

Risk Analysis Workshop



Presented by:
 Greg Davis, P.E., State Estimates Engineer and
 Kurt Lieblong, P.E., State Project Review Administrator

Risk Analysis Process Training

RISK ANALYSIS PROCESS TRAINING



Design Training Expo
 Disney's Coronado Springs Resort
 Lake Buena Vista, FL

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Design Build	Tom Andrus	03/26/2013
Risk Analysis Process Training	Greg Davis	03/05/2013
Florida Greenbook TND Chapter 19	Billy Hattaway	04/02/2013
New Conduit Specifications & Pay Items	Chester Henson	04/16/2013



Presentation Format

➤ **Risk Introduction and
Pre-workshop Activities**

*Greg Davis, P.E.
State Estimates Engineer*

➤ **Risk Analysis Workshop**

*Kurt Lieblong, P.E., C.V.S.
State Project Review Administrator*



Risk Introduction



What is Risk?

◆ Project Management Institute (PMI) Says:

“An uncertain event or condition that, if it occurs, has a positive or negative effect on the project’s objectives.”



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Why Risk Analysis?

Traditional

- Contingency is intended to include all risk (known & unknown)
- Little control of cost and schedule
- Reactive



Risk-Based

- Risk are clearly identified and quantified
- Reasonable control of cost and schedule
- Proactive



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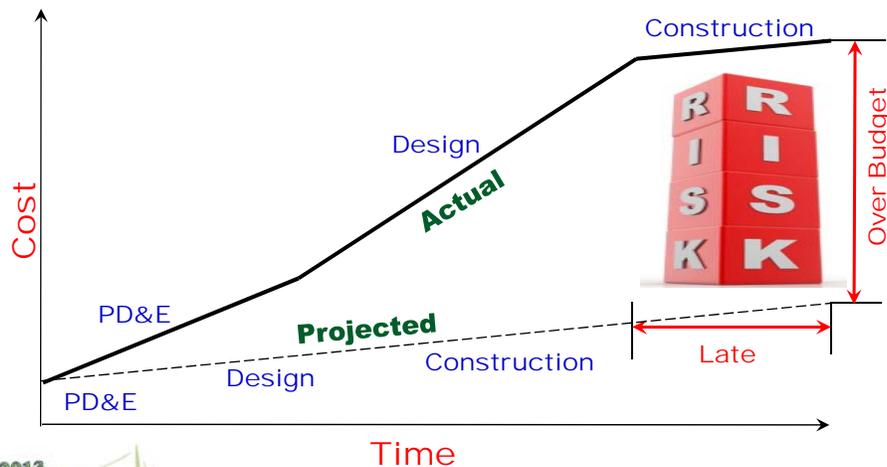
Why Risk Analysis?

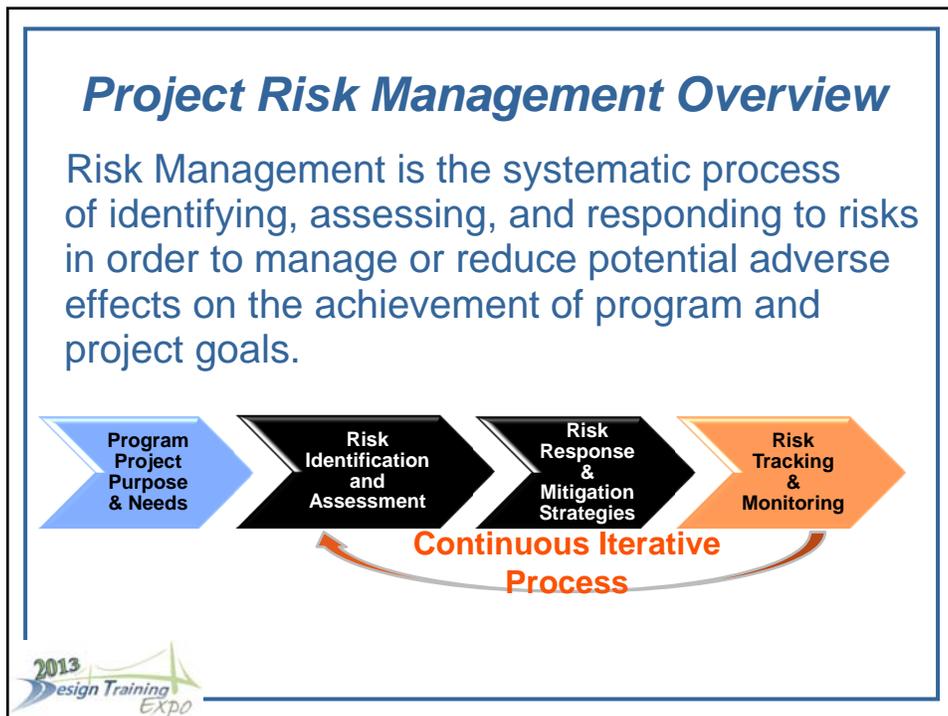
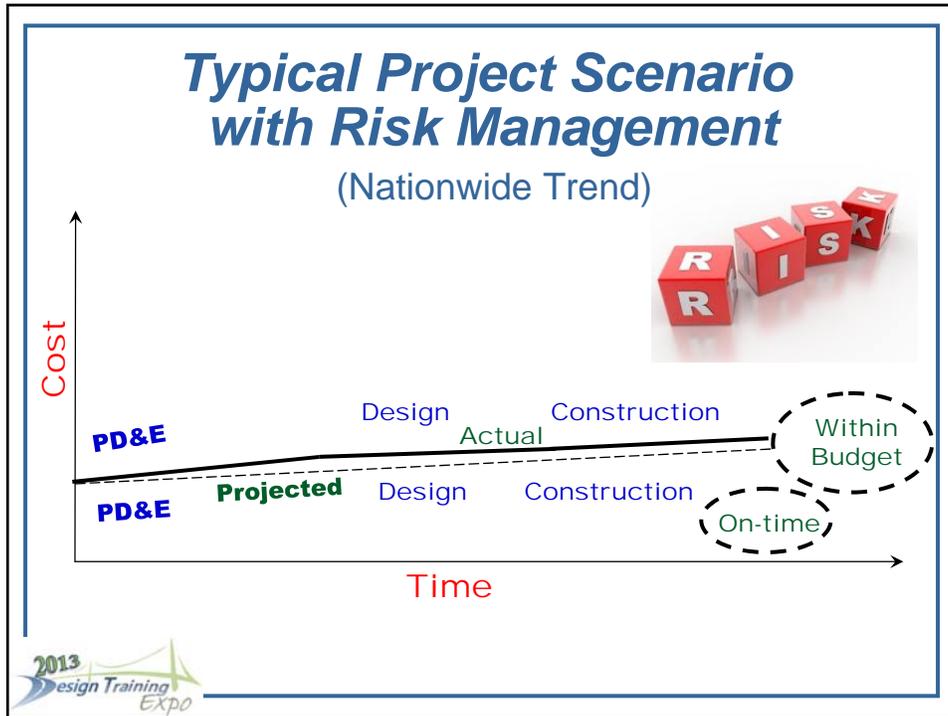
- Stabilize & Support Work Program with better cost estimates and schedules:
 - Validate cost & schedule for accurate project delivery
 - Replace general project contingency with risk-based cost
- Enhance Risk Assessment/Mitigation activities in Project Management;
- Support FHWA requirement for financial plans on major projects by providing risk-based cost estimates.

Maximizes the Likelihood of Meeting Time & Budget Goals



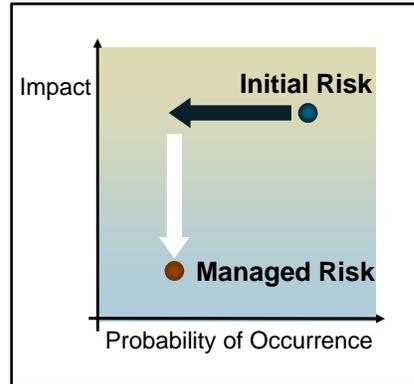
Typical Project Scenario without Risk Management (Nationwide Trend)





Goal of Risk Management

- ◆ Risk Management's aim is to:
 - ◆ Assess potential impact of various scope, event, and budget risks on the project's cost and schedule.
 - ◆ Identify opportunities and mitigation strategies to reduce both the likelihood of an event occurrence and the potential effect if it occurs.



Risk Management Objectives

- ◆ Decrease the probability and impact of negative risk events
- ◆ Increase the probability and impact of positive risk event
- ◆ Make better decisions
- ◆ Allocate risks to those who can best control them
- ◆ Increase agency credibility
- ◆ Foster good relationships with project stakeholders



Risk Management Outcomes

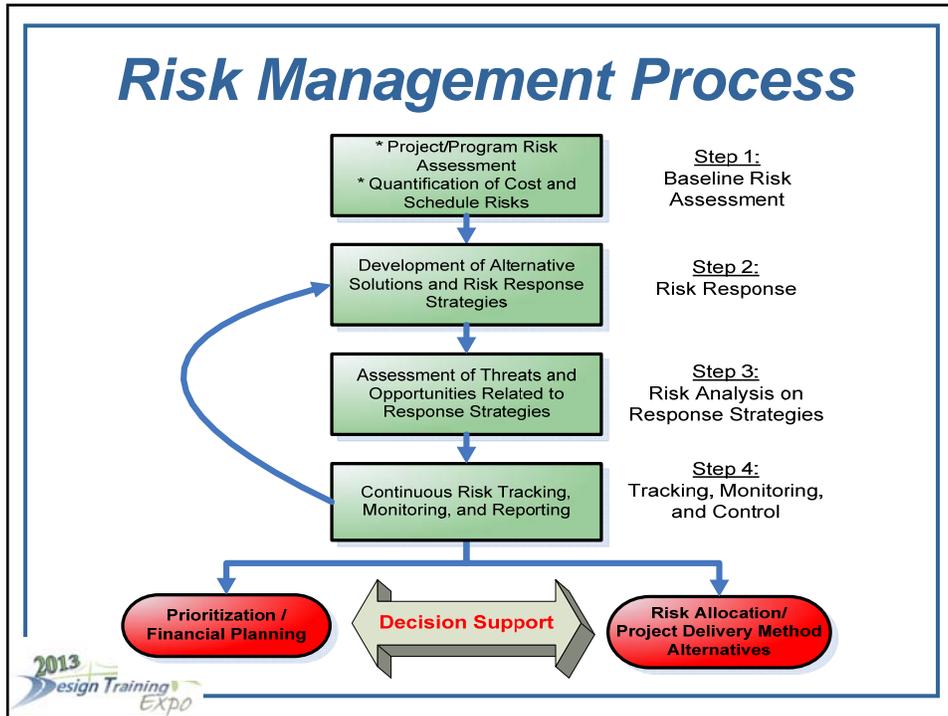
- ❑ Validation of Project Cost and Schedule
- ❑ Managed Risk Response Plan
 - Identification of high cost and schedule risk drivers
 - Reduced Contingency as project evolves
- ❑ Understand and Communicate Cash Flow Requirements in Financial Plans



When to Use Risk Management

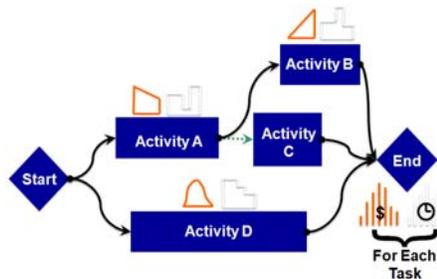
- ◆ Early planning and budgeting
- ◆ Evaluation of project delivery alternatives
- ◆ Financial Planning Support
- ◆ Establishing Risk Allocation between parties
- ◆ Preparation of project contract documents
- ◆ **Throughout Project Delivery Lifecycle**





Baseline for Risk Assessment

- Define purpose & need of project
- Establish scope of work
- Validate base cost estimate
- Develop project flowchart



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Before the Workshop...

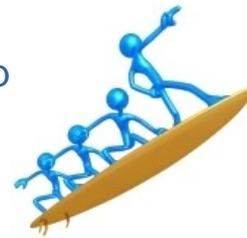
- ◆ **Preparation Session** with the project team to:
 - ✓ *Educate*
 - ✓ *Plan*
 - ✓ *Set the stage*
 - ✓ *Build expectations* with the project team.



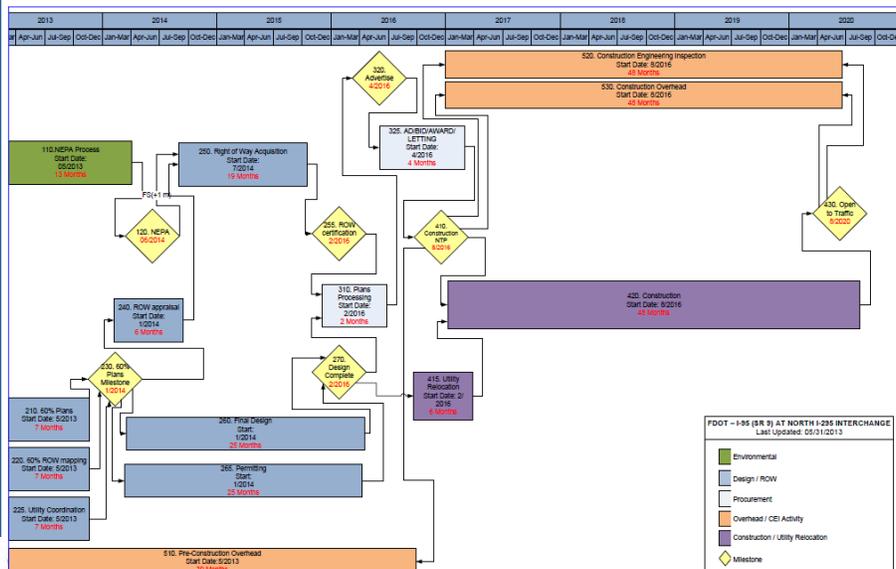
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Preparation Session

- ◆ Risk Analysis Process Overview
- ◆ Project Overview & Identify Risk Areas
- ◆ Develop Project Starter Risk List
- ◆ Create a flowchart of the project schedule
- ◆ Review Base Cost Estimate
- ◆ Assign tasks to the project team
- ◆ Set the agenda for the workshop



Project Schedule Review



Base Cost Variability Review

Common Terminology

Base Costs

Base Cost Estimate:

The Base Cost represents the cost which can reasonably be expected if the project materializes as planned. Base Costs are initially estimated by the Project Team and reviewed and validated during the Risk Workshop by the Cost Team and Subject Matter Experts.

Base Cost Uncertainty:

An estimate of the error or tolerance within the quantity or unit price of an item. The level of uncertainty is directly related to its position in the project life cycle: the earlier in the project development process, the greater the uncertainty; the closer to completion, the less uncertainty.

Cost Category	Activity	Base	Low	High
Hard Costs	EB Construction	\$278.08	-14%	7%
	LIFT Bridge - Structural W/ Fenders	\$134.80	-14%	3%
	APPROACH SPANS - Substructure	\$9.46	-15%	3%
	APPROACH SPANS - Superstructure	\$11.10	-11%	9%
	LIFT Bridge Mechanical	\$24.59	-10%	10%
	Demolition	\$11.00	-20%	5%
	Clear - 25 percent Highway	\$5.02	-15%	3%
	Electrical	\$9.00	-10%	10%
	Architectural (Control Room/Machine Room)	\$6.22	-10%	10%
	Architectural Treatments	\$4.00	-10%	10%
	Architectural Lighting	\$0.81	-10%	10%
	Other (Inmate, Water, Control, Flexi Roof)	\$1.56	-10%	10%
	Traffic Police Alignment	\$0.54	-5%	10%
	Misc. (Field Office & Equipment, Public Involvement, Maintenance & Operation, etc.)	\$1.01	-10%	10%
	Utility Relocation (Utility Estimate Cost)	\$0.00		
	Mobilization (3 percent)(Construction Items)	\$6.97	-14%	7%
	Design/Build Engineering (4 percent of CN \$)	\$9.44	-10%	10%
	Excuse Warranty (1.5 percent of CN Costs)	\$3.54	-10%	10%
	Construction Inspection	\$2.00	0%	75%
	Construction QC	\$3.00	0%	75%
Total EB Contract (Hard Costs)	\$293.87	-13%	8%	
Soft Costs	Preliminary Engineering Design (PEP Development/for Design Build)	\$3.00	-10%	0%
	District Construction RE Services and Eng	\$1.30	0%	50%
	Owner's Rep	\$0.30	-10%	10%
	Construction Phase Services (2 percent)	\$5.08	-10%	10%
	Total Engineering - non-OB (Soft Costs)	\$9.68	-9%	12%
Project Sub Total Project Costs	\$293.65	-12%	8%	



Base Cost Variability Review

Pay Items	Quantity			Unit Price			Total Amount		
	Low	Base	High	Low	Base	High	Low	Base	High
102-1	10%	10%	10%	\$107,238,808.30	\$115,458,199.93	\$124,297,809.79	\$10,723,880.83	\$11,545,819.99	\$12,429,780.98
101-1	8%	10%	12%	\$117,962,689.13	\$127,004,019.92	\$136,727,590.77	\$9,437,015.13	\$12,700,401.99	\$16,407,310.89
120-6	903,207,80948,368.19993,528.58			\$12.27	\$13.63	\$14.99	\$11,079,650.08	\$12,926,258.43	\$14,895,974.00
160-4	480,762.33504,800.45528,838.56			\$2.75	\$2.75	\$2.75	\$1,322,096.41	\$1,388,201.23	\$1,454,306.05
285-704	5,341.52	5,608.60	5,875.67	\$9.81	\$10.90	\$11.99	\$52,400.31	\$61,133.70	\$70,449.31
285-707	199,159.20209,117.16219,075.12			\$13.14	\$14.60	\$16.06	\$2,616,951.89	\$3,053,110.54	\$3,518,346.43
285-709	166,639.80174,971.79183,303.78			\$14.85	\$16.50	\$18.15	\$2,474,601.03	\$2,887,034.54	\$3,326,963.61
285-711	90,469.49	94,992.96	99,516.44	\$17.10	\$19.00	\$20.90	\$1,547,028.28	\$1,804,866.33	\$2,079,893.58
285-712	9,958.28	10,456.19	10,954.11	\$17.64	\$19.60	\$21.56	\$175,664.06	\$204,941.40	\$236,170.57
327-70-1	3,133.39	3,290.06	3,446.73	\$4.50	\$4.50	\$4.50	\$14,100.26	\$14,805.27	\$15,510.28
327-70-4	7,520.12	7,896.13	8,272.13	\$4.50	\$4.50	\$4.50	\$33,840.54	\$35,532.57	\$37,224.59
327-70-5	6,394.43	6,714.15	7,033.87	\$4.50	\$4.50	\$4.50	\$28,774.94	\$30,213.68	\$31,652.43
334-1-xx	117,245.03123,107.28128,969.53			\$82.02	\$86.34	\$90.66	\$9,616,789.10	\$10,629,082.68	\$11,691,990.95
337-7-xx	19,750.22	20,737.73	21,725.24	\$93.80	\$105.00	\$115.00	\$1,852,570.64	\$2,177,461.76	\$2,498,402.83



Base Cost Variability Review

Construction Contract	\$127,549,704	\$139,854,422	\$153,284,902	-9%	10%
Structures (inc approach slabs)	\$53,984,801	\$56,684,041	\$59,383,281	40.5%	
Pavement	\$19,734,817	\$22,286,384	\$24,960,911	15.9%	
Earthwork	\$11,111,880	\$12,960,099	\$14,931,426	9.3%	
MOB	\$9,437,015	\$12,700,402	\$16,407,311	9.1%	
MOT	\$10,723,881	\$11,545,820	\$12,429,781	8.3%	
Barrier Wall (inc median inlets)	\$8,562,779	\$8,990,917	\$9,419,056	6.4%	
Retaining/MSE Walls & Railing	\$6,629,095	\$6,960,550	\$7,666,155	5.0%	
Drainage	\$2,523,303	\$2,649,468	\$2,775,633	1.9%	
Removal of Existing Structures	\$1,866,029	\$1,959,330	\$2,052,631	1.4%	
Clearing & Grubbing	\$1,108,967	\$1,164,415	\$1,219,864	0.8%	
Toll Collection Equipment	\$618,000	\$648,900	\$679,800	0.5%	
Signing & Pavement Markings	\$570,829	\$599,370	\$627,912	0.4%	
Erosion Control	\$442,460	\$464,584	\$486,707	0.3%	
Miscellaneous Roadway	\$85,849	\$90,142	\$94,434	0.1%	
Initial Contingency	\$150,000	\$150,000	\$150,000	0.1%	



Base Cost Variability Review

Component	Base Cost Estimate			Variability	
	Low	Base	High	From	To
PD&E	\$64,000	\$80,000	\$96,000	-20%	20%
Design PE	\$7,061,000	\$7,561,000	\$8,061,000	-7%	7%
Post-design PE	\$1,275,497	\$2,797,088	\$4,598,547	-54%	64%
Construction Contract	\$127,549,704	\$139,854,422	\$153,284,902	-9%	10%
Construction Support (CEI)	\$13,846,970	\$18,573,803	\$24,084,735	-25%	30%
Utility Costs	\$1,250,000	\$1,250,000	\$1,250,000	0%	0%
Railroad Costs	\$288,000	\$288,000	\$504,000	0%	75%
Right of Way Costs	\$4,772,624	\$5,011,255	\$5,249,886	-5%	5%
Environmental Mitigation	\$1,000,000	\$1,000,000	\$2,000,000	0%	100%
Project Total	\$157,107,796	\$176,415,568	\$199,129,070	-11%	13%



Workshop Details



Objectives of the Workshops

- ◆ Identify the project risk to account for uncertainty surrounding scope, cost and schedule;
- ◆ Assess the project risks by quantifying the affects on the cost and schedule:
 - ✓ Likelihood of occurrence
 - ✓ Impact
- ◆ Analyze the project risks through modeling to develop a baseline risk assessment.
- ◆ Produce a Risk Register for future monitoring of identified project risks.



Project Team Roles

- ◆ Provide Project Information:
 - ✓ Project location maps, overheads, etc.
 - ✓ Project cost estimate and backup
 - ✓ Design and construction schedule or flow chart
 - ✓ Develop comprehensive list of risks, typically using starter risk list
- ◆ Workshop Support:
 - ✓ Provide input on risk identifying, quantification and mitigate
 - ✓ Provide information on project history and key decisions as these items come up in discussion



Who Should Attend Workshop

- ◆ Project Manager
- ◆ External Subject Matter Experts
- ◆ Internal and External Stakeholders
- ◆ Disciplines
 - ✓ Construction
 - ✓ Bridge & Structures
 - ✓ Environmental
 - ✓ Right of Way
 - ✓ Geotechnical
 - ✓ Construction
 - ✓ Utilities
 - ✓ Local agencies
 - ✓ Others depending on project scope



Workshop Approach

- ◆ Collaborative team approach
- ◆ 2 to 3 day structured workshop
- ◆ Identify & quantify threats and opportunities
- ◆ Identify risk management strategies



Workshop

- ◆ Risk Lead presents a CRA process Overview
- ◆ Project Team presents the project
- ◆ Base cost presented to and validated by the group
- ◆ Base schedule presented to and validated by group



Workshop

- ◆ Sessions by Functional Area
 - ✓ Identify Risks
 - ✓ Quantify Risks
 - ✓ Discuss possible Mitigation
- ◆ Build Consensus of various stakeholders
- ◆ Engage the Internal and External Subject Matter Experts
- ◆ Workshop Wrap-up



Workshop

- ◆ Typical Functional Sessions
 - ✓ Structures/Geotechnical
 - ✓ Roadway Design
 - ✓ Drainage
 - ✓ Environmental
 - ✓ Right-of- Way
 - ✓ Utilities
 - ✓ Construction
 - ✓ Maintenance of Traffic
 - ✓ Management, Funding & Market Conditions

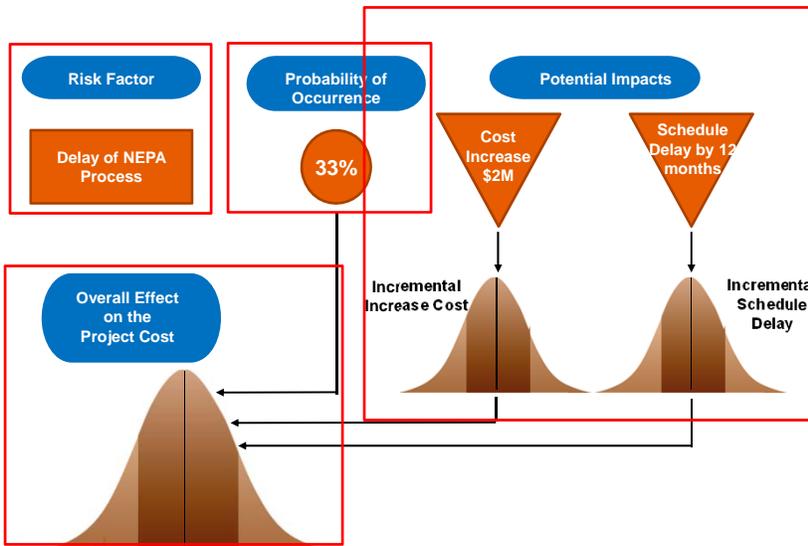


Risk Register: Risk Quantification

Risk Register for I-4					Initial Risk Quantification														
Risk ID	G-Ref	Risk Agency Category	Activity Impacted	Risk Name	Description	Initial Probability of Occurrence (%)	Cost Risk Information (Millions \$)			Schedule Risk Information (Months)									
							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) Sched. Use	Initial P(M) Sched. Use	Initial P(H) Sched. Use	
1	DES-01	Design, Structures, and Details Risk	118	Add South Street Modification	Need need to make plan work. Additional construction cost. Current Risk is being purchased coverage from AIG. Estimate: \$93.4M plus ROW (which is already included in the bid for the contract). Includes potential ability for SDCP to pursue an ability to significantly affect the schedule. Should require increased spacing of "green" construction log.	100%	\$93.40	\$93.40	\$93.40					0	0	0			
12	NSA	Design, Structures, and Details Risk	125, 126, 127, 128, 129 (Cost, SDR Schedule)	Issues in obtaining agreements with local governments (A)	Issue: Grand National complex, South of Houston, which is a public land parcel. Delay in agreement to obtain agreement, and/or some costs of the agreement (due to local government costs). Potential for delay, including potential to be placed in an agreement (due to cost of delay). To delay and then no agreement (due to cost).	85%	\$0.00	\$0.00	\$0.00					0	0	0			



Quantifying Individual Risks



Risk Management Process

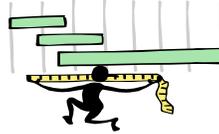
Assess



Probability

40%

x



Impact to Schedule

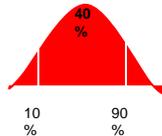
60 Days

and/or

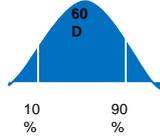


Impact to Cost

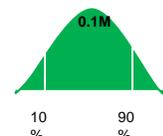
\$100,000



10% 90%



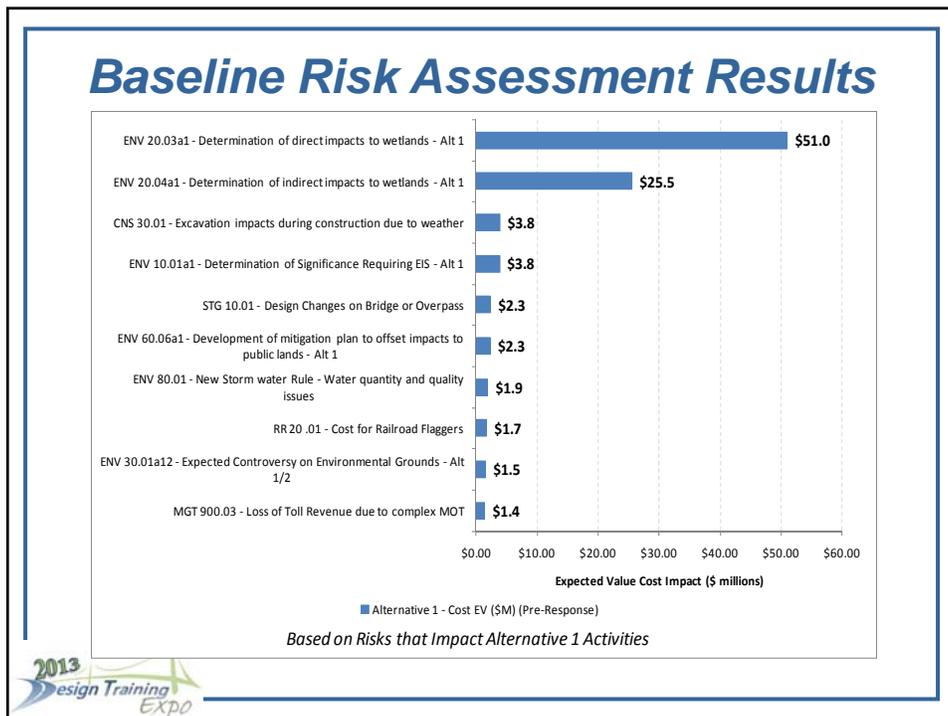
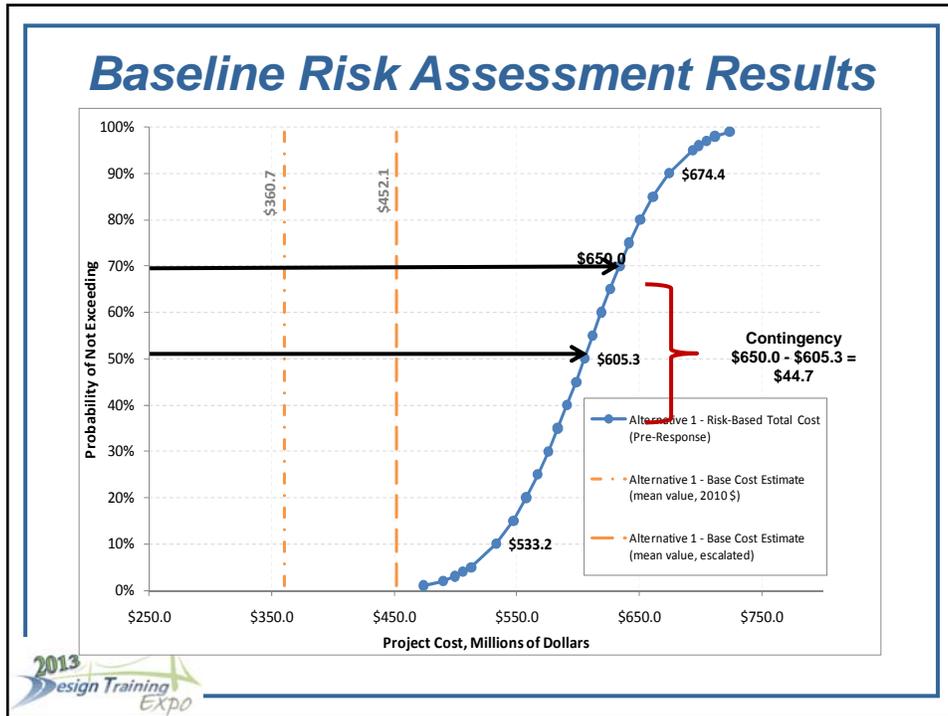
10% 90%



10% 90%

Modeling and Presentation

- ◆ Preliminary results are generated and presented to project team for feedback & review.
- ◆ Results are finalized and presented to management
 - ✓ Risk based cost and schedule estimates
 - ✓ Ranking of key drivers of risks



Workshop Deliverables

- ◆ Final report detailing the results of the workshop
- ◆ Final Risk Register for Project Manager to use managing the identified risks



References

- Project Management Handbook Chapter 19
<http://www.dot.state.fl.us/projectmanagementoffice/PMHandbook/pmhandbookindex.shtm>
- Washington State Department of Transportation
<http://www.wsdot.wa.gov/Projects/ProjectMgmt/RiskAssessment/>
- FHWA Risk Assessment
<http://international.fhwa.dot.gov/riskassess/index.cfm>
http://www.fhwa.dot.gov/ipd/project_delivery/resources/risk_management/

Summary

- ◆ Pre-workshop Activities
 - ✓ Defined risk, risk analysis & risk management
 - ✓ Identified activities prior to a workshop
- ◆ Risk Analysis Workshop
 - ✓ Assessment
 - ✓ Workshops



Risk Management



“Hope is not a Strategy”

Questions?

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