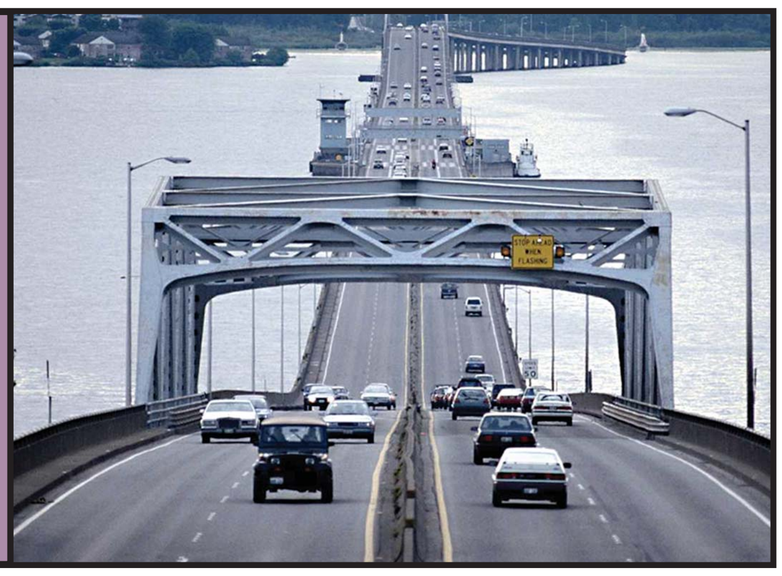
MANAGING COST AND SCHEDULE - CEVP AND RISK MANAGEMENT

Washington State Department of Transportation

> "Shocking or not, the Department of Transportation has performed an unprecedented public service with these latest cost estimates. It is a much-needed dose of fiscal reality. The department offered realistic cost-range estimates."
>
> Seattle Post-Intelligencer Opinion
> June 9, 2002



The Washington State Department of Transportation (WSDOT) is tasked to deliver a large set of major capital transportation projects, collectively worth about US $10 Billion. Recognizing the historical and worldwide problem of large cost overruns on such projects, WSDOT sought a way to prevent such overruns.

In early 2002, WSDOT implemented a new process (CEVP - Cost Estimate Validation Process) to better estimate the probable cost and schedule (as well as cash flow) of their planned Mega-projects, specifically including risk, opportunity, and other uncertainties. This process was designed to provide:

- More realistic projections of probable cost and schedule, including the effects of inflation
- Better decision-making and risk management for individual projects and for the entire program of projects

WSDOT, along with a consultant team including Golder Associates and John Reilly, developed and have applied CEVP annually to ten Mega-projects. These projects were at varying levels of design, with budgets ranging from several hundred to several billion US dollars. Streamlined versions of CEVP, called SCoRE and CRA, were subsequently developed and applied to nearly 100 other projects, also at varying levels of design, with budgets ranging from several million to several hundred million US dollars.

In a cooperative workshop environment for each project, with a facilitator and project-independent subject matter experts, project cost and schedule uncertainty is evaluated for each alternative project design as follows:

- Clarify project assumptions, scope, and strategy (in terms of sequence of significant project activities)
- Verify and de-bias "base" costs and durations, as well as escalation rates, for all significant project activities (if no problems occur)
- Replace standard "top-down" contingency with "bottom-up" risks and opportunities:
  - -Identify potential problems and opportunities ("events") that could affect project cost and schedule
  - -Assess likely impacts of an event's occurrence on activity costs and durations
  - -Assess chance of each event occurring
  - -Assess correlations
- Combine the assessments (using computer models)

The approach has the following features and benefits:

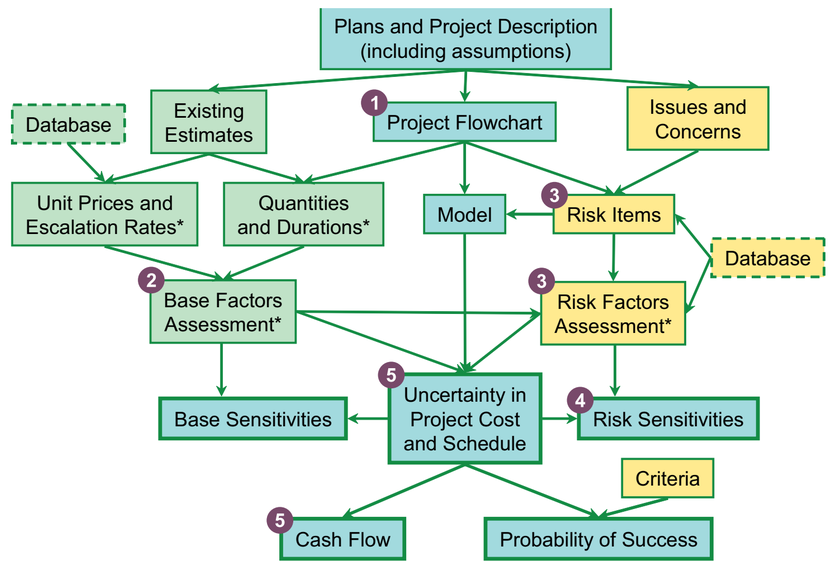
- Efficient and relatively simple, yet comprehensive
- More accurate than lumping contingencies and escalation
- Scalable to fit project size and development level
- Collaborative with project personnel, promoting consensus
- Updatable, so that revisions can be made as the project evolves (e.g., evaluate risk management) and/or new information is obtained

In addition to producing more realistic cost and schedule estimates, the approach has generated the following additional benefits for WSDOT:

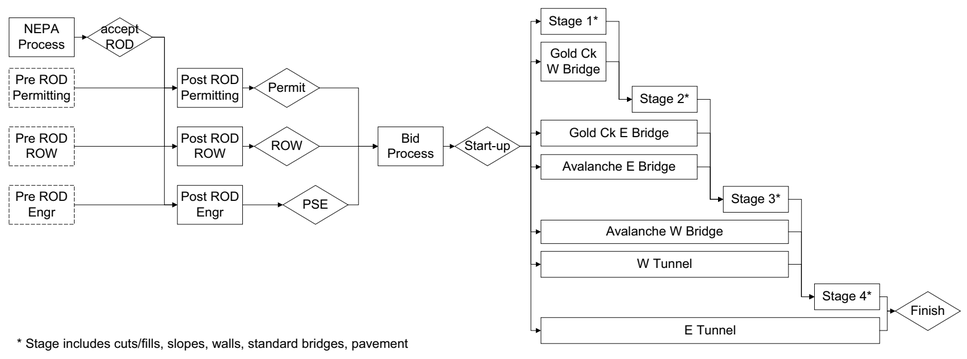
- Enhanced internal project communication and understanding
- A better basis for a strategy to manage a set of projects - e.g., a model to determine the uncertainty in program costs, schedule and cash flow for a set of about 150 projects was developed
- Input for subsequent Risk Management and Value Engineering studies

The method and results have been validated to the extent currently possible, have been well received by all stakeholders (including the public), and has thus been adopted by WSDOT (mandated for all projects over $25M, supported by an internal group CREM and staff training by Golder Associates) and is currently being adopted (in various forms) by other state and federal agencies (e.g., FHWA).

Process for Each Project



1 PROJECT FLOWCHART



* Stage includes cuts/fills, slopes, walls, standard bridges, pavement

2 BASE FACTOR ASSESSMENT

Activity	Base Cost (current$M)	Base Duration (months)	Avg Annual Escalation Rate (%/yr)
NEPA (to ROD)	0	10-11-12	2.5-3.0-4.0[a]
…			
Gold Creek W Bridge	6-8-12[b]	5-6-8[b]	2.5-3.0-4.0[a]
…			

notes: 10th percentile – most likely value – 90th percentile
[a] perfectly positively correlated [b] moderately positively correlated

3 RISK FACTOR ASSESSMENT

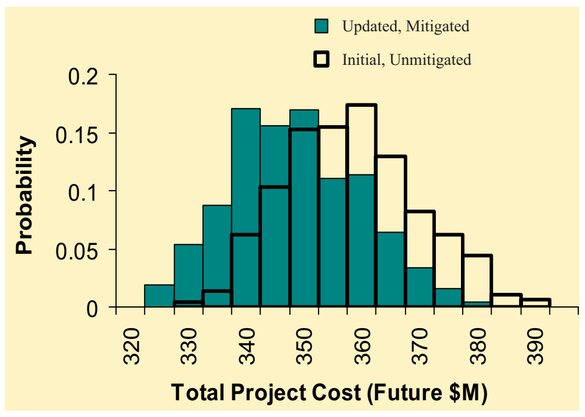
Risk / Opporunity Event	Probability	Cost Impact ($M current)	Duration Impact (mos)
Difficulty in locating adequate retention pond sites	50%	+1-2-5 to ROW	+6-8-12 to ROW plan
…			
Difficulty in constructing avalanche bridge foundations	33%	+2-4-6 to E. Bridge[a] +1-2-4 to W. Bridge[b] *independent*	+1-2-4 to E. Bridge[a] +1-2-4 to W. Bridge[b]
…			

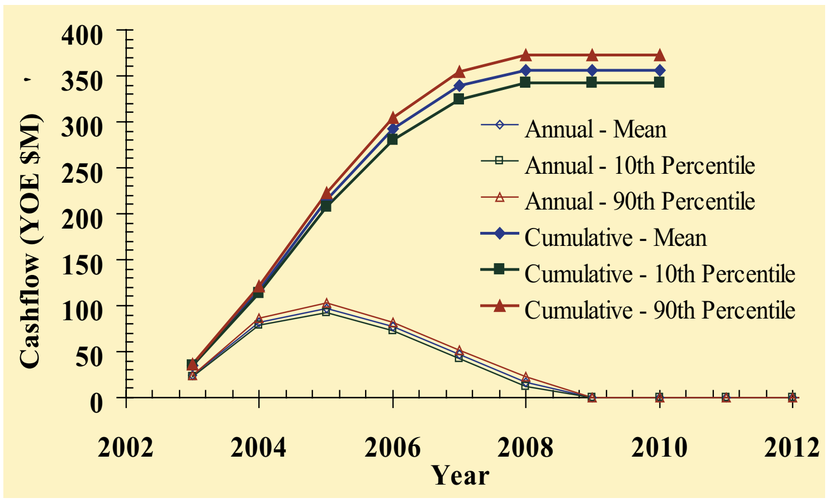
notes: 10th percentile – most likely value – 90th percentile
[a] moderately positively correlated [b] moderately positively correlated

4 RISK SENSITIVITIES

Risk or Opportunity	Cost (current)		Schedule	
	Contribution	Rank	Contribution	Rank
unacceptable connectivity enhancements	26%	1	9%	6
difficulty in locating adequate retention pond sites	-4%	29	9%	5
incr seismic criteria (and other design criteria)	11%	5	3%	10
difficulty in constructing avalanche bridge foundations	16%	2	17%	1
…				

5 UNCERTAINTY IN PROJECT COST AND SCHEDULE





John Reilly Assoc. Int'l

Golder Associates