

# Stripping out Bias in Risk Estimates

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# Topic Overview

- *Why risk based estimates are needed*
- *Pessimism Biased case study*
- *Decision Making Heuristics*
- *Lessons Learned in Risk Based estimating.*

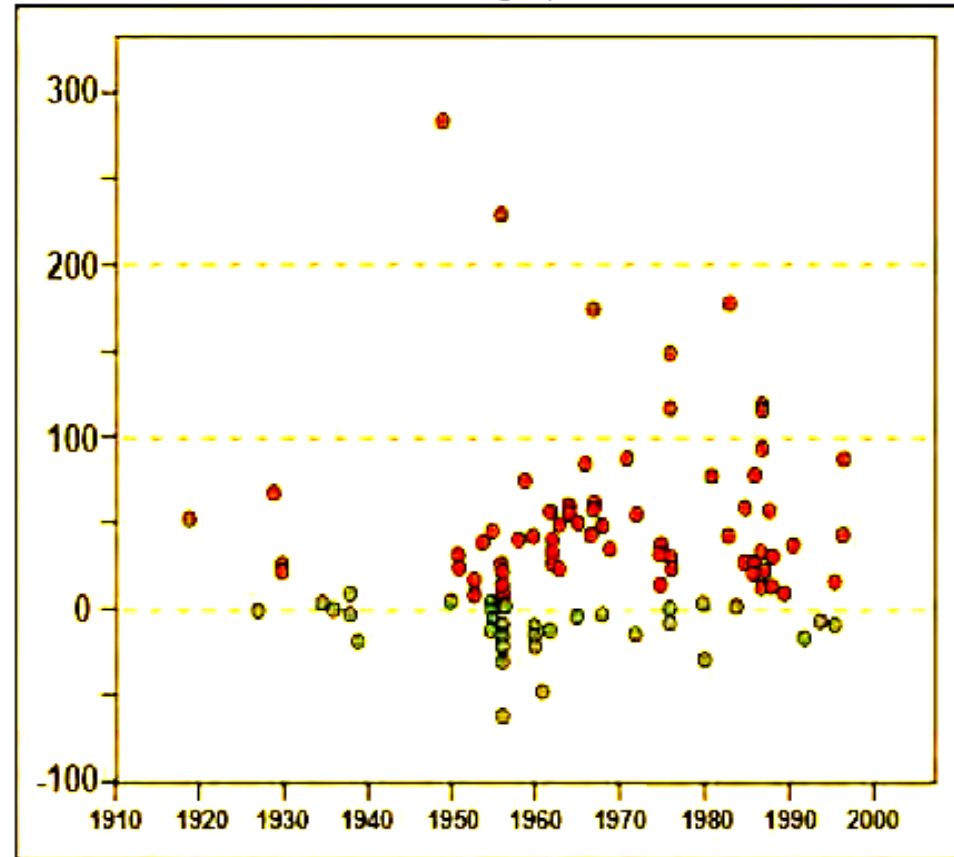
# Flyvbjerg Study, June 2002

## - 258 International Projects

- Cost estimates\*\* have been “Systematically misleading”
- A wide range of projects has this problem
- This condition has existed for a very long time (70 years).
- This cannot be explained by normal errors / random results
- Best explained by “strategic misrepresentation”
- How to correct this problem?

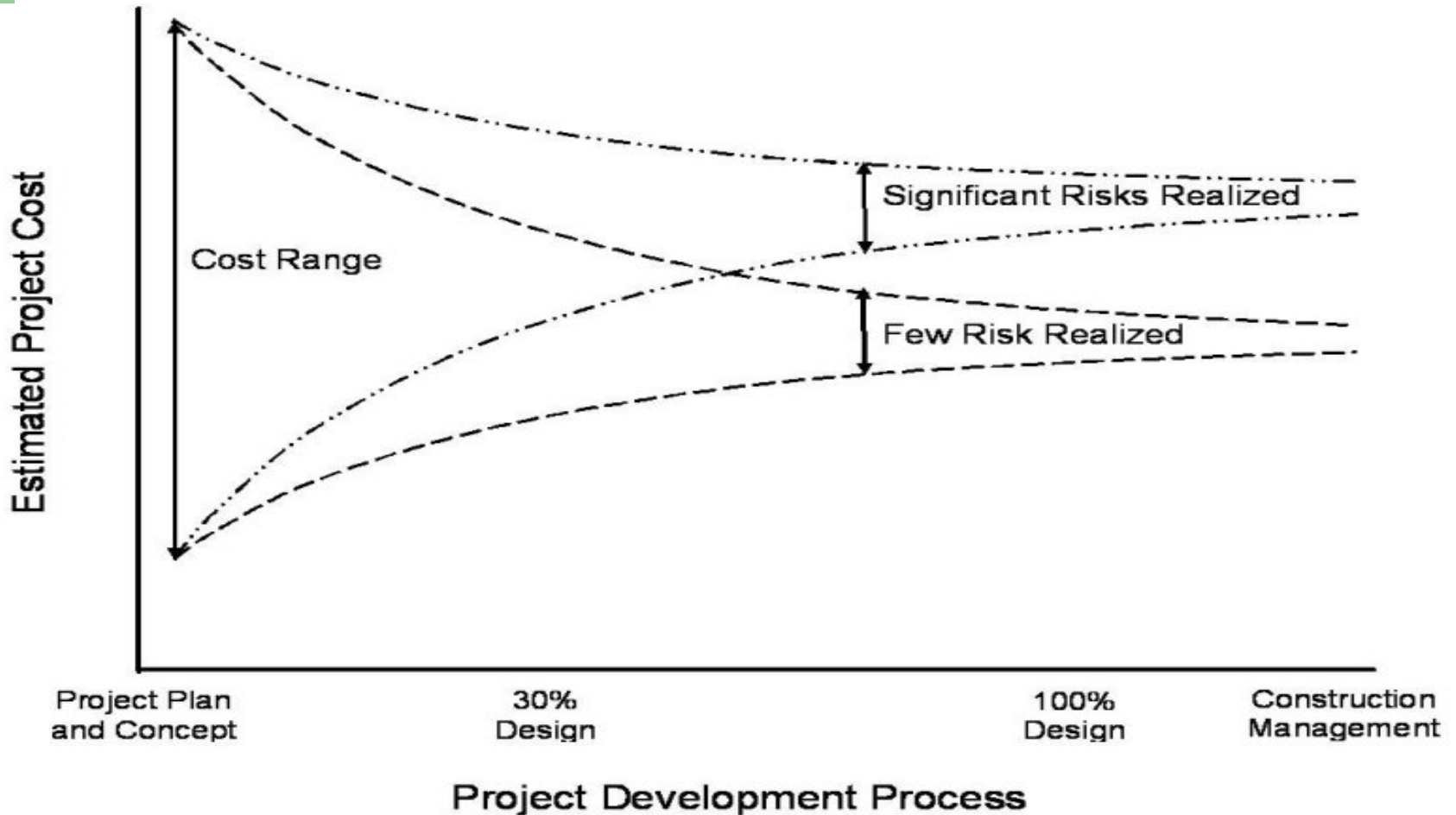
\*\* at time of decision to implement

Final cost vs. budget, 1910 to 2000



Source: 2006 CSVA  
Conference

# Risk & Project Estimates





## **Risk Management Tip**

Guard against  
excessive optimism  
by the Project Team

# Why Consider Risk?



A news article from Sept 5, 2007 - MTO to hold off on awarding Vernon Narrows bridge

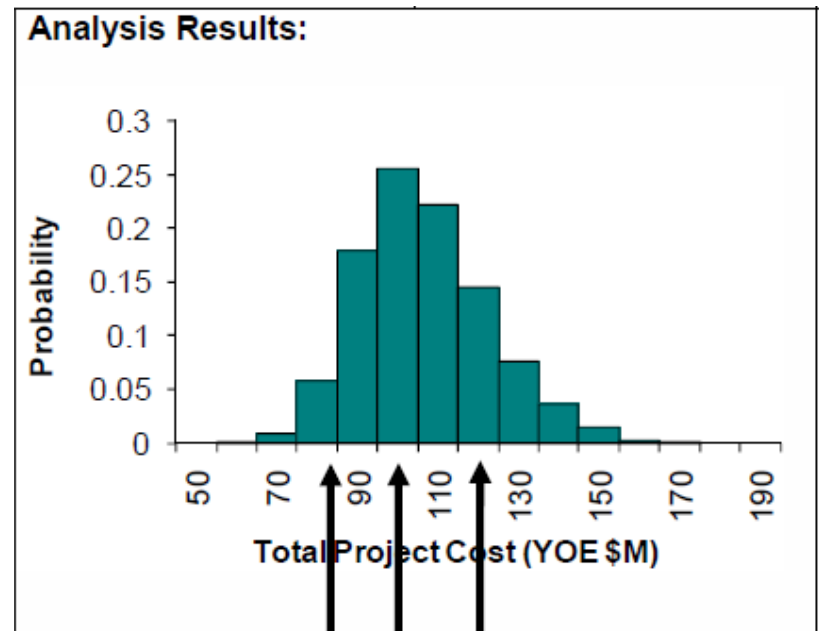
*The Ministry of Transportation (MTO) has decided not to award the contract for construction on the bridge where Hwy. 11 crosses the Vernon Narrows until the project can be reconfigured to save costs.*

*“The (bids received on the) tender for that northbound bridge widening were several million dollars over our estimate,...*



# Case Study – New Highway Expansion Risk based Estimate

The projected cost of this project and the actual bid of \$56.1 were significantly different.



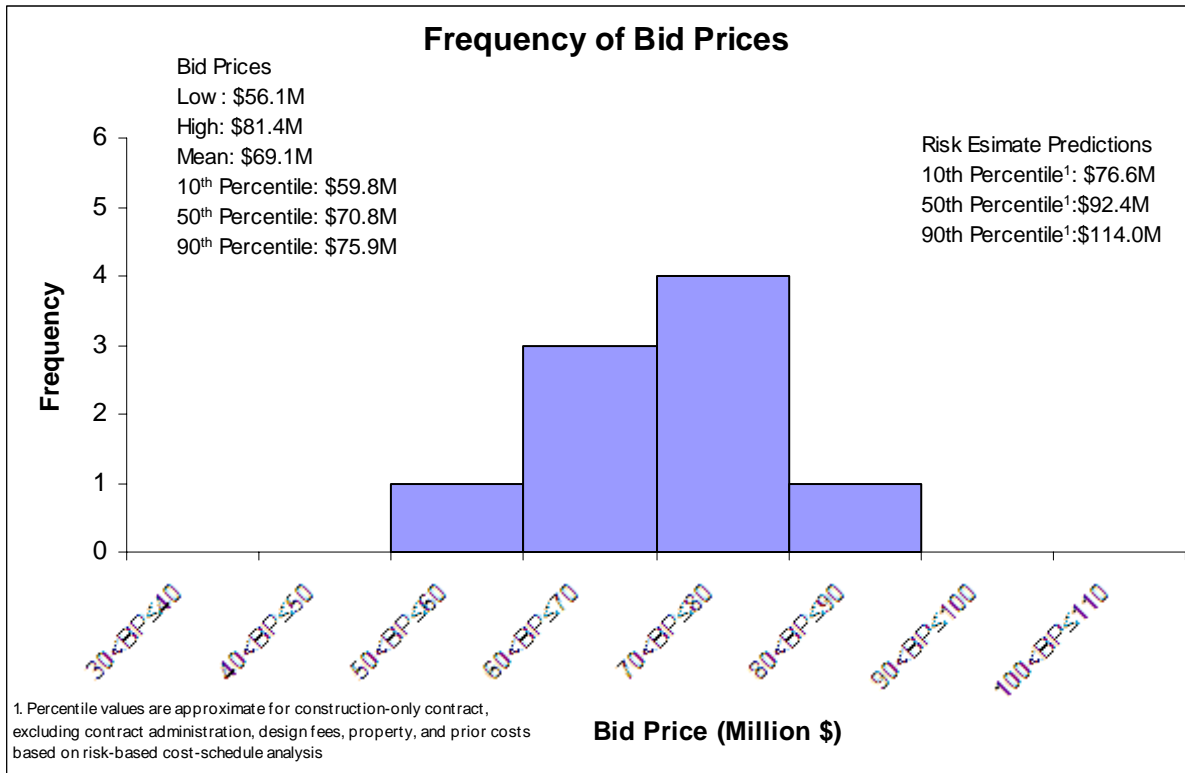
10% chance the cost\* < \$ 83 Million

50% chance the cost\* < \$ 100 Million

90% chance the cost\* < \$ 123 Million

\*construction costs only

# Pessimism biased estimate meets market conditions





# Lessons learned on pessimism bias

The bid price fell below the one percentile estimate.

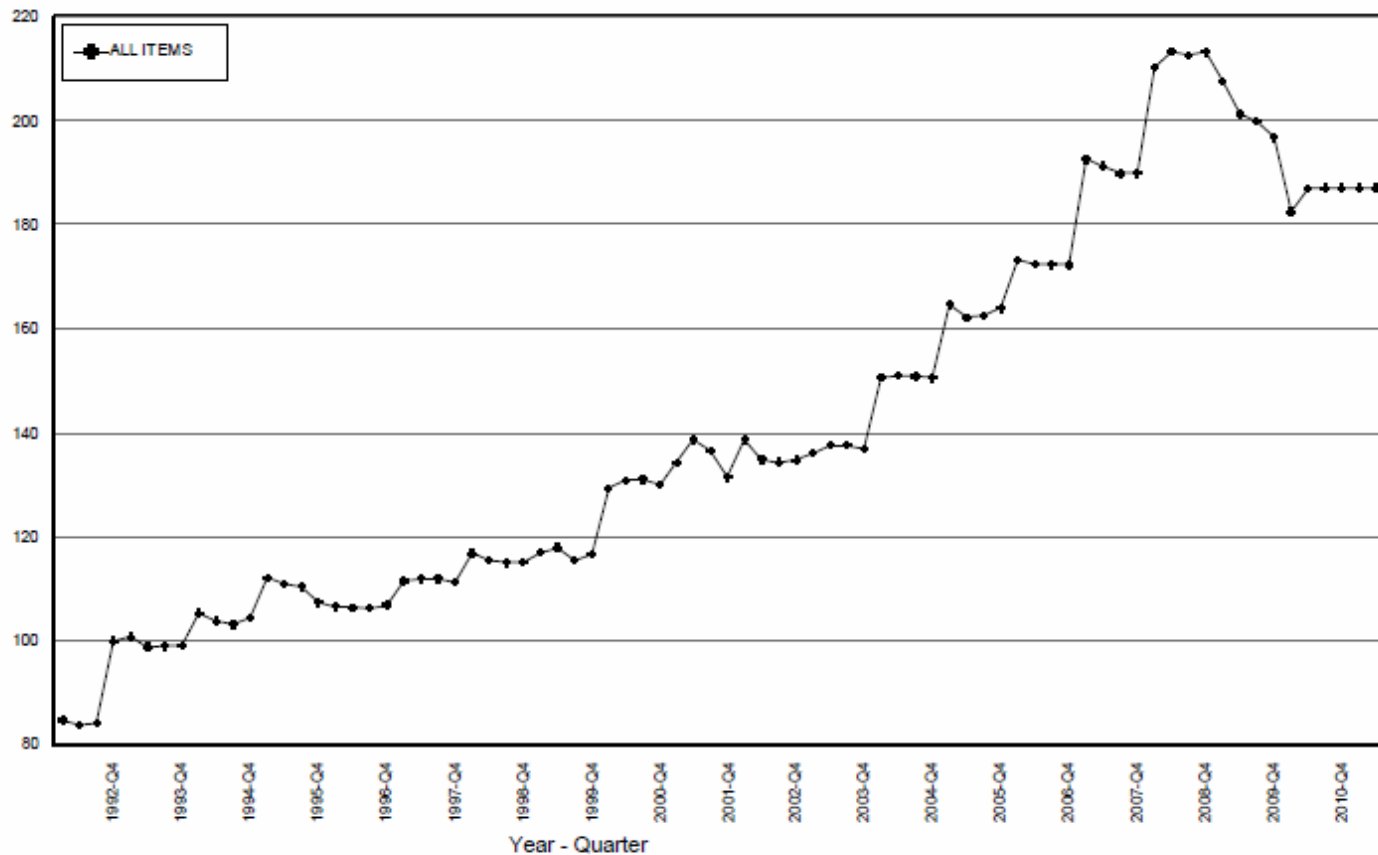
Why did this happen?

- Escalation predictions lagged behind market realities.
- Prediction of Unit prices is pessimism biased
- Lack of generally accepted rules for risk based estimates

# Construction Escalation

- In recent years, MTO has been challenged by central agencies to produce more “accurate estimates”
- Escalation was difficult to predict and in some years was as high as 20%.
- Reviewing the tender price index shows that when the case study was bid there was 8.93% de-escalation for grading items.
- Subject matter experts were biased towards their recent experience of constant escalation.

# MTO's Tender Price Index



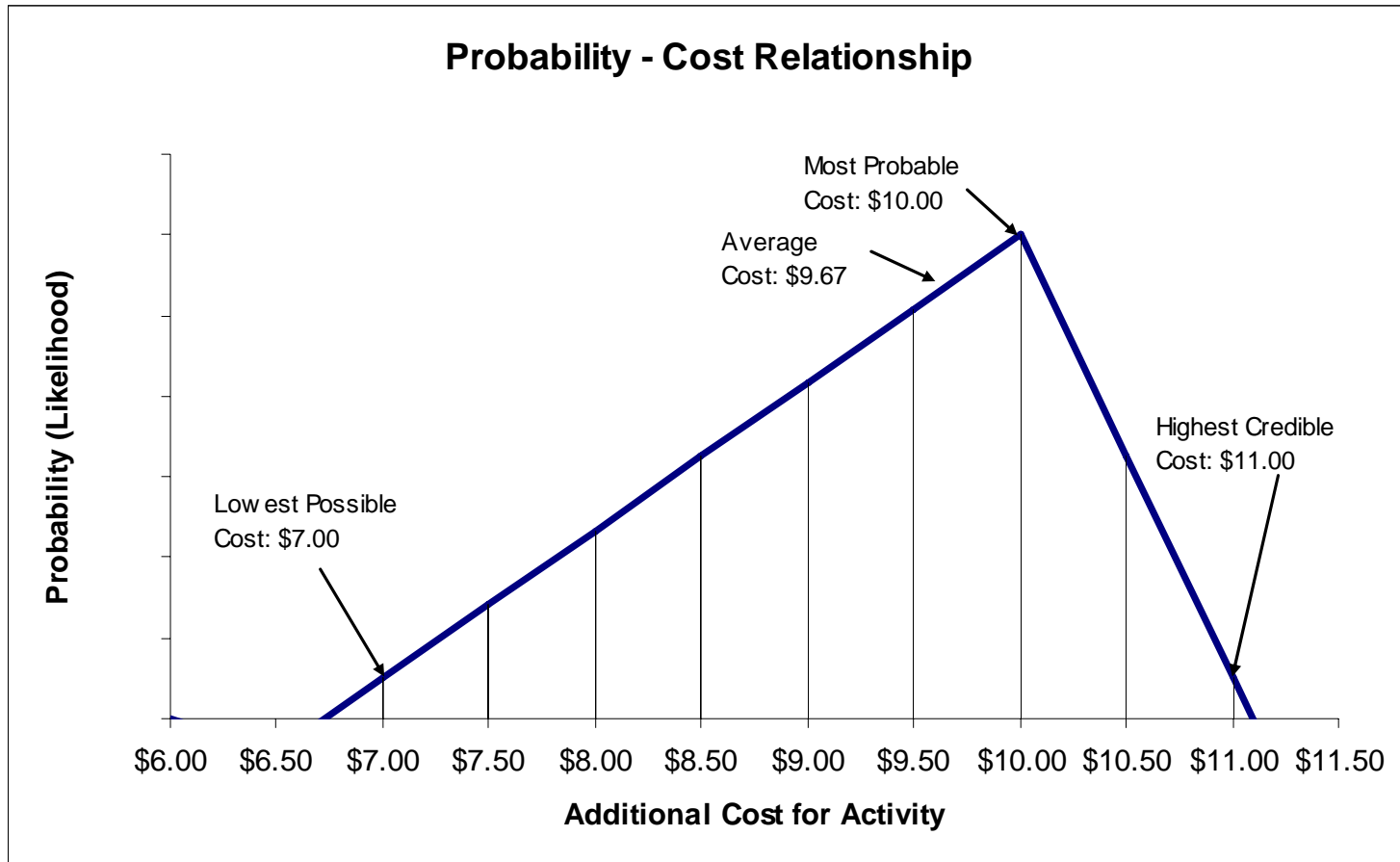
# The Grading Index is very volatile

FISCAL YEAR	QUARTER	COMPOSITE	AVG ANNUAL INCREASE / DECREASE
<b><u>GRADING</u></b>			
1992 / 1993	Q4	100.00	0.00 %
1993 / 1994	Q4	101.03	1.03 %
1994 / 1995	Q4	100.75	-0.27 %
1995 / 1996	Q4	111.80	10.97 %
1996 / 1997	Q4	113.39	1.41 %
1997 / 1998	Q4	109.93	-3.05 %
1998 / 1999	Q4	117.00	6.43 %
1999 / 2000	Q4	107.43	-8.18 %
2000 / 2001	Q4	116.83	8.75 %
2001 / 2002	Q4	100.77	-13.75 %
2002 / 2003	Q4	103.14	2.35 %
2003 / 2004	Q4	104.70	1.52 %
2004 / 2005	Q4	113.88	8.77 %
2005 / 2006	Q4	137.39	20.64 %
2006 / 2007	Q4	130.37	-5.11 %
2007 / 2008	Q4	142.89	9.60 %
2008 / 2009	Q4	152.72	6.88 %
2009 / 2010	Q4	139.08	-8.93 %
2010 / 2011	Q2	140.97	1.36 %

# Prediction of Unit prices was pessimism biased

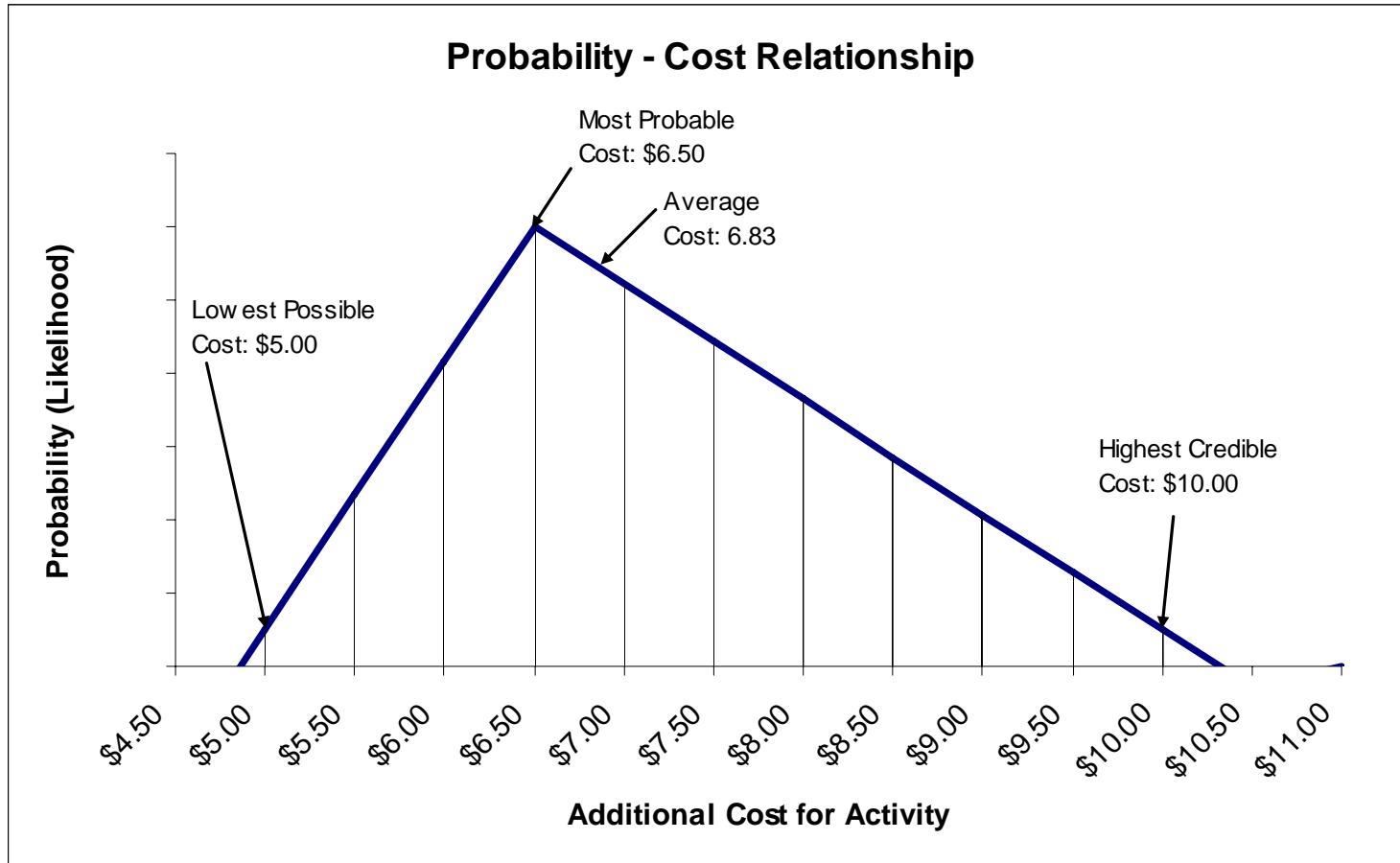
- Risk based estimates typically are based on a triangular distribution of costs.
  - Most probable cost(assume everything goes well)
  - Lowest possible cost
  - Highest Credible Cost

# Lesson Learned - A biased triangular distribution of of earth excavation



The Earth Excavation quantity was pessimistic. It assumed a high water table, and a bucket and shovel operation. The most probable price reflected a recent contract.

# Earth Excavation Distribution – without pessimism bias



The risk should have been stripped out of the most probable Earth Excavation - no problem with water table, bidders using scrapers.

# Lessons Learned, Item Prices

- Grading Prices are very volatile. They are based on labour and equipment and materials. Use first principles to estimate the best possible price for grading and granular materials.
- The 80:20 rule applies. Items that significantly affect the price of contract need focus. The winning bidder will have focused on a winning price for major items.
- Historical databases don't easily reflect market conditions.



# Decision Making Heuristics

Biases can be explained with psychology.

The following slides are sourced with permission from *The opposite of rationale is not necessarily irrational; Using Function Analysis and Fast to understand Decision-Making Heuristics*, Gary Myers, SAVE International Conference, 2004

# A GENERAL PURPOSE HEURISTIC: AVAILABILITY

Events are estimated to be more likely to occur if they can more easily be brought to mind.

# AVAILABILITY HEURISTIC MECHANISMS

- Events are judged more likely to occur if:
  - They can be retrieved easily from memory;
  - They can be conceived of easily;
  - A supporting scenario can be easily constructed; or,
  - They are mentally associated with another event which is likely to occur.

# EXAMPLES:

- Which is more likely:
- Dying from diabetes or stomach cancer, or from a car accident?
- Dying from a shark attack or from a part falling off an airplane?
- “K” being the first letter or third letter of a word in a typical sample of English writing?

Reference: The Psychology of Judgement and Decision Making; Scott Plous, Wesleyan University



# We are all influenced by

A single, prominent failure with a given feature prevents its serious consideration for a new application

A best-case or worst-case scenario, once imagined, is “hard to shake”

A superficial similarity with a past application unduly impacts current considerations

# Lack of generally accepted rules for risk based estimates.

- Clear guidance is needed for what should be included in a risk based estimate. The risk based estimate should separate property, design & contract administration and utility relocations.
- The agency should establish rules for applying escalation on risk based estimates.
- Estimates of change orders should be based on guidance provided by the agency.
- Guidance on estimating minor items should be provided.

# Lessons Learned

Understand that we are all biased based on our experiences. Learn about biases and heuristics.

Provide guidance on escalation in risk based estimates and general rules for minor items and change orders.

Pay attention to items or elements that have a major impact on the contract price. Where possible, develop a first principles estimate for a major quantity.

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References:

The Psychology of Judgement and Decision Making; Scott Plous, Wesleyan University

The Opposite of Rational Is Not Necessarily Irrational; Using Function Analysis and FAST to Understand Decision-Making Heuristics Gary R. Myers, PE, CVS **Date:** July 12, 2004, (Available from SAVE International)

