RAVE : Reducing Risk with Value Engineering

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SOCIÉTÉ CANADIENNE
D'ANALYSE DE LA VALEUR

CANADIAN SOCIETY
OF VALUE ANALYSIS

Presentation Overview

- ✓ Canadian Society of Value Analysis
- ✓ Value Engineering
- ✓ Relationship between Risk and Value
- ✓ RAVE Job Plan
- ✓ Qualitative Risk Analysis and VE

Canadian Society of Value Analysis Mission

To promote the application of the value methodologies for the benefit of governments, industry, practitioners and society.

Hon David Caplan, Minister of Public Infrastructure, with Alain LeBlanc, CSVA President, 2004 Conference

CSVA Philosophy

Open to other methodologies and harmonization of value analysis with other techniques

Sustainable Design

Direct Value Measurement

Function Performance Specification

Parametric Paired Comparison,

Risk Assessment

Quality Function Development

Balance Scorecards

Value Engineering Definition

The systematic application of recognized techniques which:

- Identify the function of a product or service,
- Establish a value for that function, and
- Provide the necessary function reliably at the least overall cost.

Value Engineering Definition (con't)

In all instances, the required function should be achieved at the lowest possible life cycle cost consistent with requirements and/or performance, maintainability, safety and aesthetics.

Value Engineering is also known as:

- Value Analysis,
- Value Planning,
- Value Management

Underpinning Principles of VE

Function analysis

- A project/product is not an end in itself, but a means to achieving a wider purpose or function.

Systematic approach

- Job plan, detailed procedure to conduct VE studies

System thinking

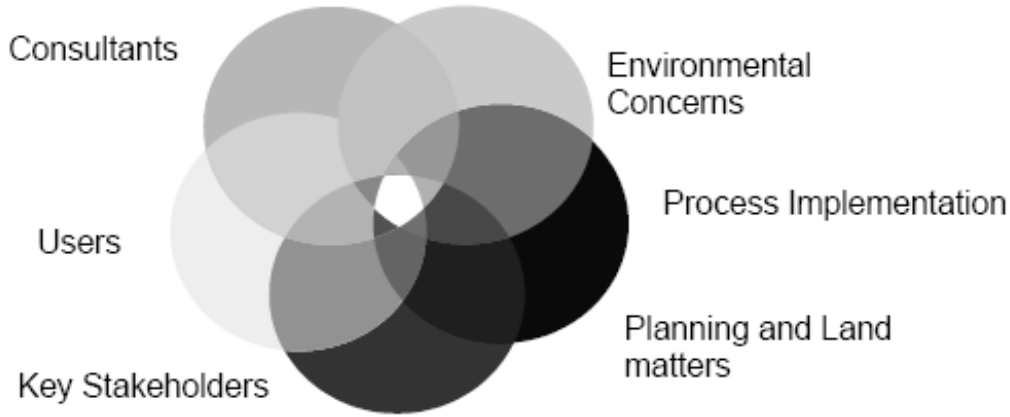
- Optimization of the system as a whole, rather than, rather than optimization of individual elements

Constructive overlap

- Multi-disciplinary team working together to achieve common objectives

Constructive Overlap

VE harnesses the creative powers of a group of people in harmony to achieve more than the sum total.



Critical Success Factors

Methodology

- VE job plan must be followed

Attitude of Participants

- Right attitude, appropriate stakeholders, awareness of process

Executive support

- VE workshops, implementation of results

Management of Process

- Clear objectives, timelines, follow-up actions, review and feedback

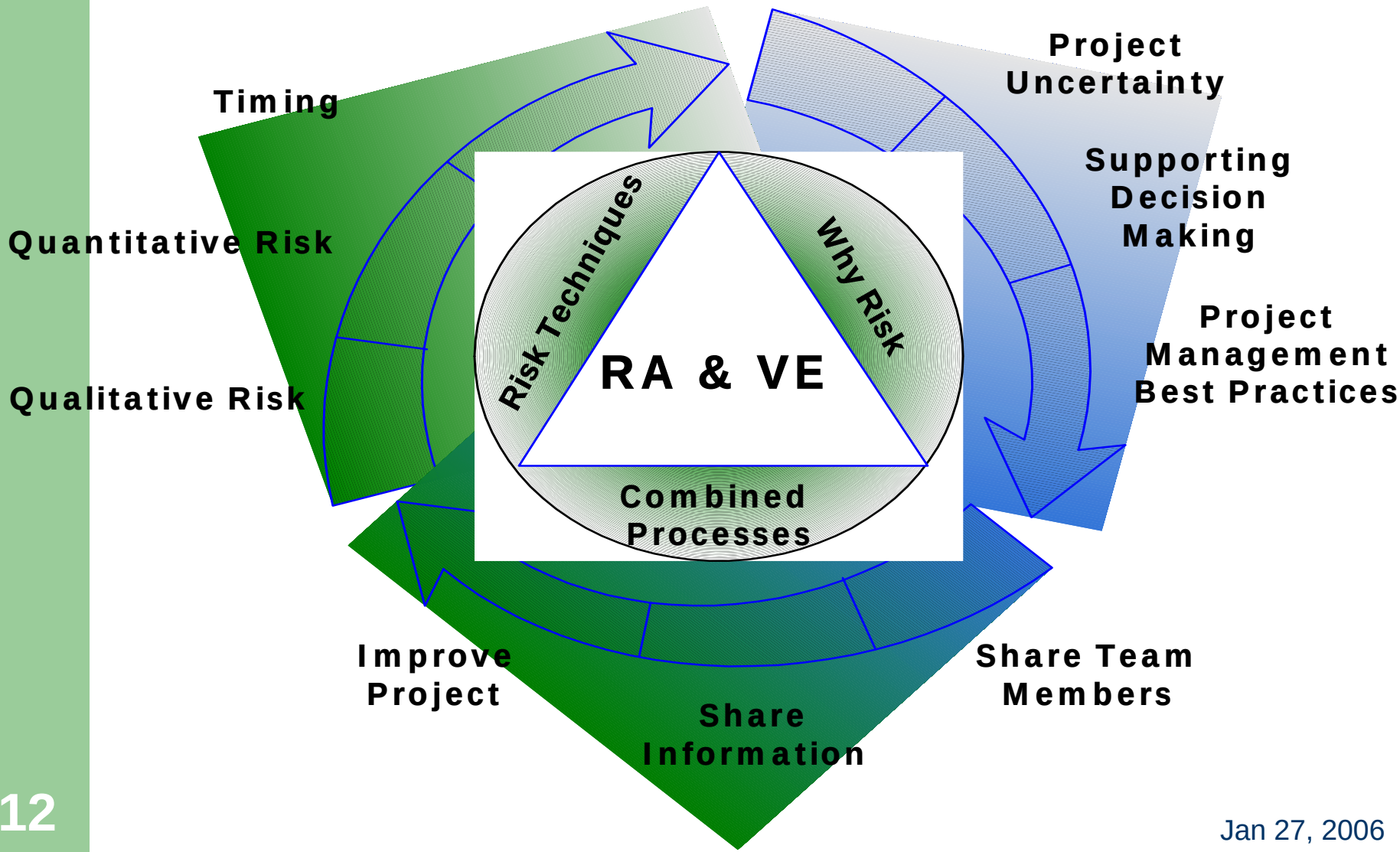
Professional Workshop Facilitation

- Probing with right questions, using appropriate tools, managing the process, maintaining momentum of team.

Benefits of VE

- Value for money from the whole project
- Appropriate quality for the project
- Responsiveness to the client's priorities
- An opportunity for stakeholders to formally participate in the design process
- Improved communication amongst stakeholders.

Risk Analysis and Value Engineering (RAVE)



Managing Complex Infrastructure Projects

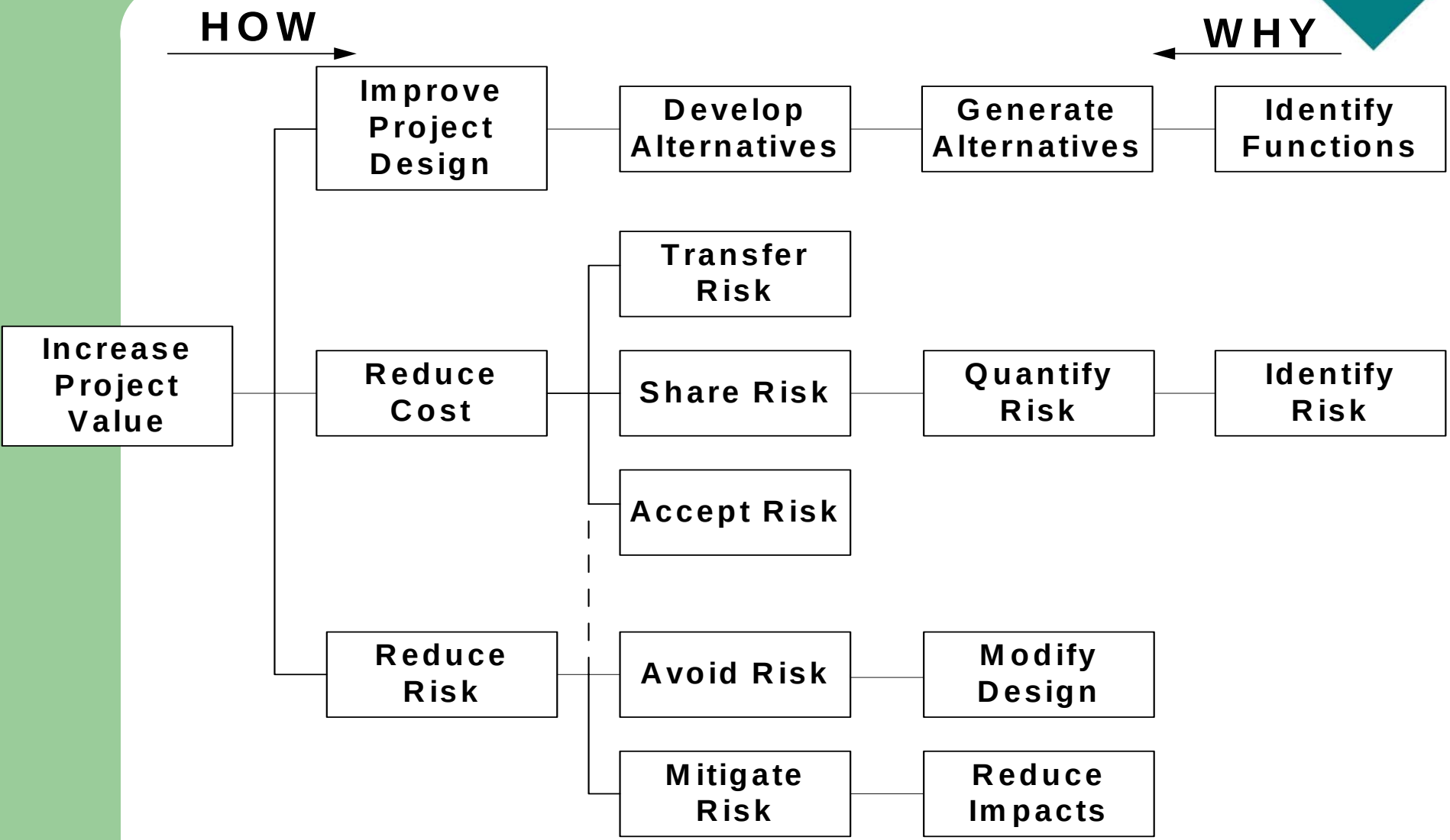
Significant uncertainty in the variables driving cost and schedule result in significant uncertainty in potential project outcomes

Assessing the consequences of the inherent uncertainty in project variables can provide a valuable perspective on project outcomes and also a basis for project improvement

Risk Management and Value Engineering are complementary methods for improving the outcome of a project

Dwight Sangrey, Ph.D, P.E., Travis McGrath, Ph.D, P.E.Bill Roberds, Ph.D Golder Associates Inc.

RAVE FAST Diagram



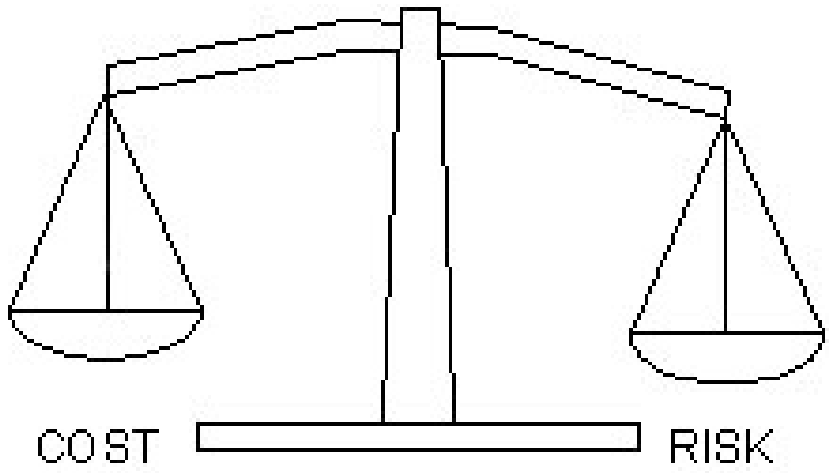
Will Willson, www.davislangdon.com

Workshops

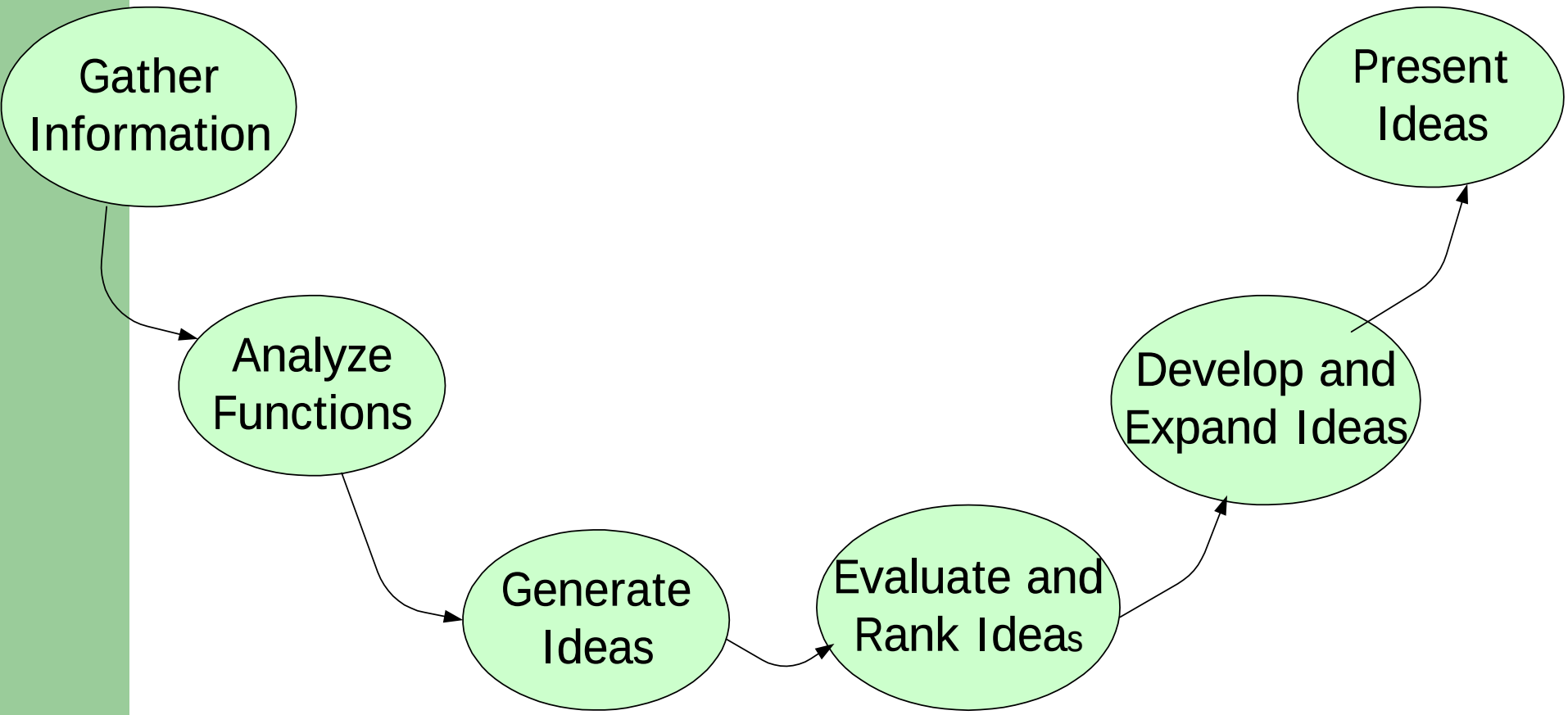
- Risk Analysis
  - Multidisciplinary team
  - Includes Outside Experts
  - Structured Process
  - **Focus on proposed design**
- VE
  - Multidisciplinary team
  - Includes Outside Experts
  - Structured Process
  - **Generates alternative designs**

Combining Risk Analysis and Value Engineering

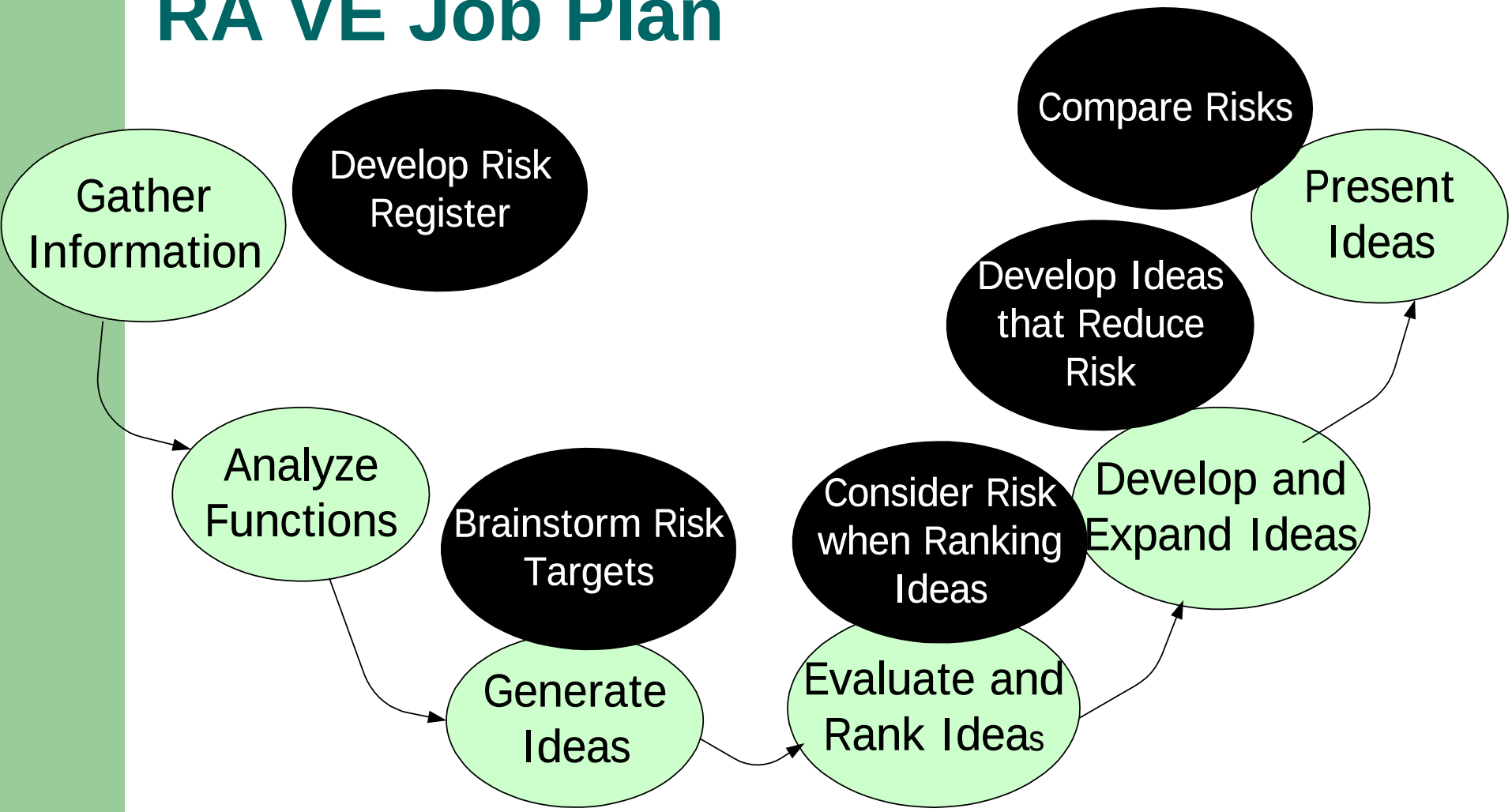
The cost savings of a VE idea should be balanced with cost & schedule risk.



VE Job Plan

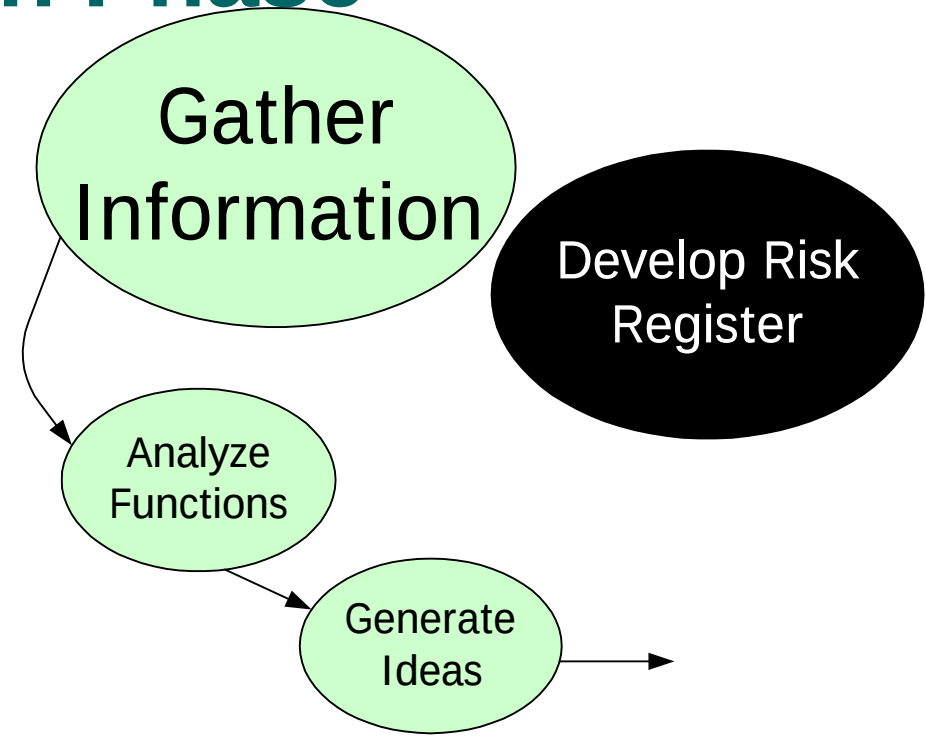

Gather Information
Analyze Functions
Generate Ideas
Evaluate and Rank Ideas
Develop and Expand Ideas
Present Ideas

RA VE Job Plan



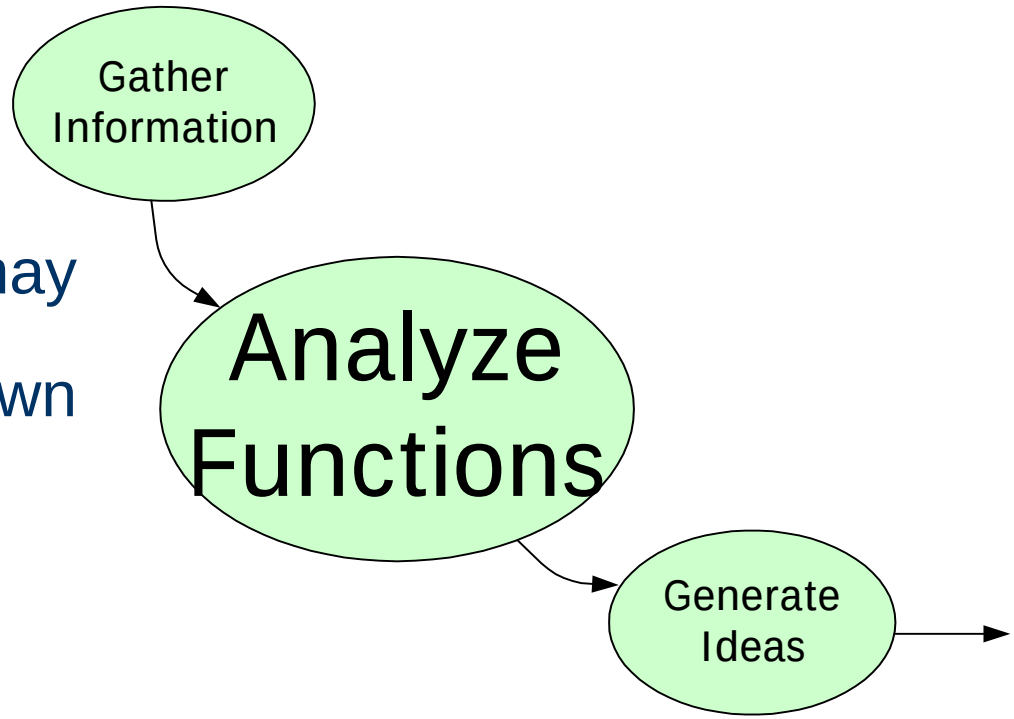
RA VE Information Phase

- Information Phase:
  - Identify issues, problems and **risks** associated with project at time of VE Study
  - Was the original need for the project generated by such risks?
  - Create or update Risk Register



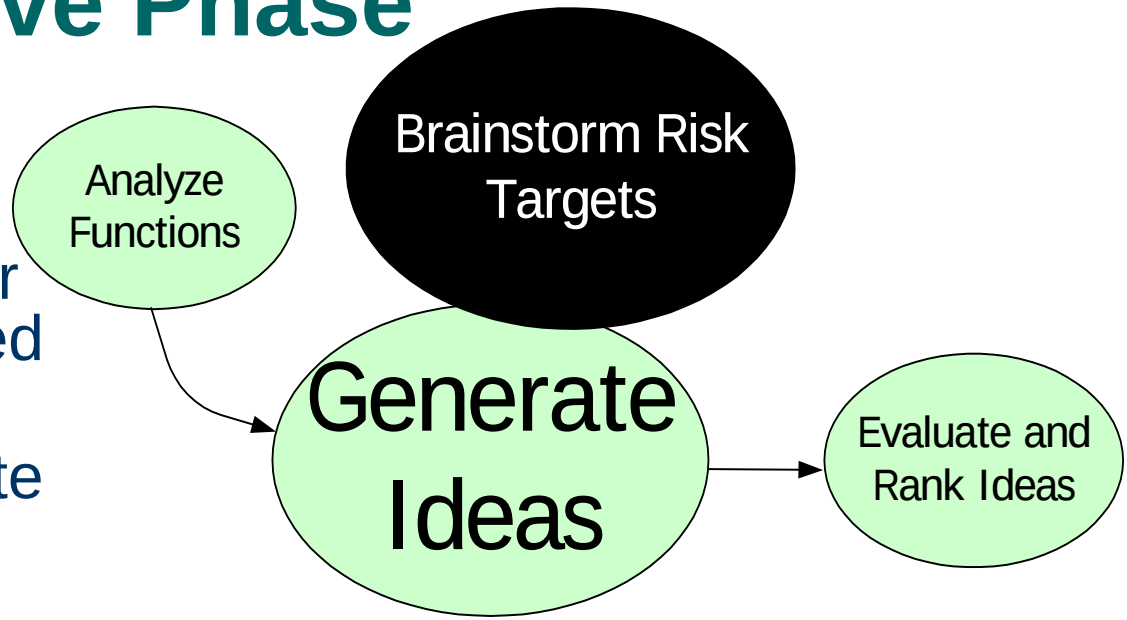
RA VE Function Analysis Phase

- Function Analysis Phase:
  - Some functions may address or be influenced by known risks



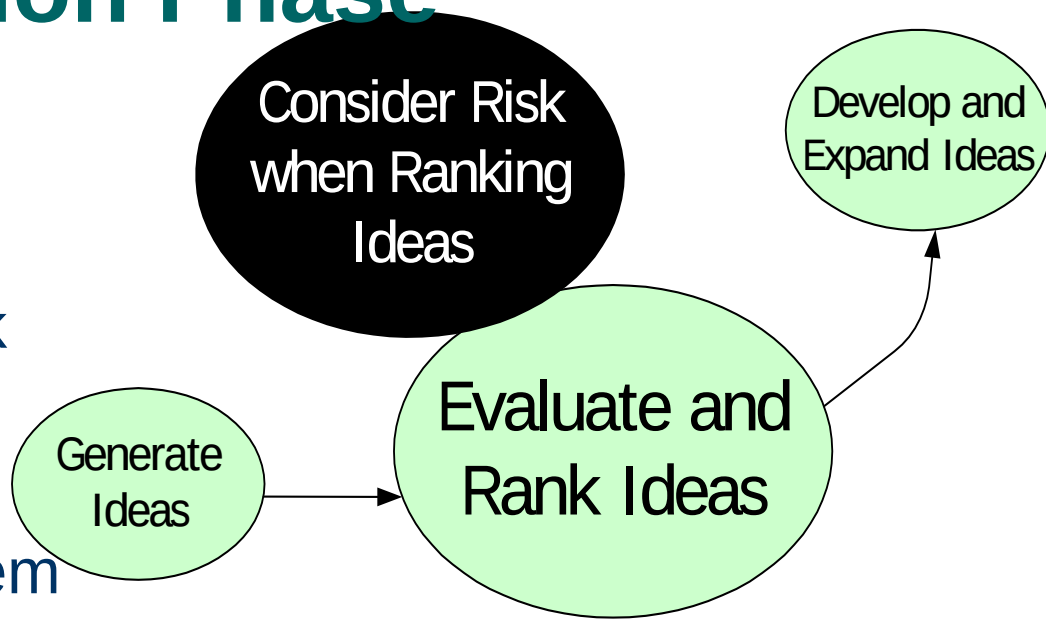
RA VE Creative Phase

- Creative Phase:
  - Ideas to avoid or mitigate identified risks
  - Desire to mitigate risks may spark creativity!



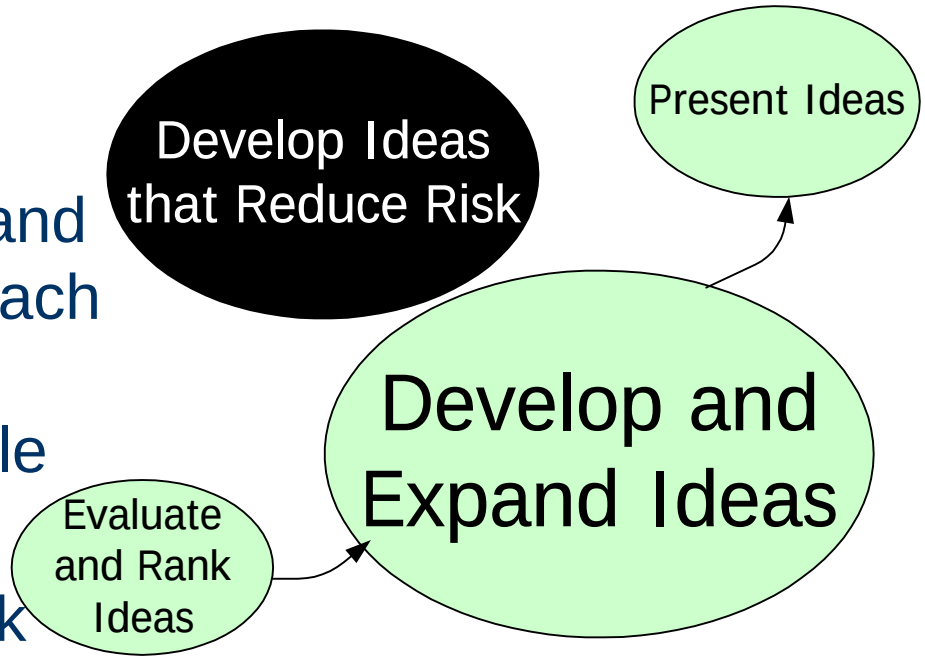
RA VE Evaluation Phase

- Evaluation Phase:
  - Evaluation criteria could include a risk item to eliminate ideas which have very high risks associated with them (cost or time)



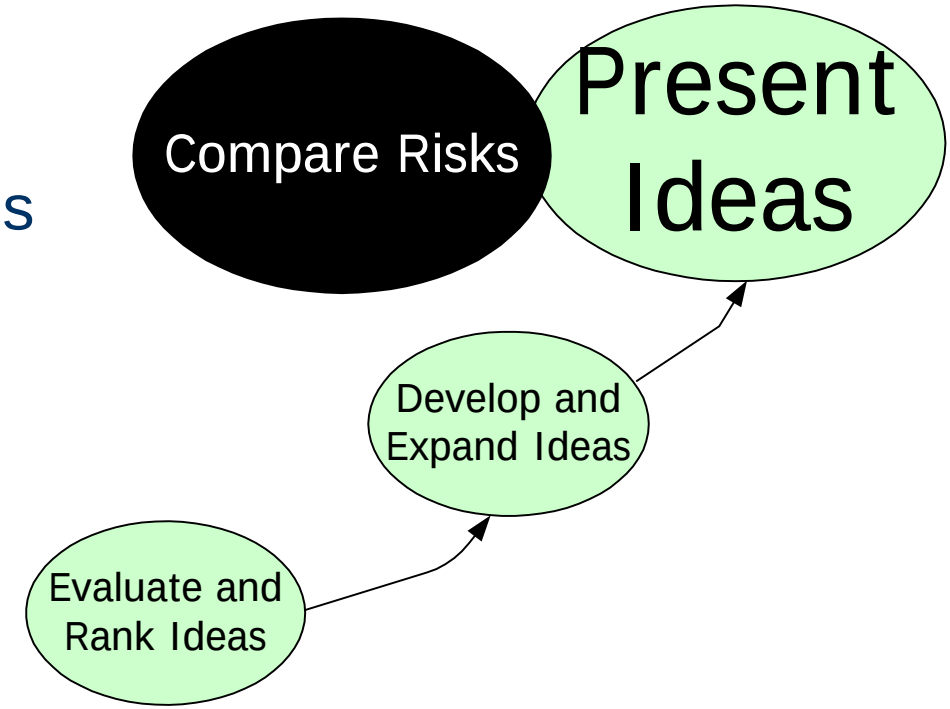
RA VE Development Phase

- Development Phase:
  - Risk allowances (cost and time) associated with each proposal give a better comparison of Life Cycle Cost
  - May be developing Risk Mitigation Plans



RA VE Presentation Phase

- Presentation Phase:
  - Risks and opportunities of the VE design compared to original design



Qualitative approach...

QUALITATIVE

- Get to understand what are the most important risks
- Few tools available other than a risk register.
- Typically fast and easy to perform – 1 to 3 hours.

Benefits of a Qualitative Risk Register

- Helps understand potential risks.
- Identifies value targets for use in brainstorming.
- Identifies criteria for screening ideas.
- Recognize risks and how they may effect project options, qualitatively.
- Risk assessment does not need to be exact to be useful.
- The level of uncertainty can indicate a need for action

Using a Risk Register

Risk = Probability of failure x Consequence of failure

- **For each risk**
  - **Estimate probability or likelihood of failure or occurrence (1 to 5)**
  - **Severity or consequence of failure (1 to 5)**

Assigning numerical values..

Probability / Likelihood	Consequence / Effect	Cost / Time
Definite = 5	Catastrophic = 5	100X
Probable = 4	Critical = 4	10X
50/50 = 3	Serious = 3	$X_{Serious}$
Remote = 2	Marginal = 2	X/10
Improbable = 1	Negligible = 1	X/100

The value of $X_{serious}$ and range of values in column 3 will be very project specific and determined by team

Sample Risk Register –

									Risk Allowance		
									RMS Difference		
									TOTALS	$34,700,000	$21,384,000
		No action against Risk				Action against Risk					
RISK	RISK MANAGEMENT	PROB-ABILITY	CONSEQUENCE COST	CONSEQUENCE TIME	TOTAL	PROB-ABILITY	CONSEQUENCE COST	CONSEQUENCE TIME	TOTAL	MAXIMUM COST	MAXIMUM WEIGHTED COST
Embankment Failure	minimize construction on soft ground; design for stability; obtain good geotechnical information	2	5	5	20	1	4	3	7	$5,000,000	$2,000,000
Collisions at Intersection	close intersection; long-term solutions; relocate intersection; change speed profile; improved signage; grade separation; relocated transition zone	5	5	1	30	1	5	1	6	$10,000,000	$10,000,000
Failure to Obtain DFO Approval	avoid creek impact; redirect creek; early contact with DFO; define type of fishery; identify areas for compensation; improve spawning areas	3	2	4	18	1	1	2	3	$500,000	$120,000
Delay Due to Property Acquisition	early contact with property owners; maintain existing alignment; identify stakeholder compensation cases; avoid sensitive properties; stakeholder buy outs	3	1	2	9	1	1	1	2	$100,000	$12,000

Risk Register using 1,2,3 Scale

			RISK EVALUATION MATRIX -->	Low (1)	Med (2)	High (3)	Legend
			Probability	< 10%	<> 10-50%	> 50%	LOW
		REV 0	Cost in $1000 CAN	<50K	<>50-500K	>500K	MED
			Time in Months	<1M	<> 1 - 3 M	>3M	HIGH

Risk ID	WBS	Description of Risk Event	Impact of Risk Event	Prob %	Potential Cost $	Potential Time Impact	Risk Level
19	Utilities - Electric	Hydro - One - Window for outage missed	Schedule delay - knock on cost implications to follow on trades - Main Contract works at Walker can not start till Hydro One has been removed and re-energized on diversion - Impacts Walker Rd and onward Av as knock on delay would be	75%	3	3	225
50	Generic - whole project	Inflation	Increased or decreased costs to project	100%	3	1	200
8	Generic - Design	Retaining walls may grow in size and / or length	Possible additional costs as design is finalized	100%	3	-	150
9	Generic - Design	Urban design components - ascetics	Additional costs as final design resolved to face of walls	100%	3	-	150
35	Generic - whole project	No detailed cost estimates from Canadian Pacific Railroad	Significant possible costs to project if costs to be passed on	90%	3	-	135

Differences between Risk Registers

- The previous Risk Registers predict Risk Allowance using an upper and lower cost envelope and Root Mean Squared analysis – Best use for qualitative risk assessment
- Others predict Risk Allowance using an upper, median and lower level cost for each risk and the Monte Carlo method – Better choice for quantitative risk assessment
- Although the VE Team is pushed to quantify risks through this simple risk register, the results are used qualitatively

Washington State Department of Transportation use of Risk in a VE study

- Investigation
  - Review the risk register, contingencies and bid items that are set up to mitigate risk
- Functional analysis
  - Include the secondary function of “reduce risk”
- Speculation (Creative)
  - Brainstorm ideas on how to reduce risk

Ken L. Smith
Deputy State Design Engineer
WSDOT

Washington State Department of Transportation use of Risk in a VE study

- Evaluation
  - Include a risk assessment as part of the evaluation criteria
- Development
  - Develop recommendations that reduce risk
  - Include a risk assessment for VE recommendations that modify the original design

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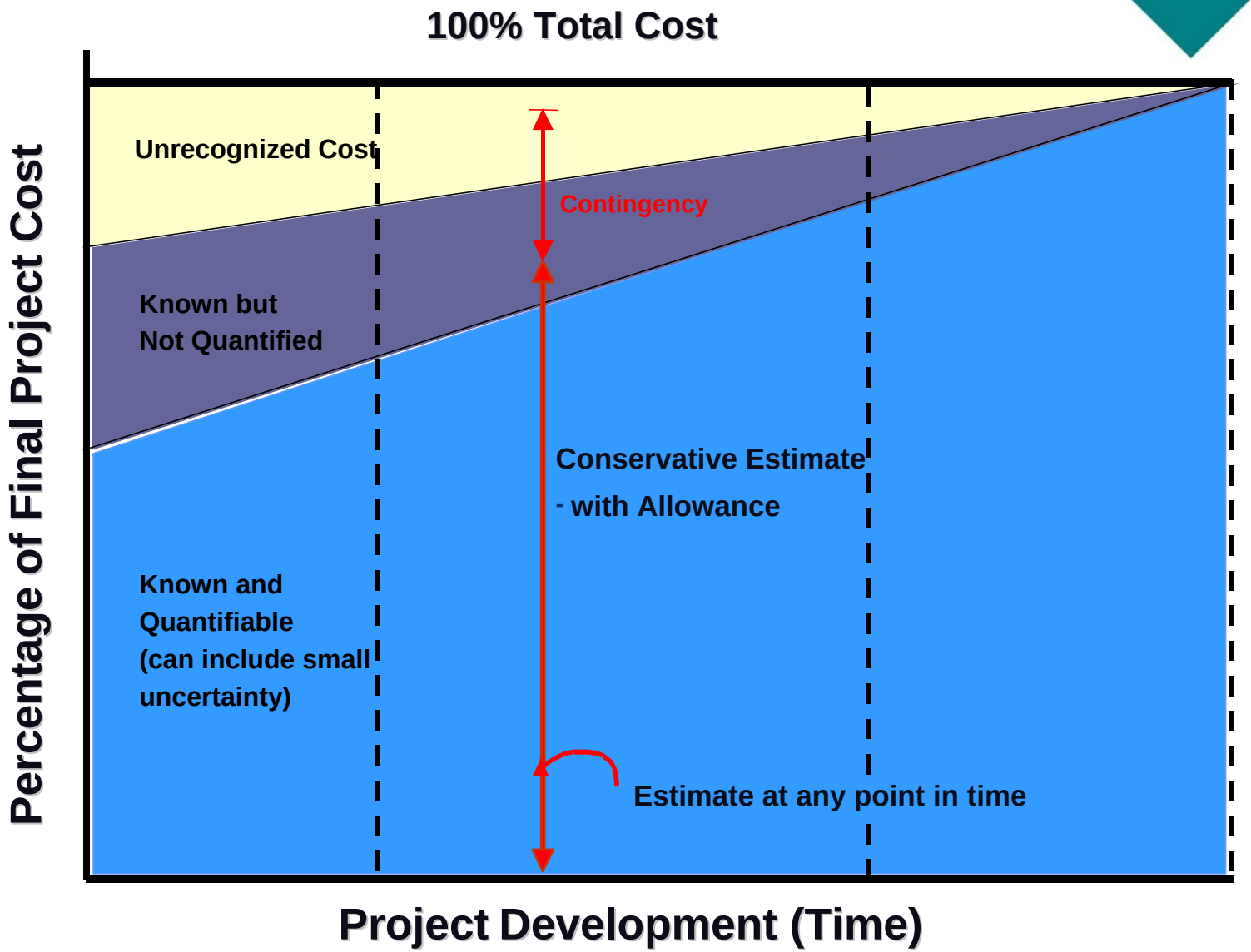
WSDOT

Quantitative Risk Analysis

- Risk Based Cost and Schedule Analysis (Cost Risk Analysis)
- Quantifies uncertainty in schedule and cost using complex modelling techniques
- Based on opinions and expertise of risk team members

Components of Cost Uncertainty

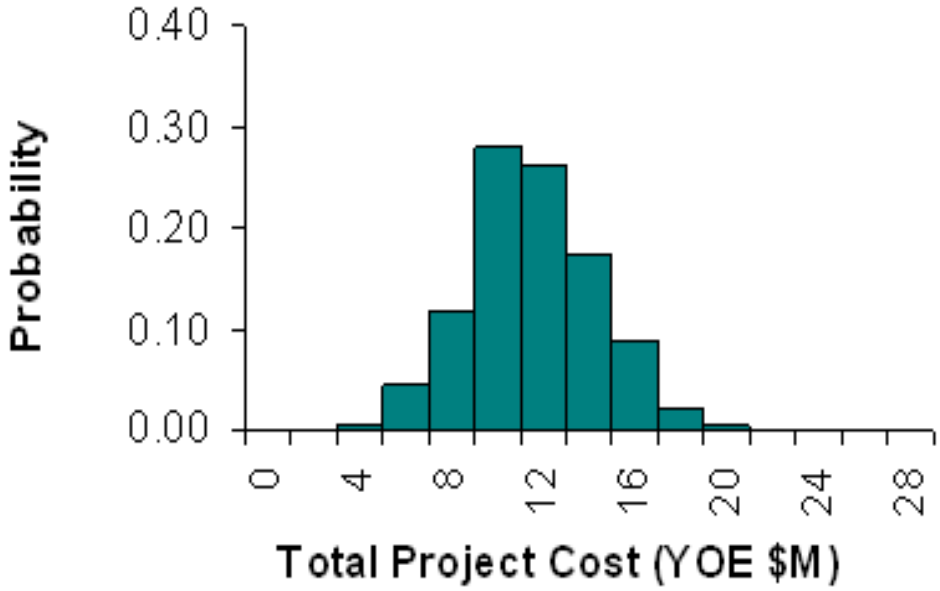


Risk Based Cost and Schedule Analysis

- Normally takes about 3 days
- Intensive workshop
- Schedule and Cost uncertainties modelled on proposed design
- Cannot invest 3 days of modelling on each VE alternative

A Risk-Based Approach

- Replace contingency with explicitly identified risks / opportunities
- Separate estimate into consistent *base* & *risk* components
- Focus on *risks & base*
- Characterize risks—consequences & probabilities



Golder Associates

Dwight Sangrey, Ph.D, P.E., Travis McGrath, Ph.D, P.E.Bill Roberds, Ph.D Golder Associates Inc.

Selecting the process

	Advantages	Disadvantages
Combined RA VE Workshop	Better understanding of VE ideas	Less time for creativity and idea development
Risk Based Cost and Schedule Analysis	Quantifies Uncertainty, Useful for Budgeting	Lot of effort to quantify uncertainty at moment in time.

Thank you!

Questions?

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http://www.mto.gov.on.ca/english/transtek/ve/

www.scav-csva.org - papers on risk & VE