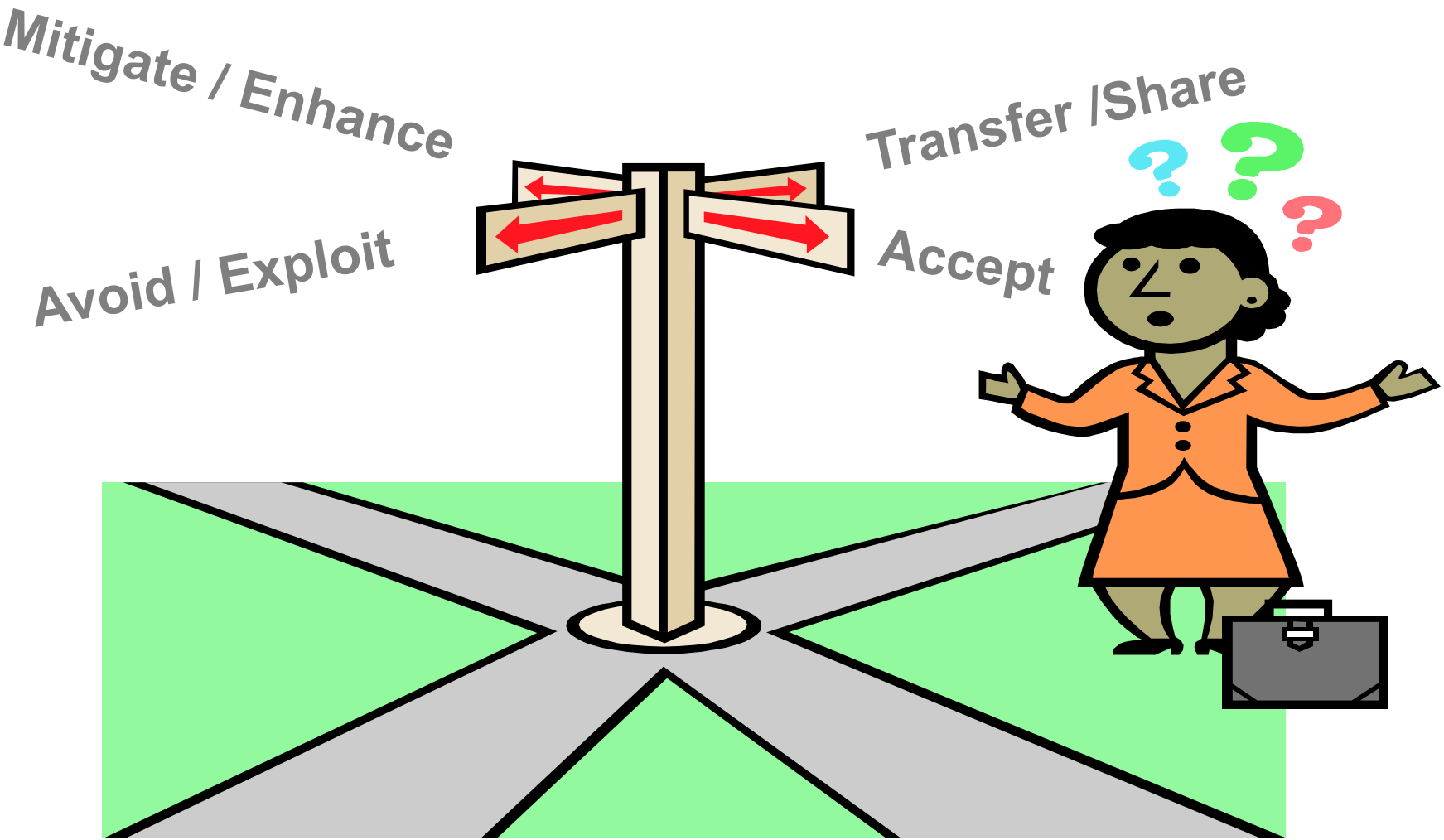
Risk Management

- Risk Assessment's aim is to assess potential impact of various scope, event, and budget risks on the project's cost and schedule.

- Risk Management's aim is to identify opportunities and mitigation strategies to reduce both the likelihood of an event occurrence and the potential effect if it occurs.



Risk Response



Risk Response Strategies

Threats Risk Factors that Increase Cost or Schedule	Opportunities Risk Factors that Reduce Cost or Schedule
Avoid: Change the project scope to eliminate the impact of a risk.	**Exploit:** To make a proactive decision to take action to show that an opportunity is realized.
Transfer: Move a risk to another party who is more capable at handling the risk (such as the developer or insurance company).	**Share:** Assigning ownership of the opportunity to a third-party who is best able to capture the benefit for the project.
Mitigate: The project team may seek to lessen the impact of a specific risk item, which may involve the consumption of additional time and/or money. Mitigation usually requires positive action and has a cost.	**Enhance:** Take action to increase the probability and/or impact of the opportunity for the benefit of the project; seeking to facilitate or strengthen the cause of the opportunity, and proactively targeting and reinforcing its trigger conditions.
Accept: To take no action when a response may be too costly to be effective or when the risks are uncontrollable and no practical action may be taken to specifically address it. In active acceptance, the project team sets up a contingency reserve fund to account for the residual expected value of the remaining risks.	

Risk Response Planning

- **Risk Response Plan** – A plan of action designed to reduce the impact once a risk event has occurred
  - ✓ **Planning –** Prior to the risk event occurring as though it will occur
  - ✓ **Trigger –** Identifies that the risk event has occurred and notifies the team to implement the risk response plan
  - ✓ **Implementation –** Actions to take after the risk event has occurred

Tracking, Monitoring & Control

- Development of Risk Management Plan involves:
  - ✓ **Identifying Risk Owners** to take responsibility for key risk factors and associated risk response strategies
  - ✓ **Identifying Monitoring Frequency** for risk updates and feedback on the effectiveness of risk response strategies
  - ✓ **Updates to the Risk Model** and results at key milestones and when baseline cost and schedules are updated
  - ✓ **Update Risk Management Plan** continuously to document and report progress

Tracking, Monitoring & Control

Risk Response Plan		Monitoring & Control		
Strategy	Action To Be Taken (response actions including advantages and disadvantages. Specify the time frame	Risk Owner	Risk Review Dates	Date, Status & Review Comments (to show the history of risks monitoring, do not delete previous comments)
Mitigation	Finalize design to identify all wetlands that are impacted. Early coordination with the outside agencies to determine mitigation ratio	Design Leader / Enviro. Mgr.	2008-Dec-2 2008-Jan-2	As of Nov. 15, 2008 there are only two potential areas where there could be additional wetland impacts. As of De. 2, 2008 agency has initially determined that mitigation ratio would be 4:1.

Presented By Jose Theiler, PE

RISK MODELING

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Risk Management Process - Modeling

The Way We Do It Today

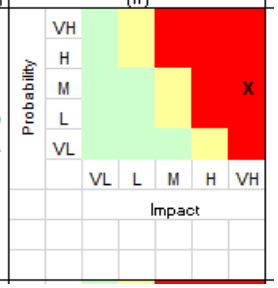
Outputs = f {	5 ea	$12	$12	3%	}
	Qty	Unit $	Contin-gency	Inflation %	

Outputs = $72.00 (PDC)

Source: FHWA

Risk Management Process - Modeling

Risk Identification									Quantitative Analysis				Qualitative Display of Max Impact		
Status	Risk ID#	Date Identified	Project Phase	Functional Assignment	Threat / Opportunity	Summary Description	Detailed Description of Risk Event (Specific, Measurable, Attributable, Relevant, Time bound)	Risk Trigger	Cost or Schedule	Probability of Occurrence (%)	Risk Impact (Max., Min., & Most Likely)	Expected Impact	Probability	Impact	Risk Matrix (Probability of Occurrence by Max. Impact)
(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
ACTIVE	CON_1	15-Apr-14	Construction	Environmental & Hydraulics	Threat	Additional Sound walls Required due to new development	There is a good chance that the neighborhood east of I-95 and north of East/West Canal asks for noise walls. It's estimated that 10,000 ft of standard noise walls will be needed at a cost of $275 to $350/LF totalling in the range of $2.75M and $3.5M.		Cost	50%	$14.000	$7.500	Medium	Very High	
											$16.000				
											$15.000				
					Threat				Schedule		4.0 mo				
											1.0 mo				
											2.0 mo				



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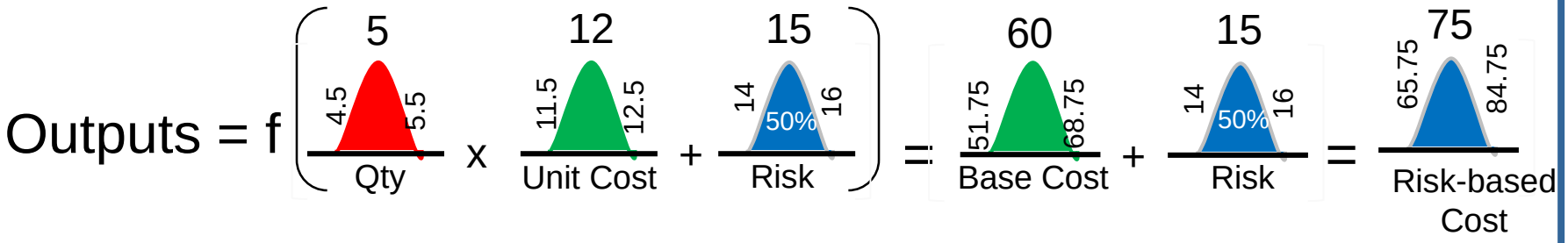
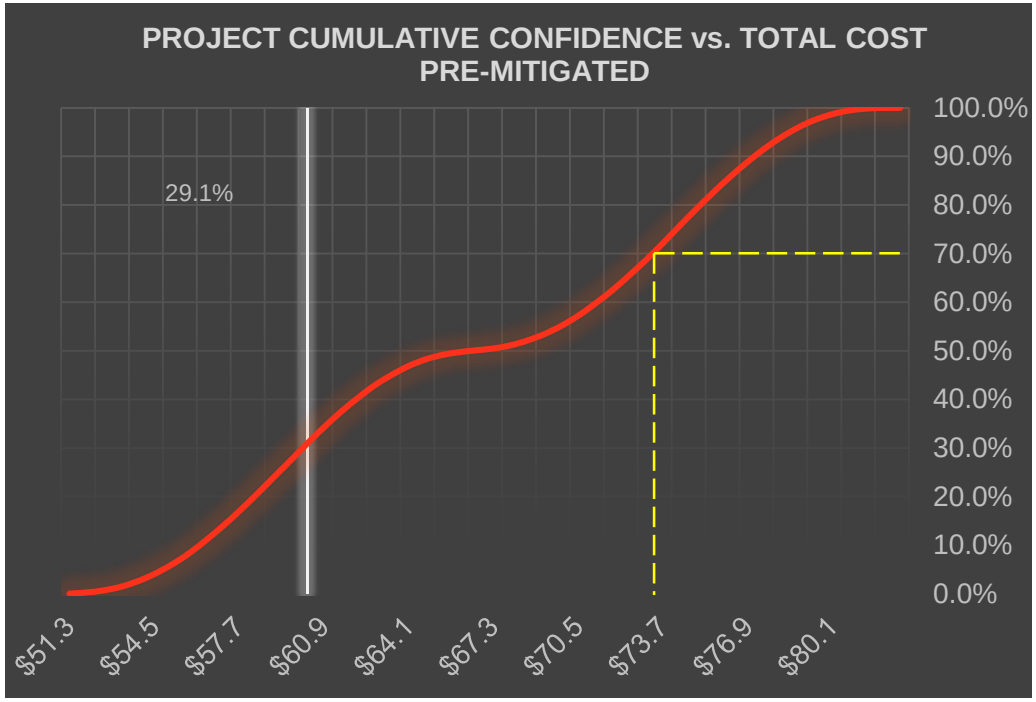
Risk Management Process - Modeling

Summary Description	Detailed Description of Risk Event (Specific, Measurable, Attributable, Relevant, Time bound)	Risk Trigger	Cost or Schedule	Probability of Occurrence (%)	Risk Impact (Max., Min., & Most Likely)	Expected Impact
(8)	(9)	(10)	(11)	(12)	(13)	(14)
Additional Sound walls Required due to new development	There is a good chance that the neighborhood east of I-95 and north of East/West Canal asks for noise walls. It's estimated that 10,000 ft of standard noise walls will be needed at a cost of $275 to $350/LF totalling in the range of $2.75M and $3.5M.		Cost	50%	$14.000	$7.500
					$16.000	
					$15.000	
			Schedule		4.0 mo	
					1.0 mo	
					2.0 mo	

Understanding How Risk Works



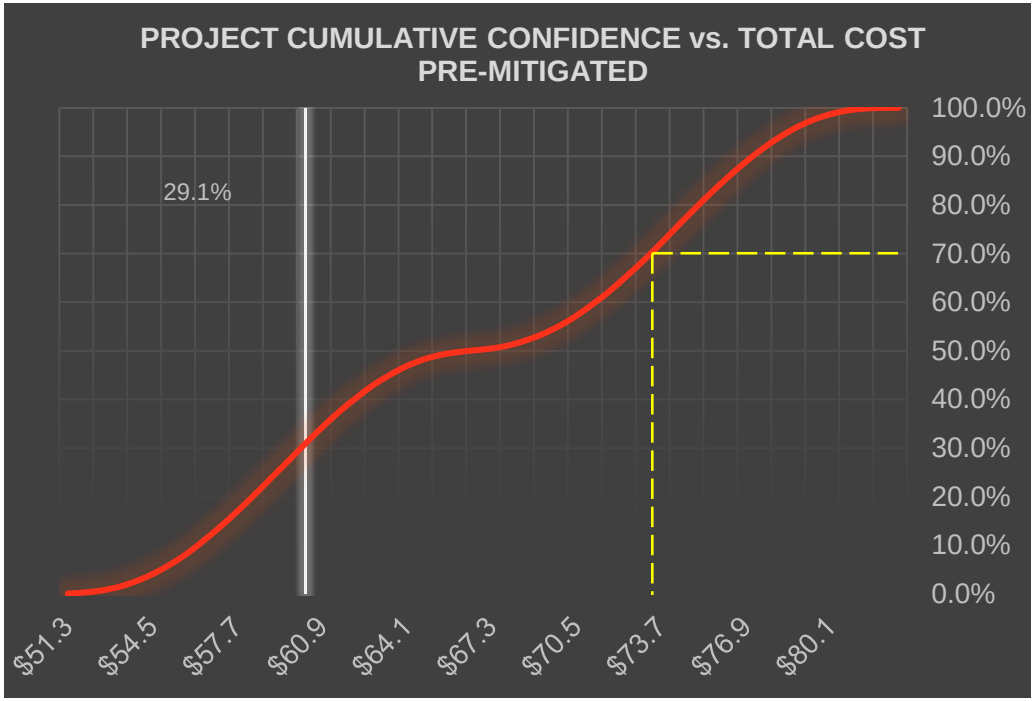
Confidence	Cost
	Pre-Mit.
5%	$54.9
10%	$56.3
25%	$59.2
50%	$66.4
70%	$73.3
80%	$75.2
90%	$77.2
95%	$78.5



Source: FHWA

What To Do With Results?

- Difference between Base Cost and 70% Confidence Amount ($13.3)
- Enter “Risk” in the LRE for $13.3



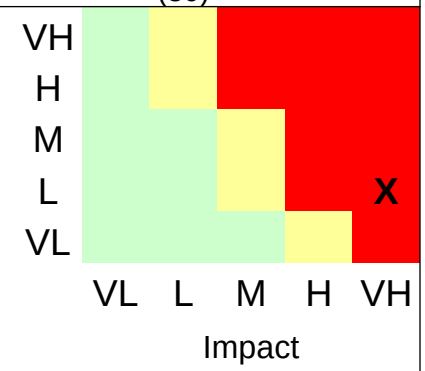
What To Do With Results?

Monitor & Control

Risk			Pre-Mitigation (Data Date = 01-Feb-12)				Mitigation		
ID	T/O	Title	Probability	Schedule	Cost	Score	Response	Title	Total Cost
CNS 10.01	T	Traffic Management - baseline solution does not work	L (25%)	N (0)	L ($60,0...	3	Reduce		$0
CNS 10.03	T	Maintaining local access	VH (80%)	N (0)	L ($60,0...	9	Reduce		$0
CNS 50.01	T	Delay in obtaining temporary permit	VL (10%)	H (30)	N ($0)	4	Reduce		$0
CNS 900.03	T	Removal of existing bridge	VH (80%)	N (0)	H ($300,...	36	Reduce		$0
CTR 40.01 A	O	Competitive Market Results in Lower Bid Prices - Scenario 1	VH (75%)	N (0)	VH ($5,0...	72	Enhance		$0
CTR 40.01 B	O	Competitive Market Results in Lower Bid Prices - Scenario 2	M (50%)	N (0)	VH ($5,0...	40	Enhance		$0
DES 10.01	T	Changes in Profile	M (50%)	VH (80)	VH ($75...	40	Accept		$0
DES 10.02	T	Changes in Design Standards	VL (5%)	N (0)	VH ($75...	8	Reduce		$0
DES 20.01	T	Changes in Design - Wider Trail	VL (10%)	VH (100)	VH ($2,2...	8	Reduce		$0
ENV 30.02	T	New permits or new information required	L (25%)	N (0)	L ($66,6...	3	Accept		$0
ENV 40.02	T	Unanticipated Cultural or Archaeological Findings	VL (10%)	H (36)	N ($0)	4	Accept		$0
ENV 60.02	T	Additional wetlands mitigation area needed	M (50%)	N (0)	VH ($1,5...	40	Reduce		$0
ENV 60.03 A	T	Additional wetlands mitigation area needed (Schedule)	VL (10%)	VH (60)	N ($0)	8	Reduce		$0
ENV 70.01	T	Design Changes for Ponds	M (50%)	N (0)	M ($90,...	10	Reduce		$0
MGT 40.02 B	T	Priorities change on existing program (Bridge Maintenance)	VH (100%)	N (0)	VH ($1,7...	72	Reduce		$0
MGT 900.04	T	Threat of Lawsuits	VL (10%)	VH (100)	N ($0)	8	Reduce		$0
ROW 900.02	T	Coordination of the removal of the Shipyard Pedestrian Bridge	M (50%)	N (0)	M ($126...	10	Reduce		$0
STG 20.01	T	Encountering Unexpected Subsurface Conditions	VH (90%)	VH (90)	VH ($1,1...	72	Reduce		$0
UTL 20.03	T	FDOT Utilities Relocation Cost	VL (10%)	N (0)	H ($250,...	8	Reduce		$0

- ✓ The Risk Register is the single most powerful Control Tool
- ✓ Incorporate it in your Progress Reports!

What To Do With Results?

Risk Response Plan			Post-Mitigated Impacts					
Strategy	**Action to be Taken**	**Cost to Mitigate (Millions)**	**Probability of Occurrence (%)**	**Risk Impact (Max., Min., & Most Likely)**	**Expected Impact**	**Probability**	**Impact**	**Risk Matrix (Probability of Occurrence by Max. Impact)**
(18)	(19)	(24)	(25)	(26)	(27)	(28)	(29)	(30)
Mitigate	Action I will take to reduce the risk	$0.10	25%	$14.000 $16.000 $15.000 [redacted] 4.0 mo 1.0 mo 2.0 mo	$3.65	Low	Very High	

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Risk Analysis – Post-Mitigated Results

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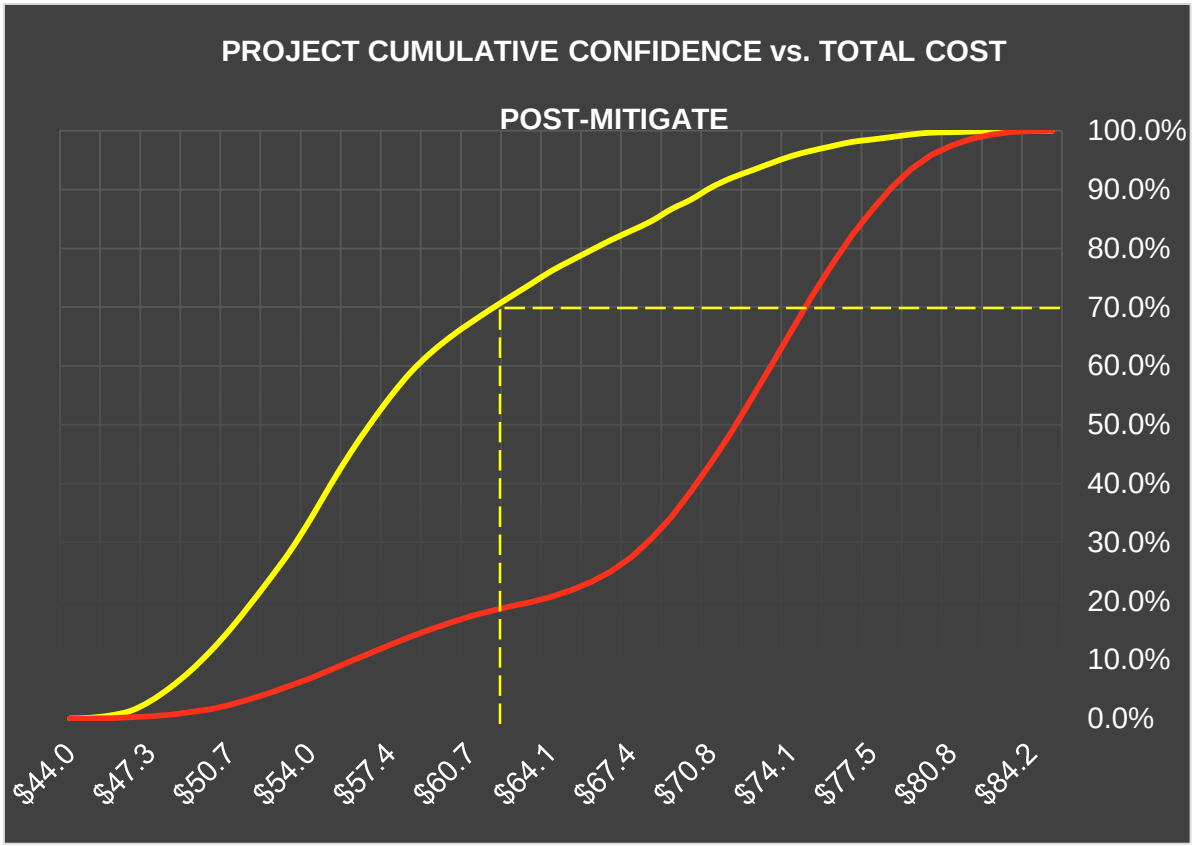

Benefits

- Builds **confidence** and **credibility** in project's estimates
- Promotes **pro-active practices** and early planning
- Facilitates development of **response strategies** for all threats & opportunities
- Better **allocation** of risks
- Facilitates **traceability** of risks throughout the life-cycle of the project
- Identification of best project **delivery method**

Return on Investment

- Helps manage expectations for budget and schedule
- Improved Communication between stakeholders
- Risk management shown to
  - ✓ decrease 90% of project problems [1] and
  - ✓ generate 5% cost savings [2]

Source: FHWA Risk Management Workshop course materials, Golder Associates Inc. & Dr. Keith Molenaar, October 9, 2007; attributed to (1) Project Management Institute, and (2) Construction Management Institute

FDOT Lessons Learned

- I-95 Managed Lanes (Broward & Palm Beach Co.)
  - ✓ Drainage Issues
  - ✓ R/W Issues
  - ✓ Cemetery
  - ✓ Realistic Cost Estimate ➔ Funded Project
- Crosstown Parkway (LAP)
  - ✓ Accelerated Schedule
  - ✓ Construction Sequencing

FDOT Next Steps

- SHRP2 Grant
  - ✓ $100,000
    - Software
    - Training
  - ✓ Implementation Plan
- Risk in-lieu of Flat Contingency %
  - ✓ Self-Assessment Tool
  - ✓ Mainstreamed Process (PSEE Annual WP Update)
  - ✓ Freed Funding for Other Projects

What's Next?

- Risk Register Repository
  - ✓ Monitoring and Controlling
  - ✓ Trending for
    - Most Occurring
    - Most Expensive
    - Response Strategies
  - ✓ Data Analysis
    - Training Opportunities
    - Process Improvements
- Cash Flow Analysis

Robert Quigley, PE – State Project Management Engineer

Tim Brock, PE – District 4 Utility & Value Engineer

Jose Theiler, PE – District 4 Program Services Administrator

QUESTIONS?