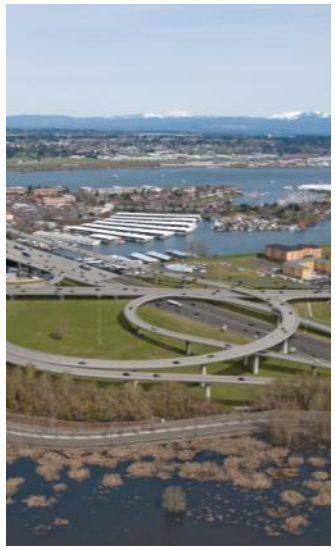
CRAVE™

2012 CSVA Conference
October 25, 2012



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HDR

Addressing Cost and Schedule Concerns

Usual Questions

- How much will it cost?
- How long will it take?
- Why does it cost that much?
- Why does it take that long?

Analysis Needs

- Risk Identification
- Qualitative & Quantitative Risk Analysis
- Value Engineering & Mitigation Strategies
- Risk Monitoring & Control

What is CRAVE™?

- Cost Risk Analysis + Value Engineering
  - Innovative and Unique process
    - Combines these two tools to assist with project delivery

What is CRAVE™?

- CRAVE™ is used to assist project delivery as well as minimize and mitigate quantified risks

- Outputs are:
  - Risk Management Plan
  - Value Engineering recommendations

Why we created CRAVE™

- Risk assessment workshops would provide valuable information about what could go wrong with my project but would fall short of providing solutions on what to do about it.

Why we created CRAVE™

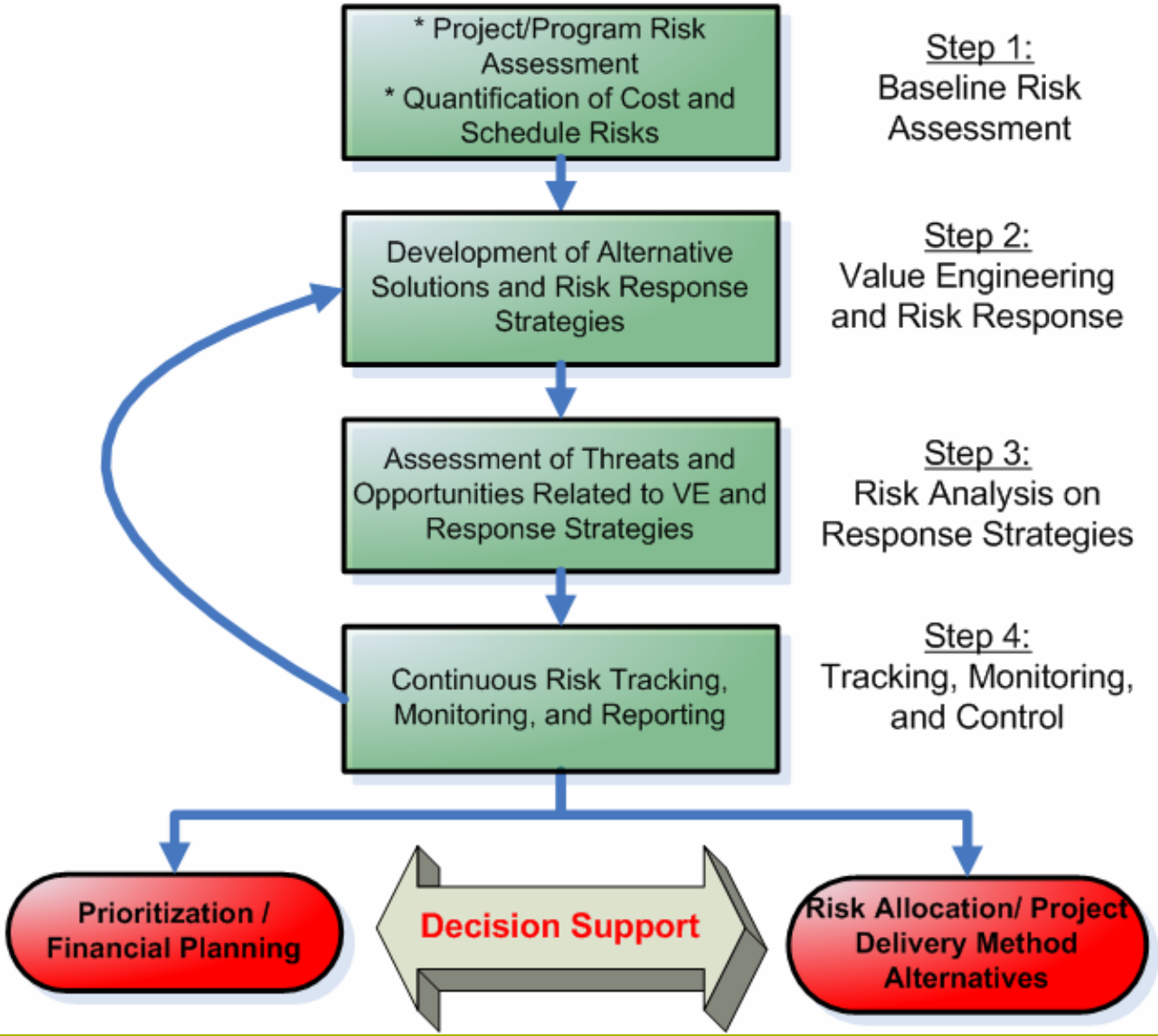
- Great ideas would come up during risk assessment workshops and would be set aside as potential VE ideas and never recorded

- The same subject matter experts are required for both process
- A VE recommendation could add risk to delivering a project

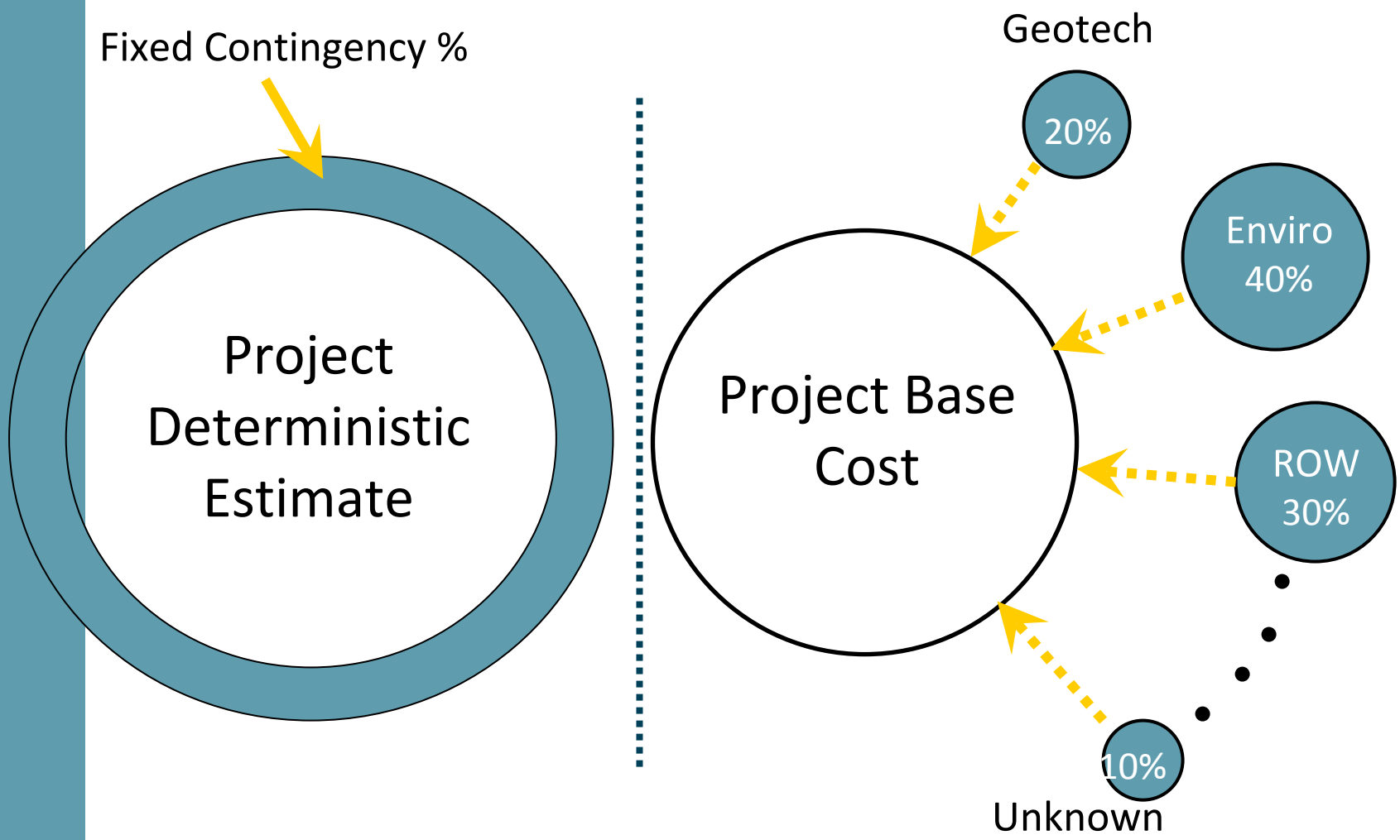
Proven Process

- Proven results on a wide range of projects, including bridges, highways, heavy and light rail alignments, ports, airports, tunnels, water treatment facilities, and pipelines
- Won national awards for process

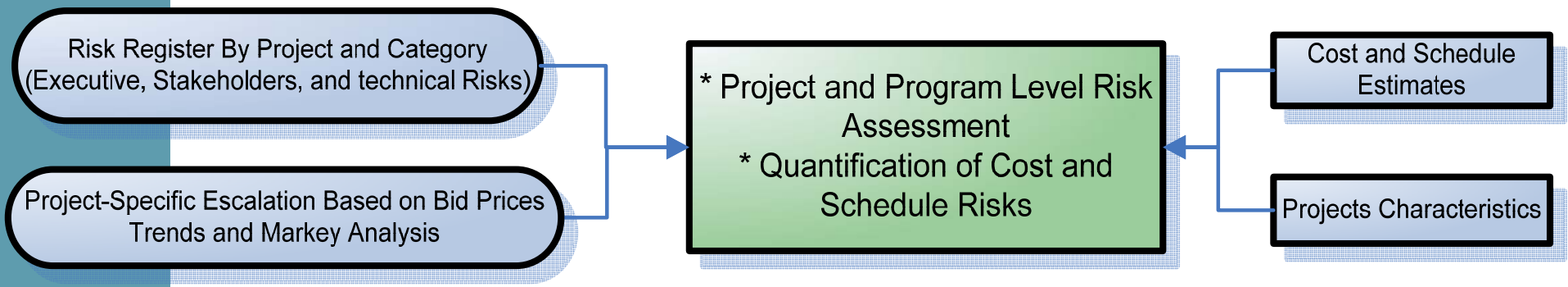
How CRAVE™ works

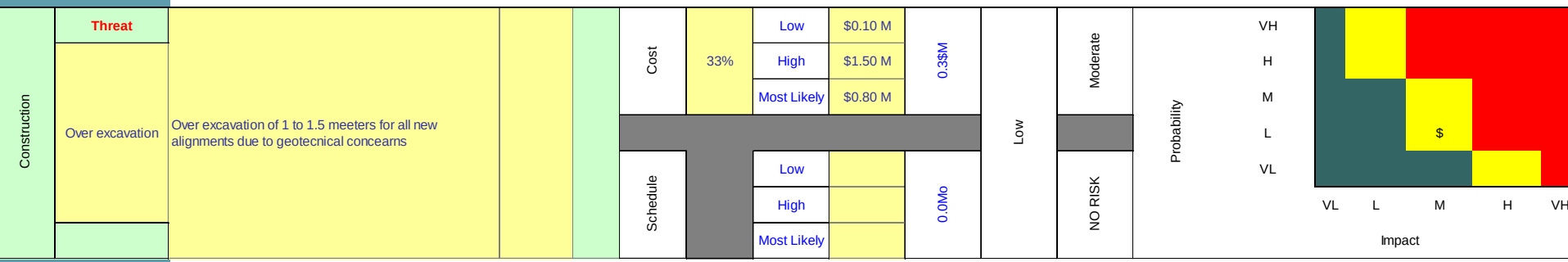


Traditional vs. Risk-Based Approach

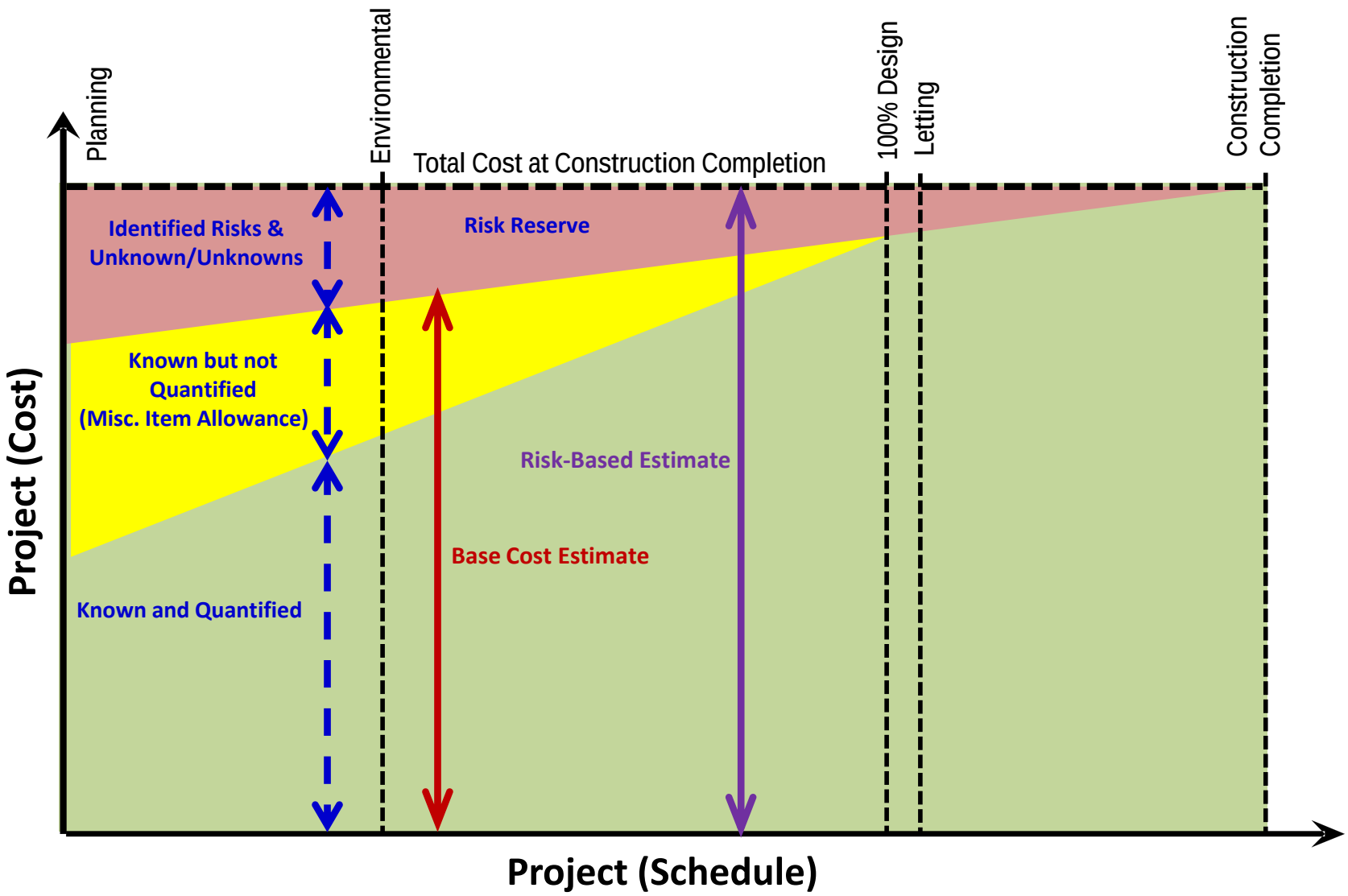


CRAVE™ Process: Step 1



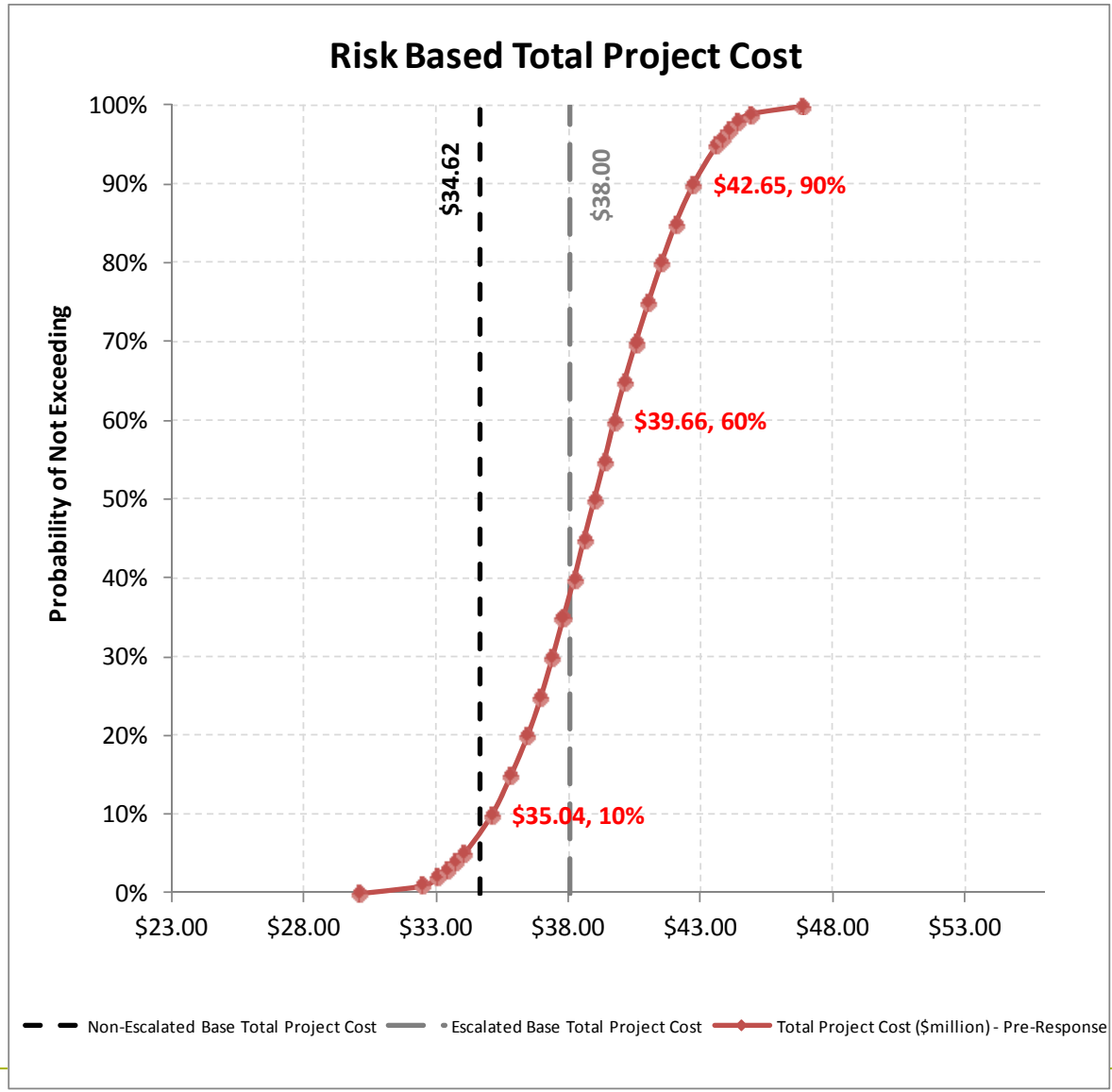


CRAVE™ Process: Step 1



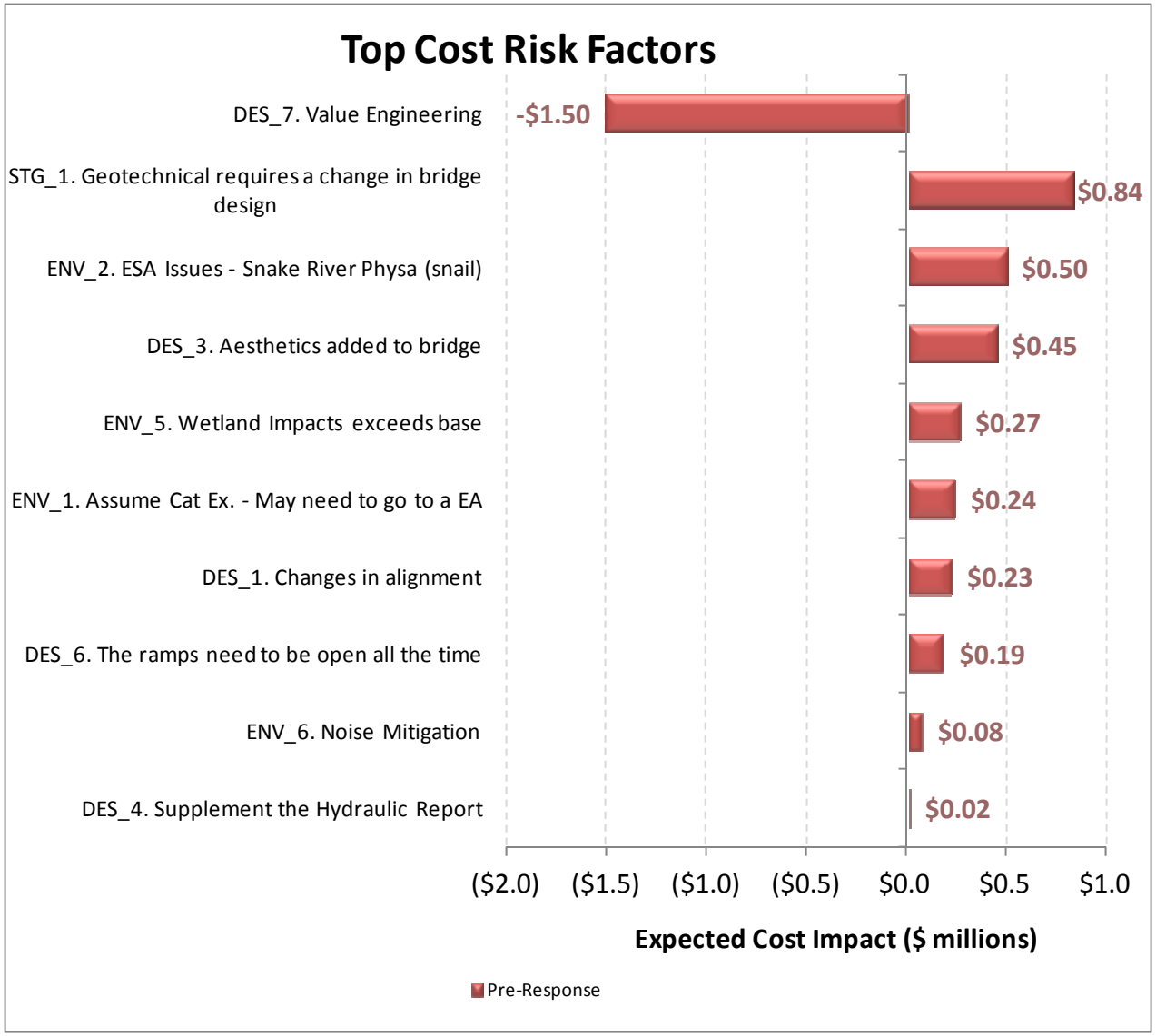
CRAVE™ Process: Step 1

Non-Mitigated Risk-Based Cost Estimates



CRAVE™ Process: Step 1

Prioritization of Risks



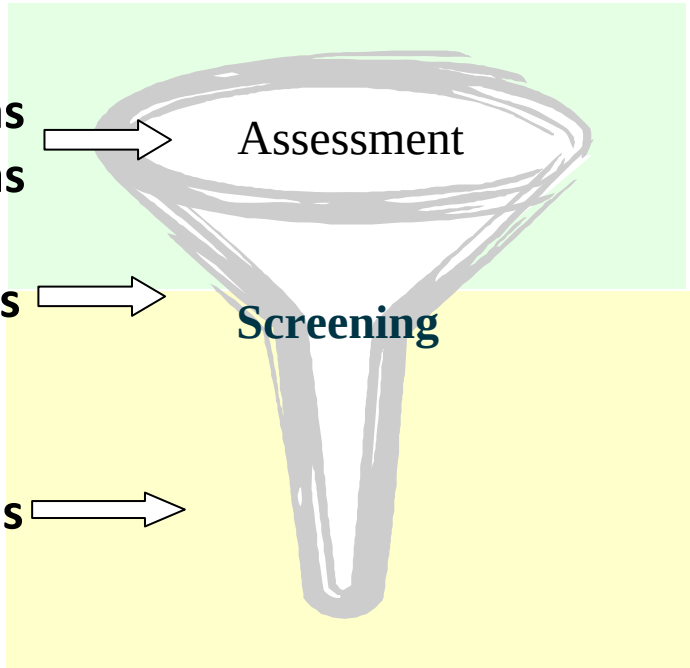
CRAVE™ Process: Step 2

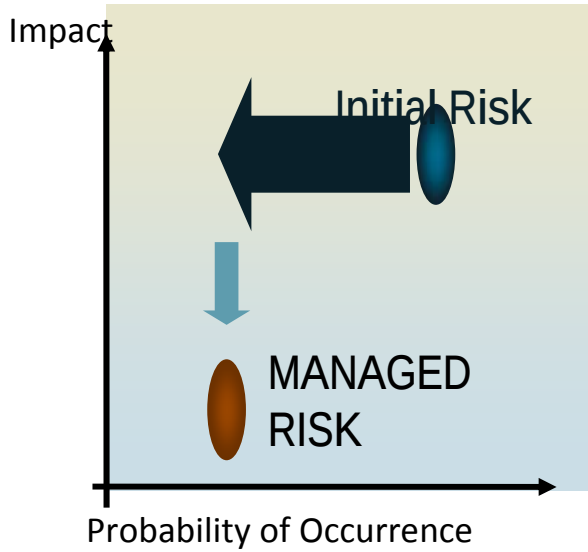
Value Engineering Assessment

High cost areas
Generate ideas

Evaluate ideas

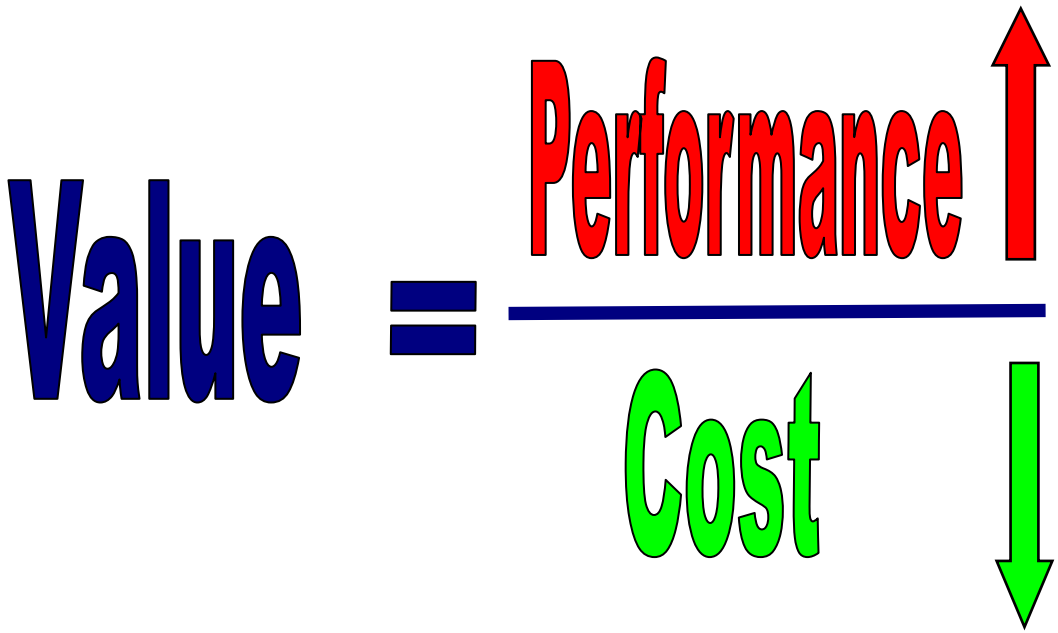
Quantify ideas





Performance Based VE

Value Engineering has traditionally been perceived as an effective means for reducing project costs. This paradigm only addresses one part of the value equation, oftentimes at the expense of overlooking the role that VE can play with regard to improving project performance.



Performance Attributes

Establishing the Goals and Objectives of VE Study is critical to its outcome.

Defining “Performance Attributes” will give the VE Team a better understanding of the project’s purpose and need.

Typical Highway Performance Attributes

- **Mainline Operations**
- **Local Operations**
- **Maintainability**
- **Construction Impacts**
- **Environmental Impacts**
- **Project Schedule**

Alternative Analysis

PERFORMANCE ATTRIBUTE MATRIX

Midway Road - CR 712 Proejct

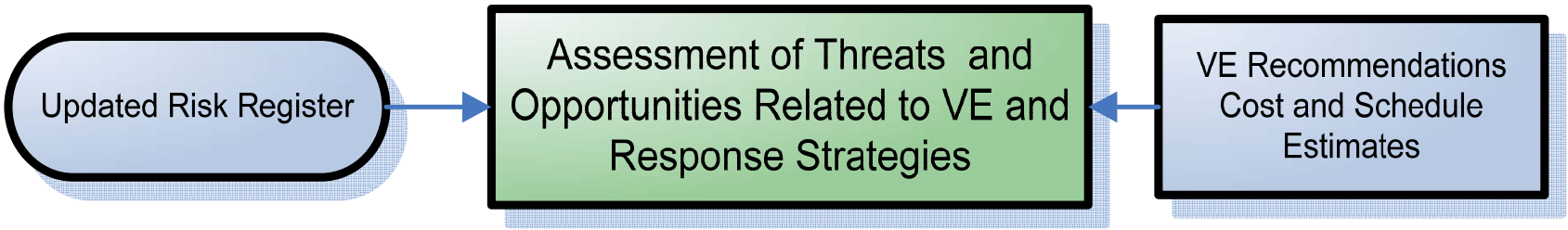
Which attribute provides the greatest benefit to the project relative to purpose and need?								TOTAL	%
Mainline Operations	**A**	A	A	A	A/E	A	A	6.5	24%
Local Operations	**B**	B	B	B	B/E	B	B	5.5	20%
Maintainability	**C**	C	C	E	C	C		4.0	14%
Construction Impacts	**D**	E	D/F	G				1.5	5%
Environmental Impacts	**E**	E	E					6.0	21%
Project Schedule	**F**	G						1.5	5%
Risks	**G**							3.0	11%
								28.0	100%

A	More Important
A/B	Equally Important

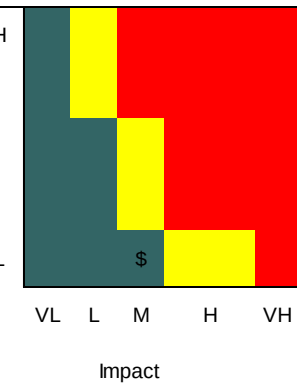
OVERALL PERFORMANCE		Performance (P)	% Change Performance	Cost (C)	% Change Cost	Value Index (P/C)	% Value Improvement
	Baseline	500		$235.7		2.12	
1	Reduce Risk	529	6%	$235.7	0.0%	2.24	6%
2	Cost Estimate	500	0%	$165.7	29.7%	3.02	42%
3	Construction staging	562	12%	$165.7	29.7%	3.39	60%
4	TH 14/15 I/C	612	22%	$235.3	0.2%	2.60	23%
5	Median Barrier	606	21%	$236.3	-0.2%	2.56	21%
6	Roadway between TH 15 & CSAH 37	562	12%	$232.8	1.2%	2.41	14%
7	Courtland I/C	504	1%	$233.0	1.2%	2.16	2%
8	Nicollet I/C	503	1%	$234.8	0.4%	2.14	1%
9	561st Intersection	599	20%	$235.5	0.1%	2.54	20%
10	Project phasing limits	511	2%	$234.9	0.4%	2.18	3%
Total		**549**	**10%**	**$158.0**	**33.0%**	**3.47**	**64%**

CRAVE™ Process: Step 3

Risk Analysis on Risk Response Strategies

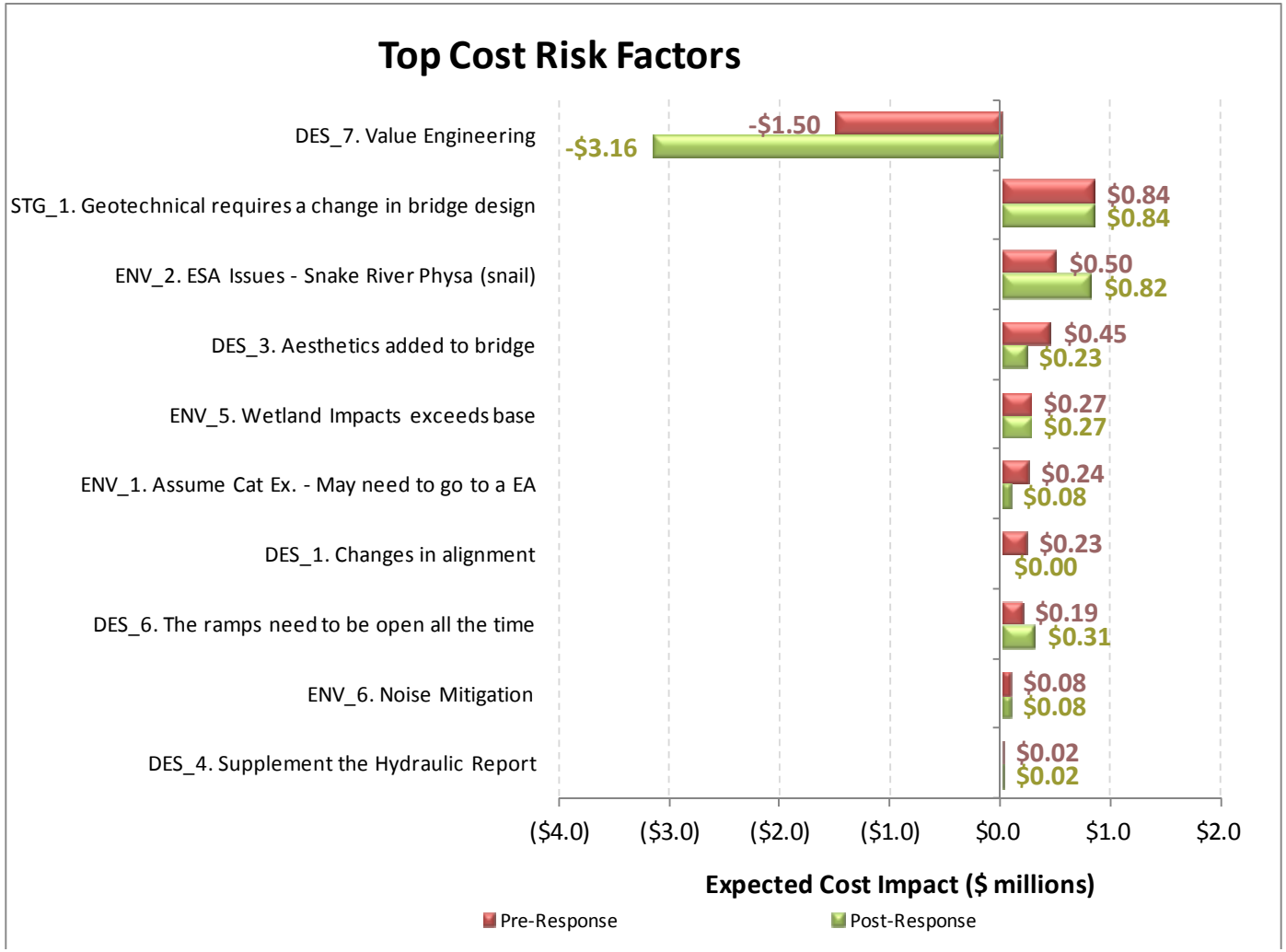


Mitigation												
Perform geotechnical explorations and soil sampling. Define the areas that may need over excavation and update the base cost acordinly	Threat	10%	Low	$0.10 M	0.1$M		$0.02 M	Very Low	Moderate	Probability	VH	
			High	$1.50 M			$0.35 M				H	
			Most Likely	$0.80 M			$0.18 M				M	
			Low		0.0Mo		0.00Mo				L	
			High				0.00Mo		NO RISK		VL	
			Most Likely				0.00Mo					



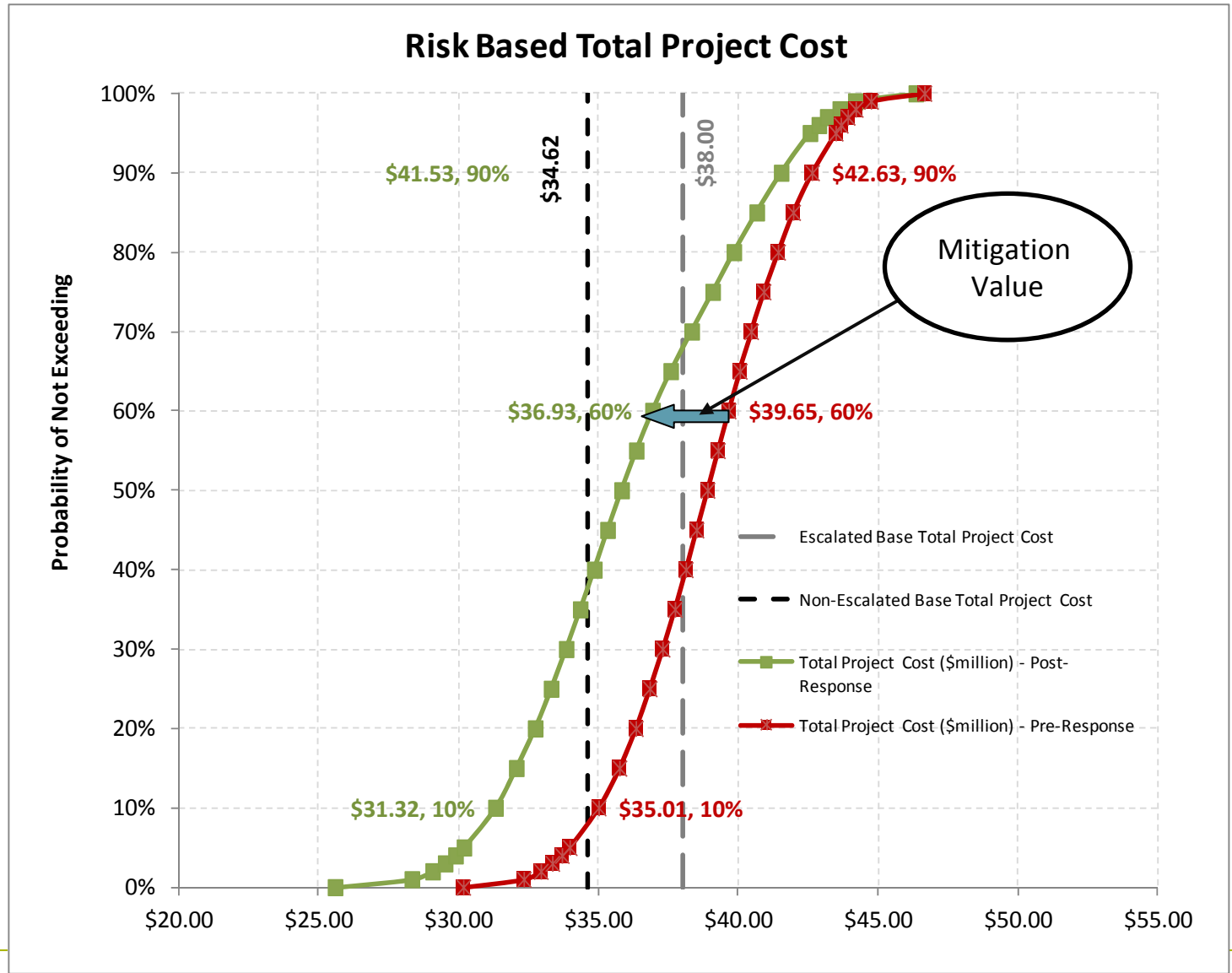
CRAVE™ Process: Step 3

Quantification/Mitigation for Each Risk



CRAVE™ Process: Step 3

Quantifying Mitigation Strategies at the Project Level



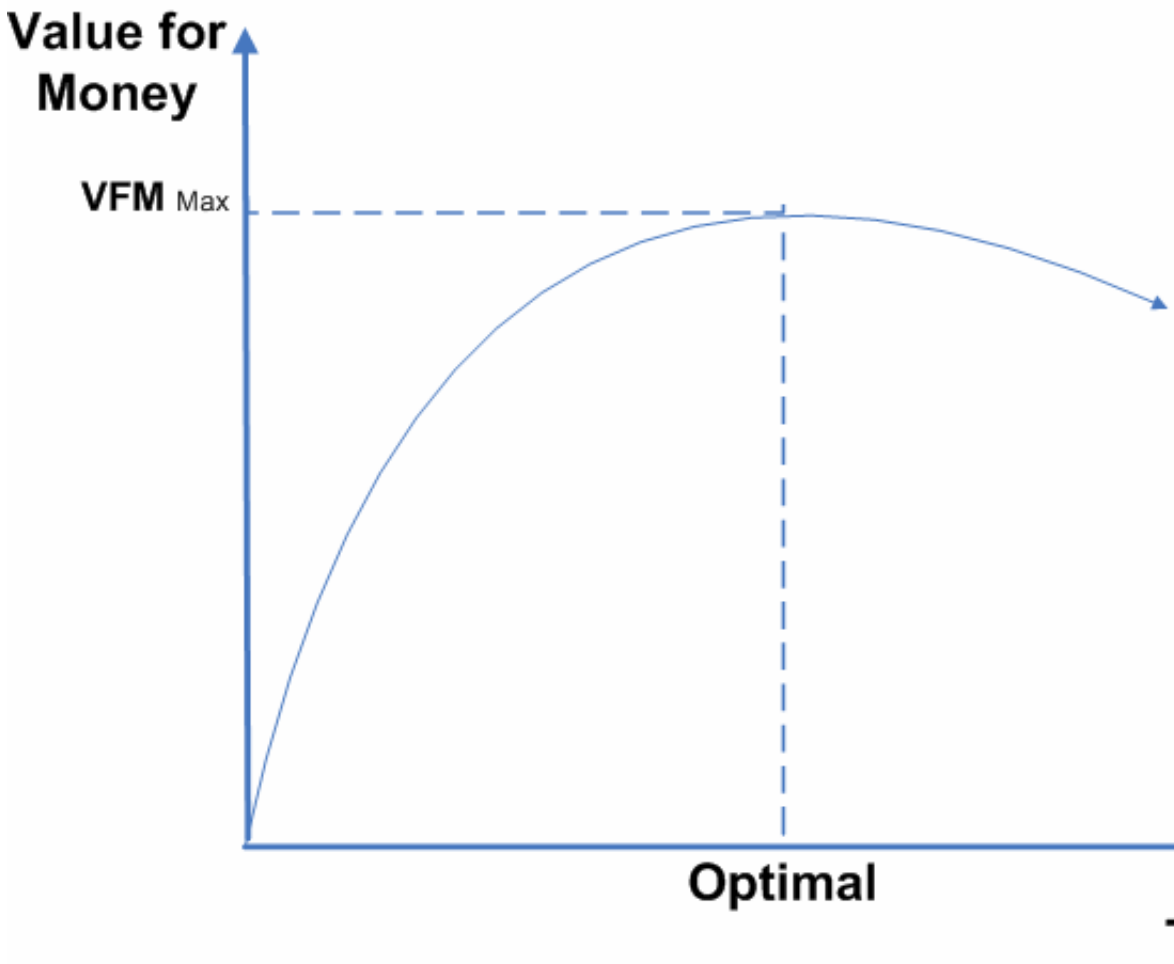
CRAVE™ Process: Step 4

Tracking, Monitoring, and Control

Avoiding Denial

CRAVE™ Process: Step 4

Informed Risk Allocation

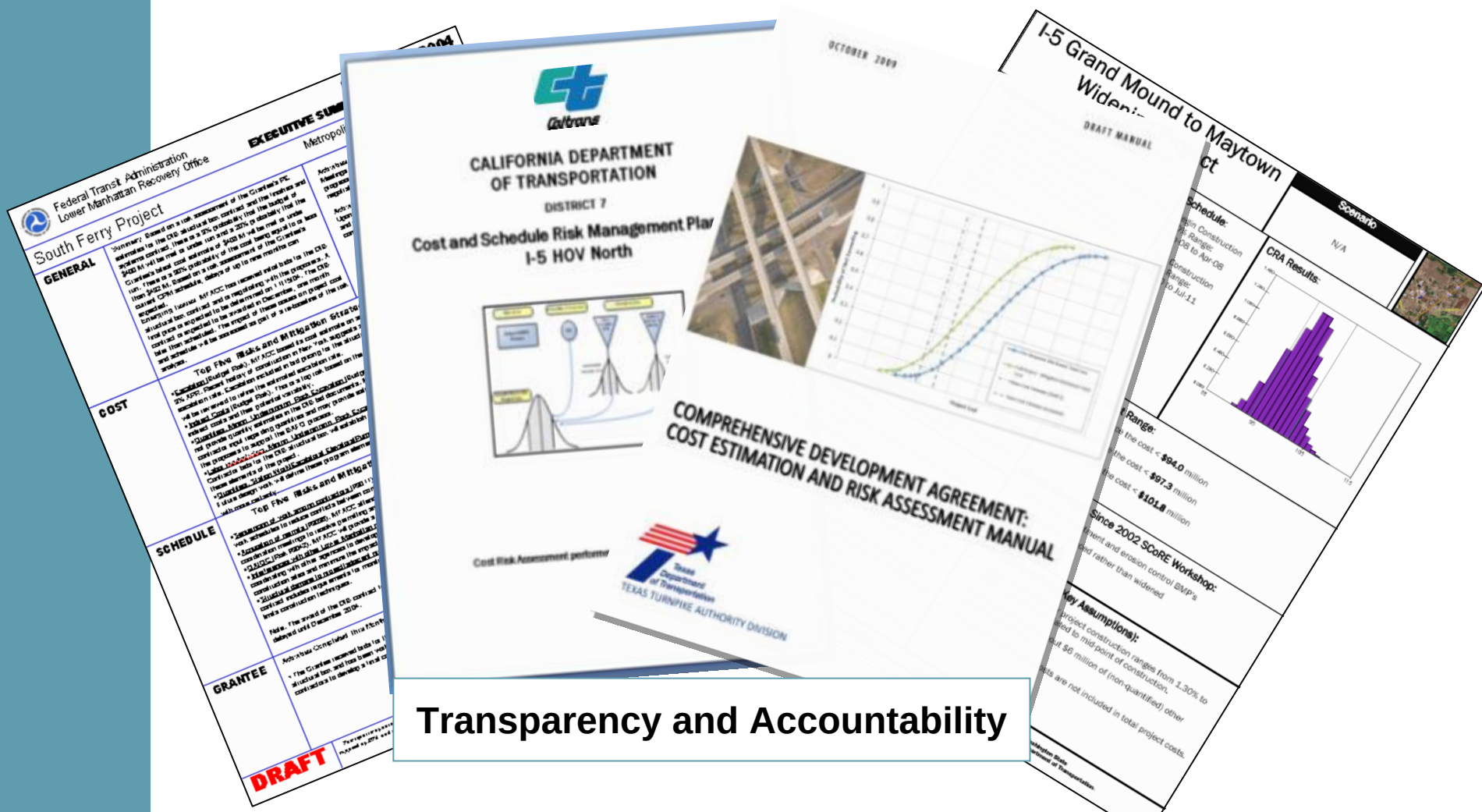


Contractors do not take risks.

They price it !

CRAVE™ Process: Step 4

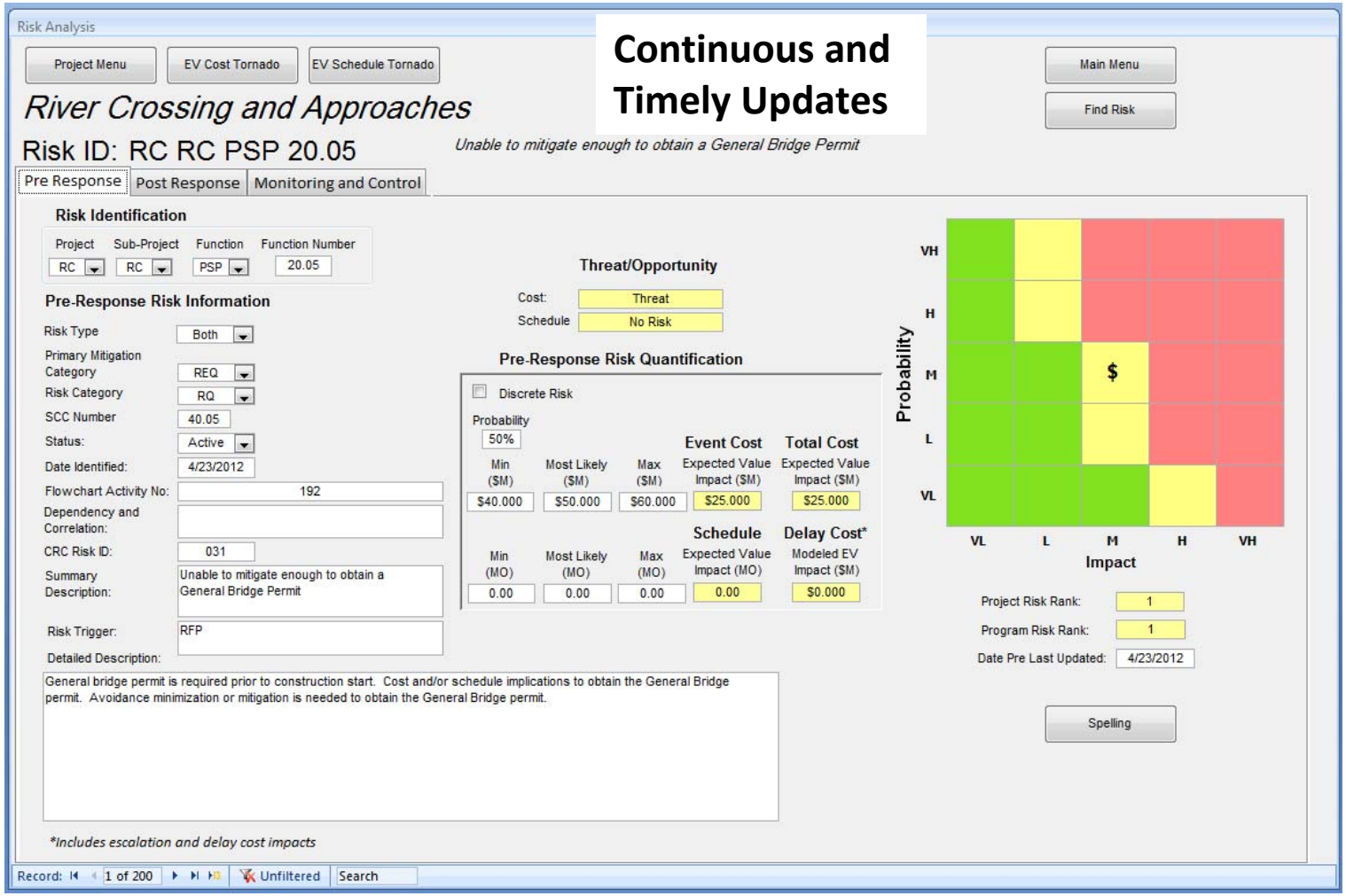
Reporting - Comprehensive, Technical, and Continuous



Transparency and Accountability

CRAVE™ Process: Step 4

Effective Tracking Tools



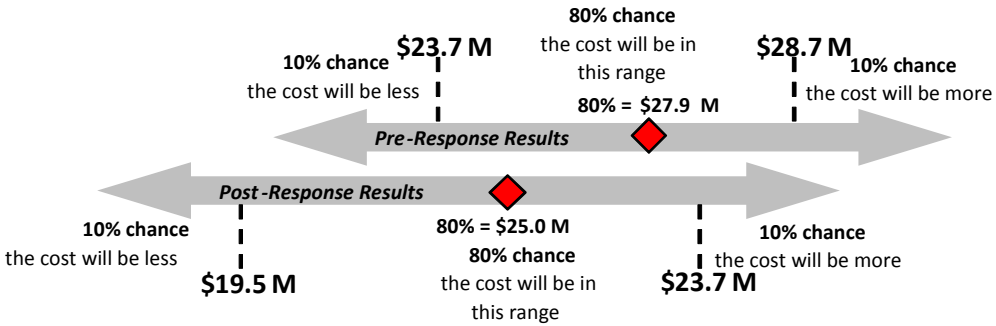
Continuous and Timely Updates

CRAVE™ Workshop Case Study

July 23-27, 2012

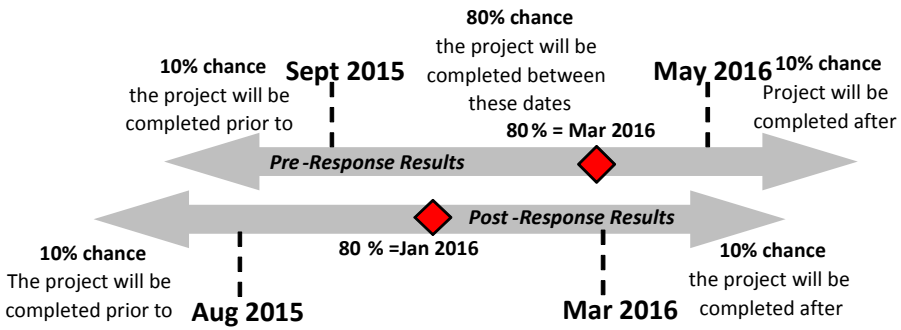
Results

Project Construction Cost Range



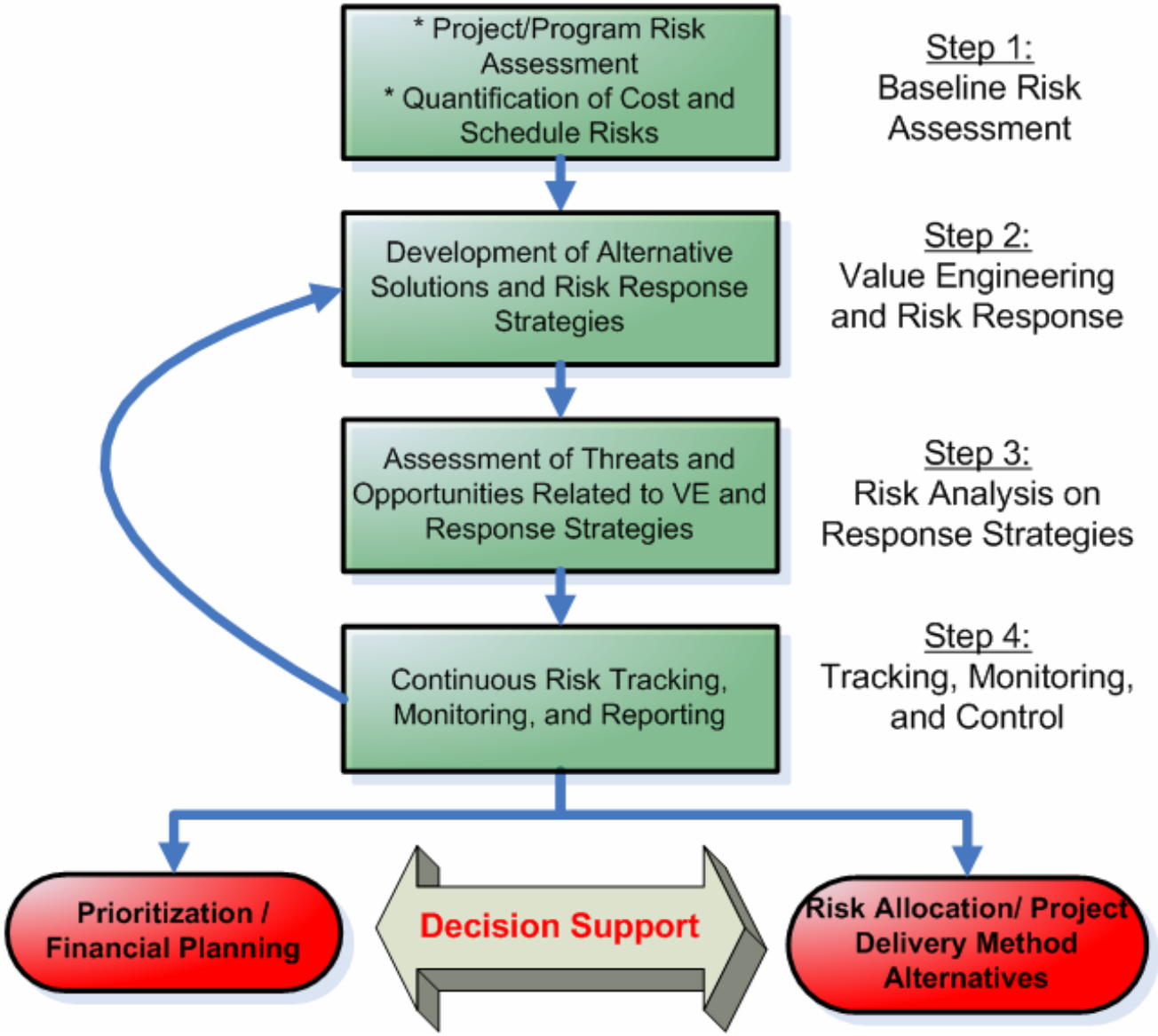
(opinion of probable cost range as of July 2012 CRAVE™)

Project Completion Schedule Range



(opinion of probable schedule range as of July 2012 CRAVE™)

How we got there ?



CRAVE™ Process – Step 1

Gather the Known's and Assumptions

Baseline Assumptions	Value
Right-of-Way Costs ($M)	$0.40 million
Pre-Construction Costs ($M)	$3.00 million
Notice to Proceed (date)	3/1/2014
Construction Duration (months)	18.0 months
Construction Costs ($M)	$21.25 million

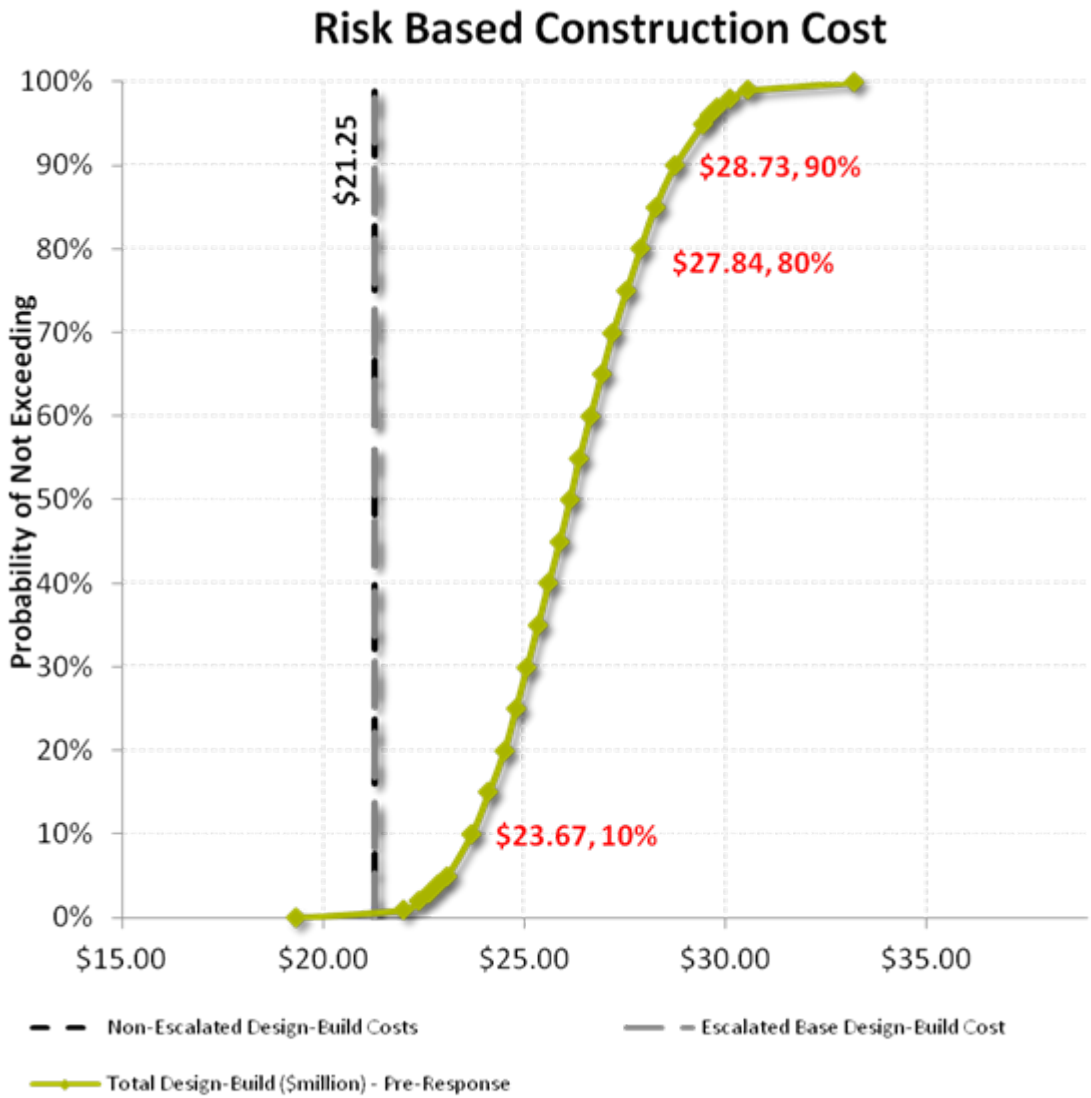
Validate costs and schedule

CRAVE Process – Step 1

The CRAVE™ Team identified independent risks that pose potential schedule and/or cost threats and opportunities

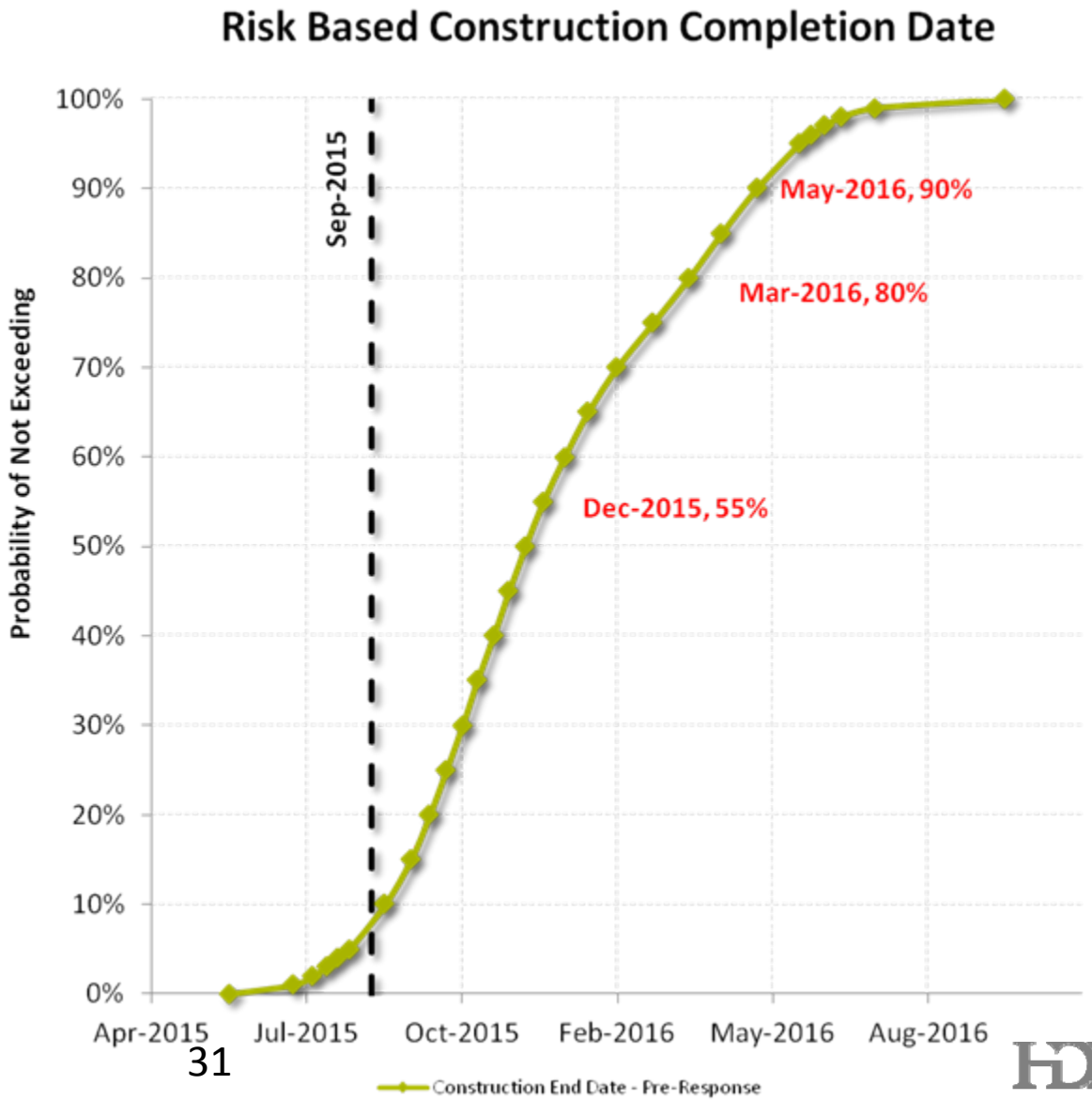
- Design uncertainty (scope creep)
- Differing site conditions in construction
- Removal of existing Holt Road Bridge
- Construction staging outside of HWY 401
- Over excavation required
- Value Engineering opportunities
- Property impacts
- Revised profiles
- Coordination with other projects
- Market Conditions
- Design delay due to EA push
- Known species at risk during construction
- Known and unknown utility impacts

Pre-Mitigated Construction Cost

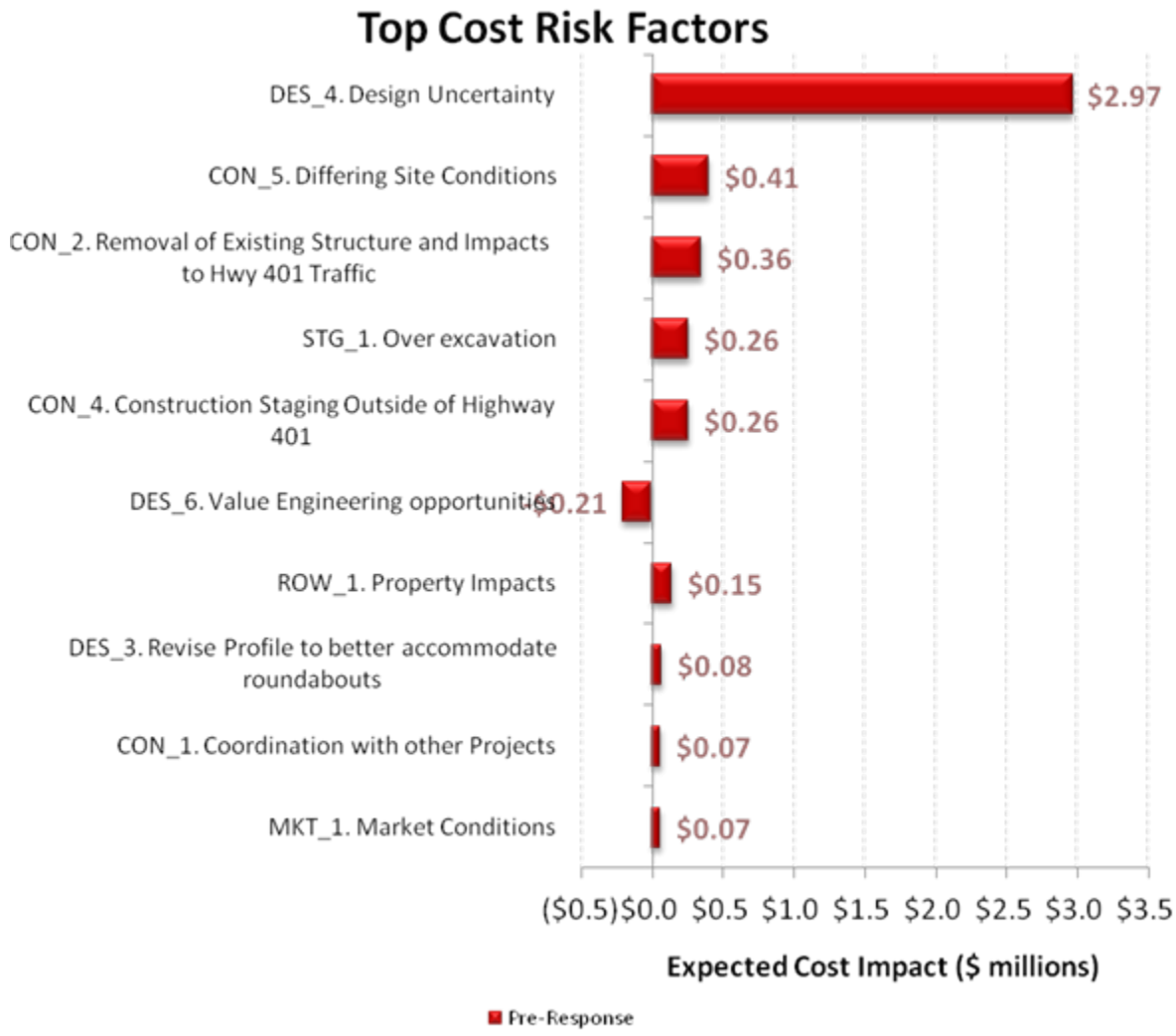


Pre-mitigated Schedule

55% chance of completion by December 2015



Candidates for Cost Mitigation



"What gets measured, gets managed"

CRAVE Process – Step 2

Value Engineering and Risk Mitigation

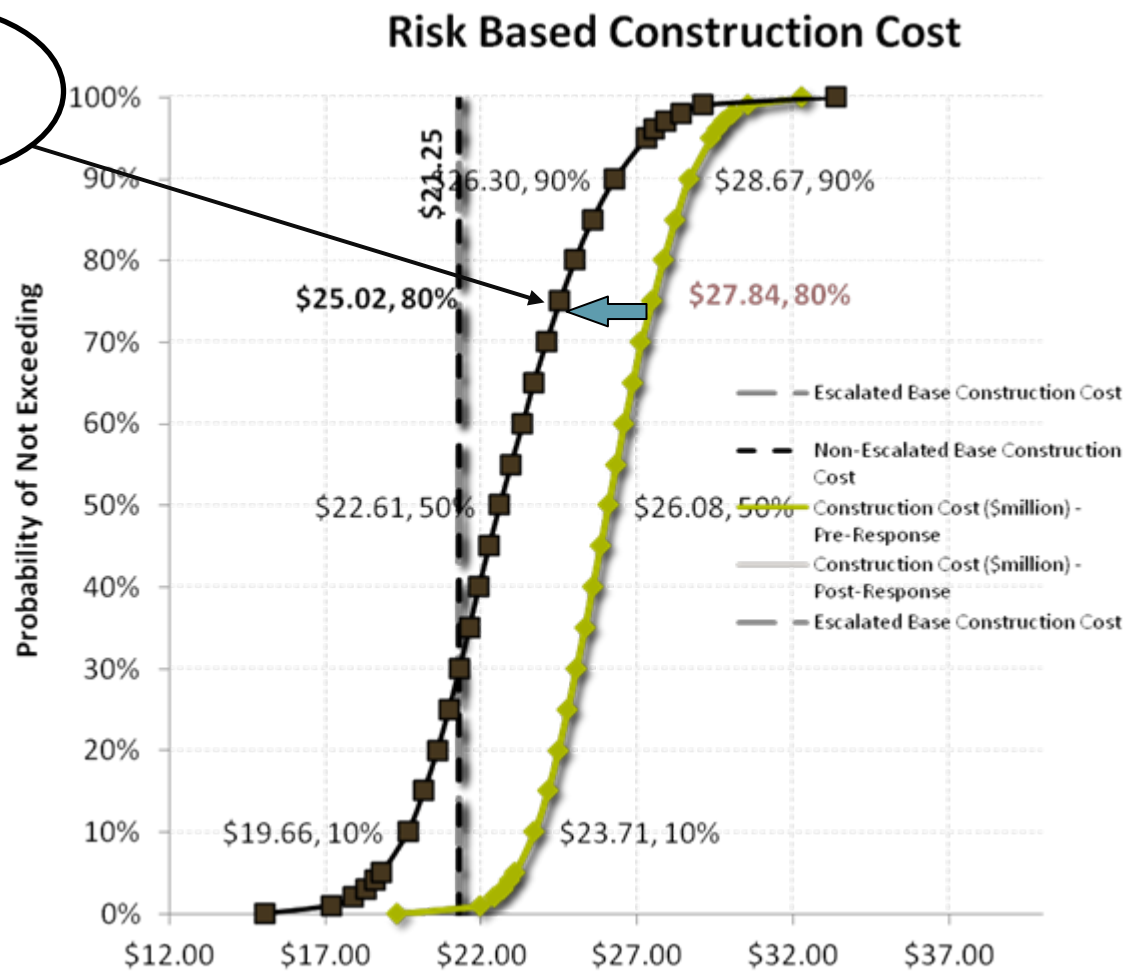
Summary of Recommendations *Highway 401 / Holt Road Interchange*			
Idea No.	**Description**	**Cost Savings/Added**	**Performance Improvement**
SR-2a / SR-12	Structure Type	-1.82M	0%
RS-3	Optimize Profile for Service Road	-0.30M	-1%
RB-1	Bridge Removal	-0.23M	+17%
RI-5 / R1-12	Roundabout Revision	-0.18M	+7%
RI-8	Remove Loop Ramp	-1.88M	+13%
RI-16a	Tight Diamond with Roundabouts	-0.30M	+5.4%
RI-17	Shift Interchange West	+0.20M	+2.4%

CRAVE™ Process: Step 3

Quantification of Mitigated Strategies & VE Recommendations

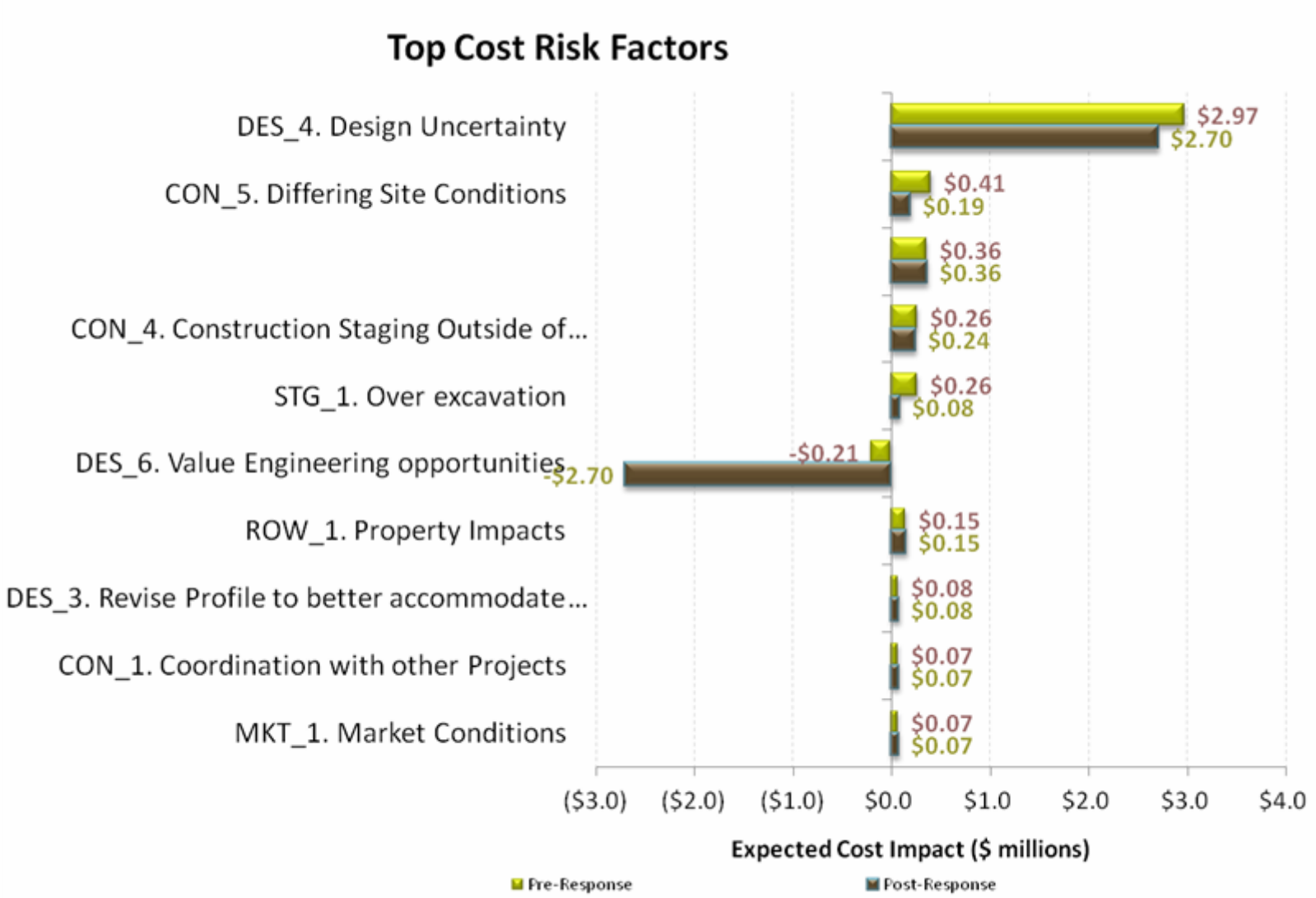
Mitigation Value

Risk Reserve @ 80%
$3.77M or 15%



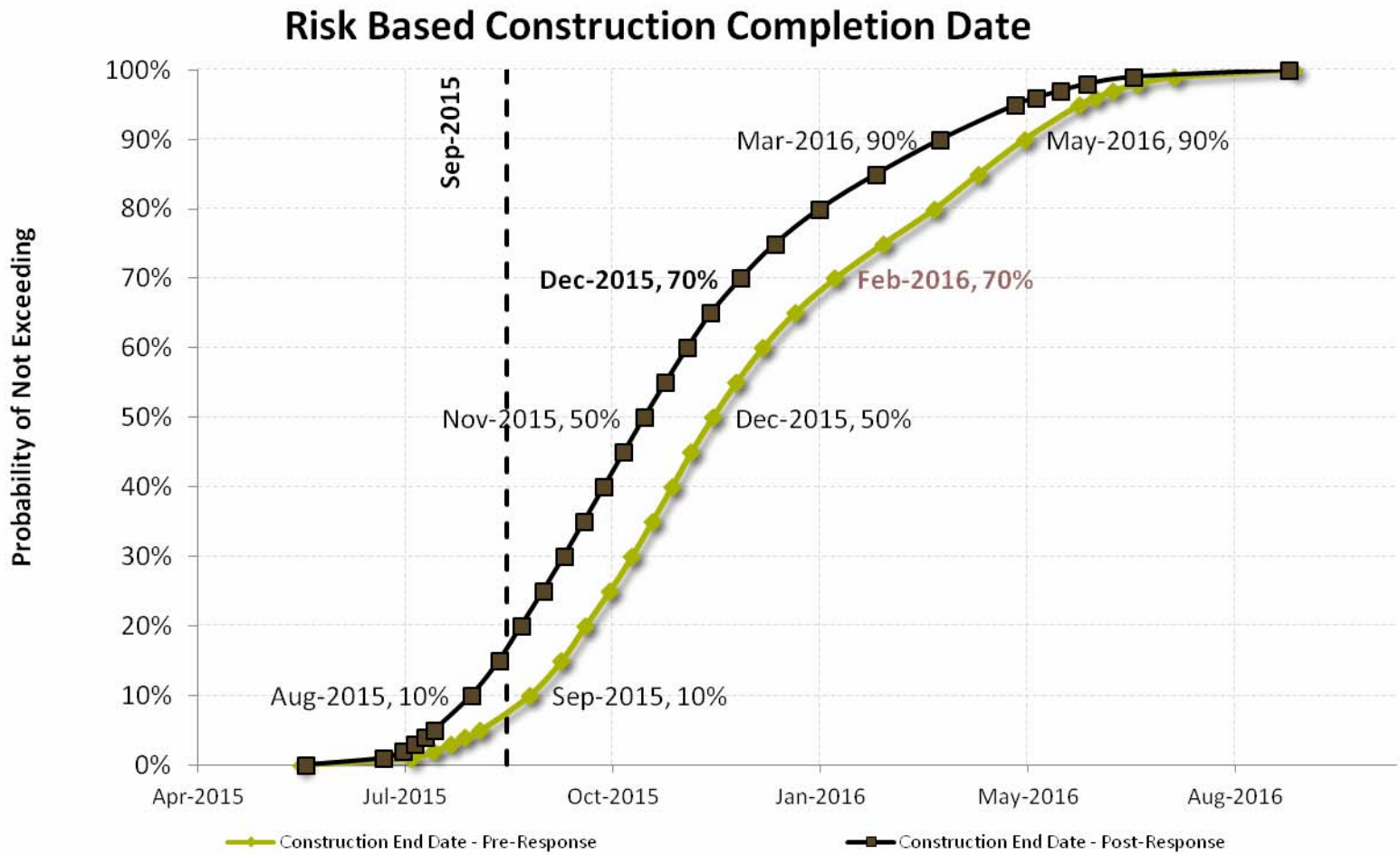
CRAVE™ Process: Step 4

Monitoring and Control



CRAVE™ Process: Step 4

Monitoring and Control Schedule



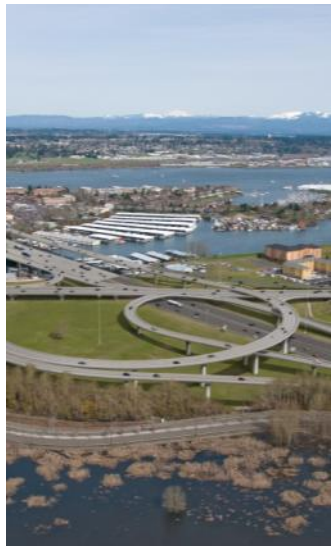
2011 VE & CRAVE™ Statistics

- HDR led 22 workshops
- Total Construction cost $4.075 billion
- Total Cost Avoidance proposed $673 million
- Reduced overall project costs by 17%
- Rate of Investment = 547:1

With every $1 spent on HDR for VE and CRAVE™ workshops we provided our clients with over $547 in cost savings opportunities!

CRAVE™

2012 CSVA Conference
October 25, 2012



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