

Risk Analysis as a Portfolio Budgeting Tool

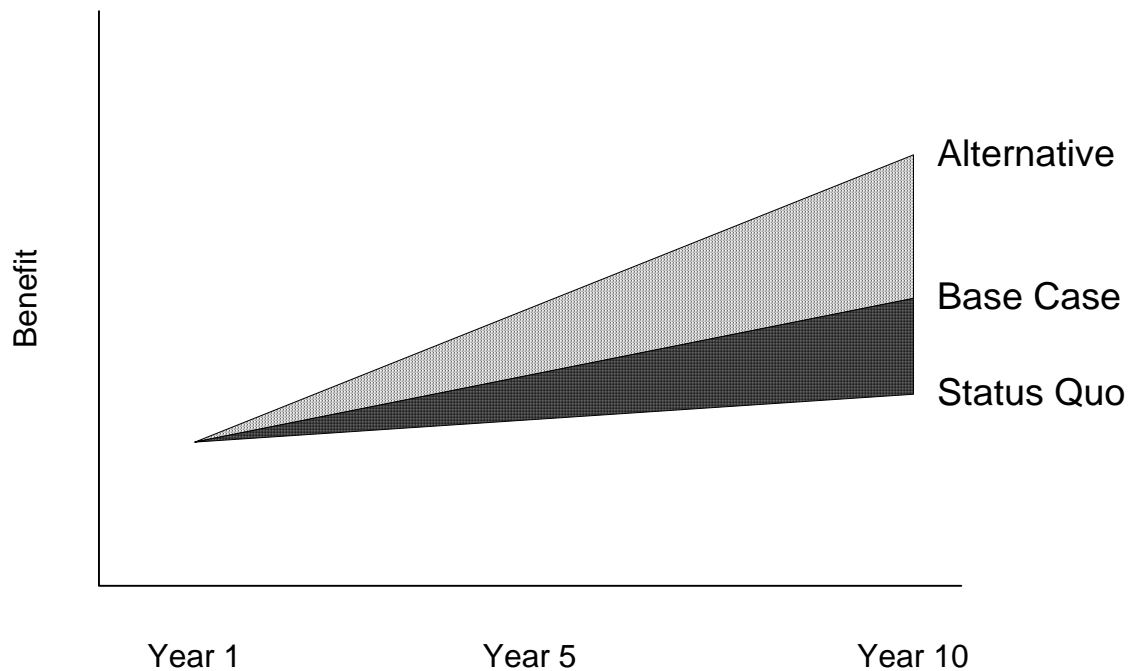
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Risk Analysis Process for Project Business Case Evaluation

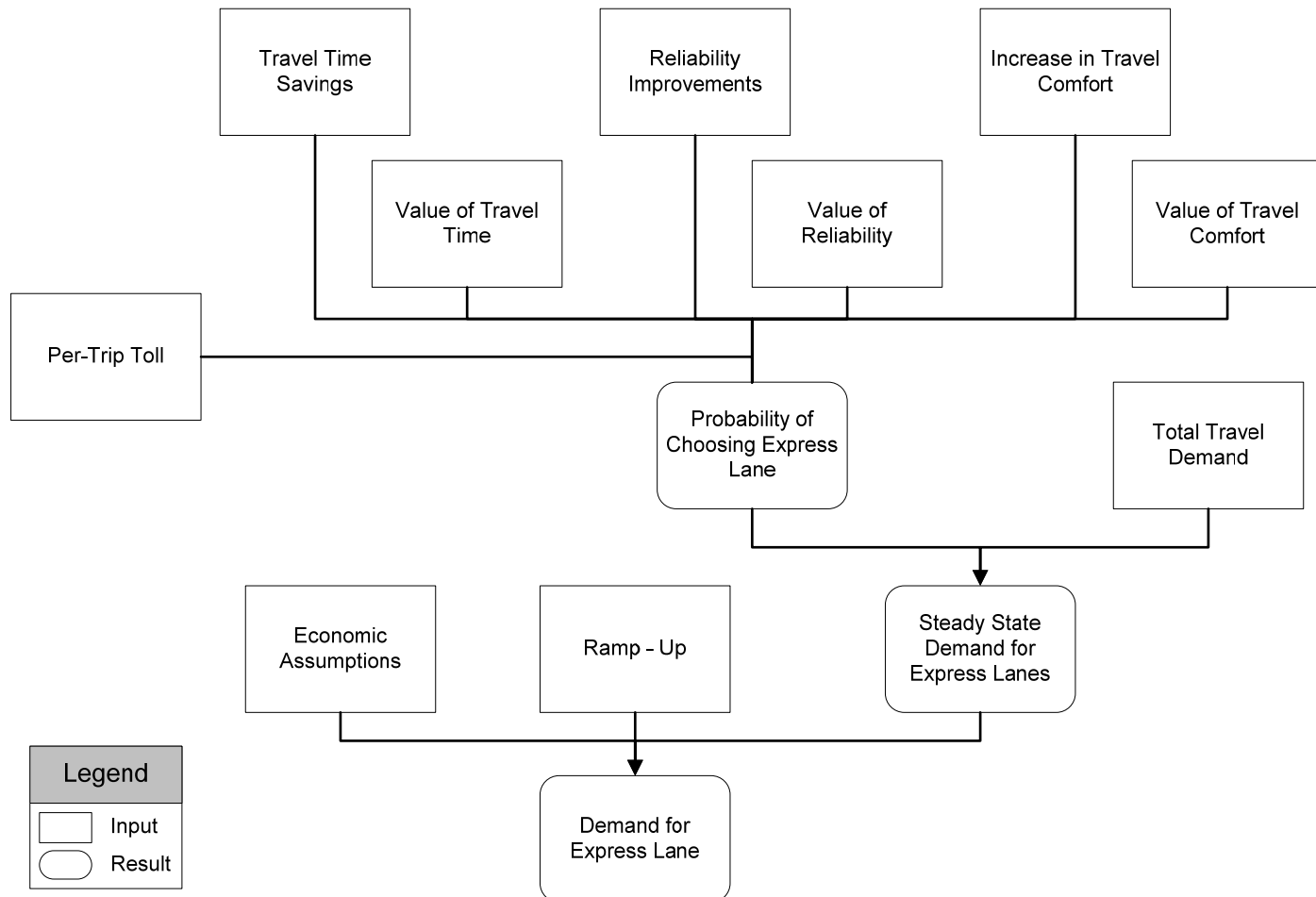
- Get the base case right
- Map the logic of your business case and risk
- Quantify and visualize your risk
- Negotiate and Manage through reasoned consent

The Base Case is Not the Status Quo!



Be Comprehensive in the Logic of Your Business Case

METROROAD HOT LANE



Objective and Subjective Probability as a Basis for Quantifying Risk

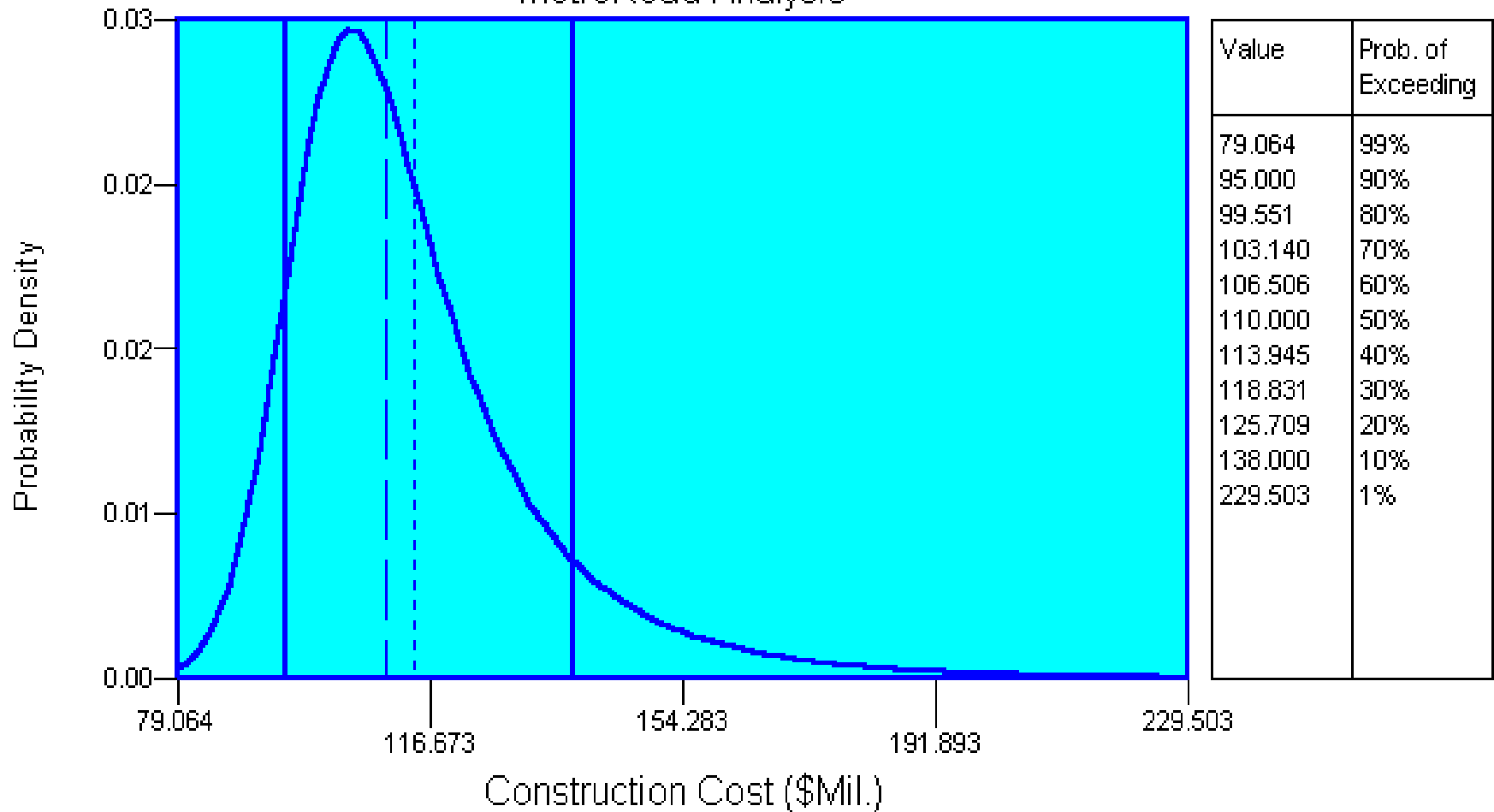
Value of Time (\$)

MEDIAN	10% LOWER*	10% UPPER*
10.0	5.0	12.0

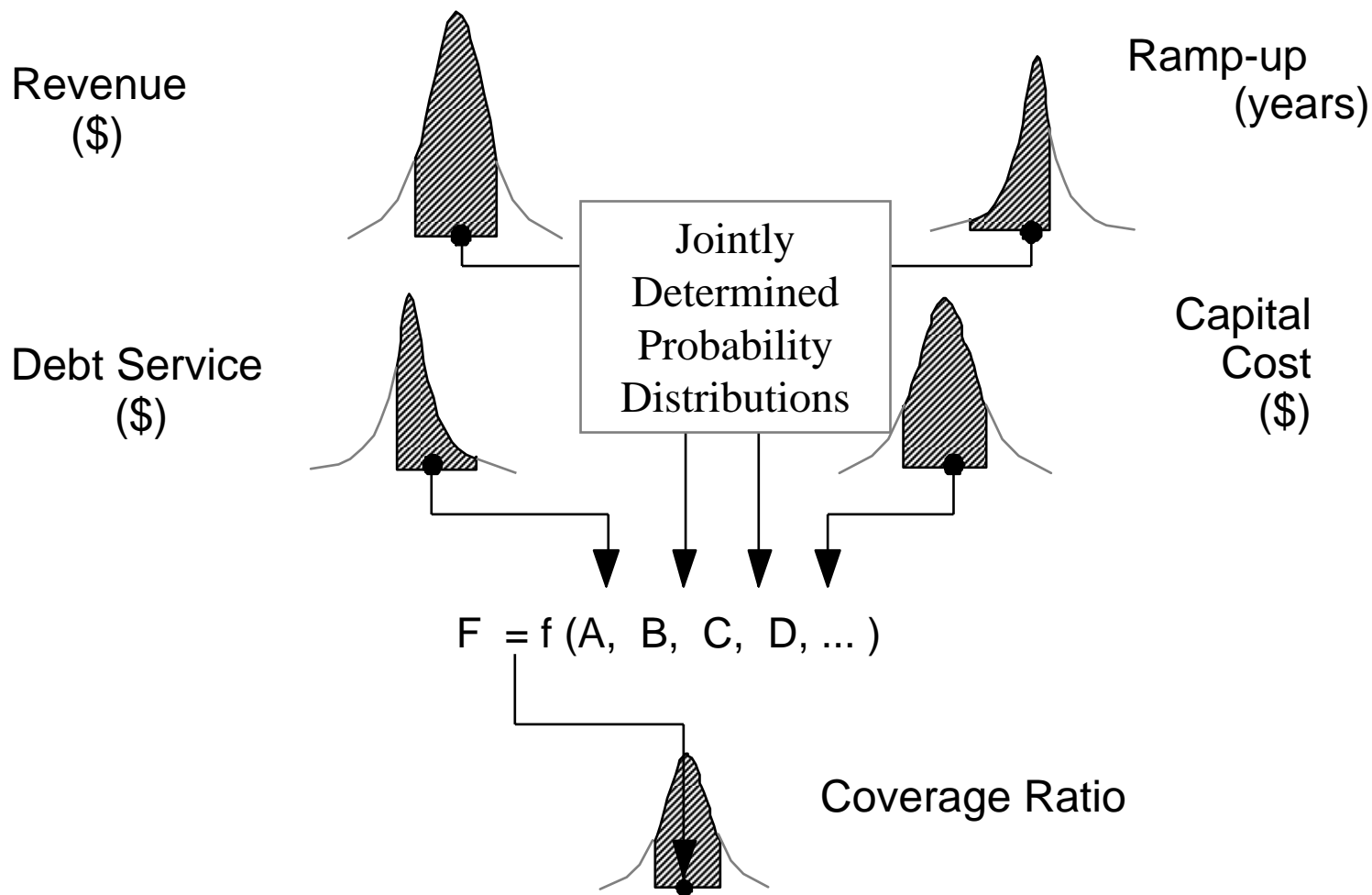
* INDICATES THE UPPER AND LOWER LIMITS OF AN 80% CONFIDENCE INTERVAL.

Risk Visualization

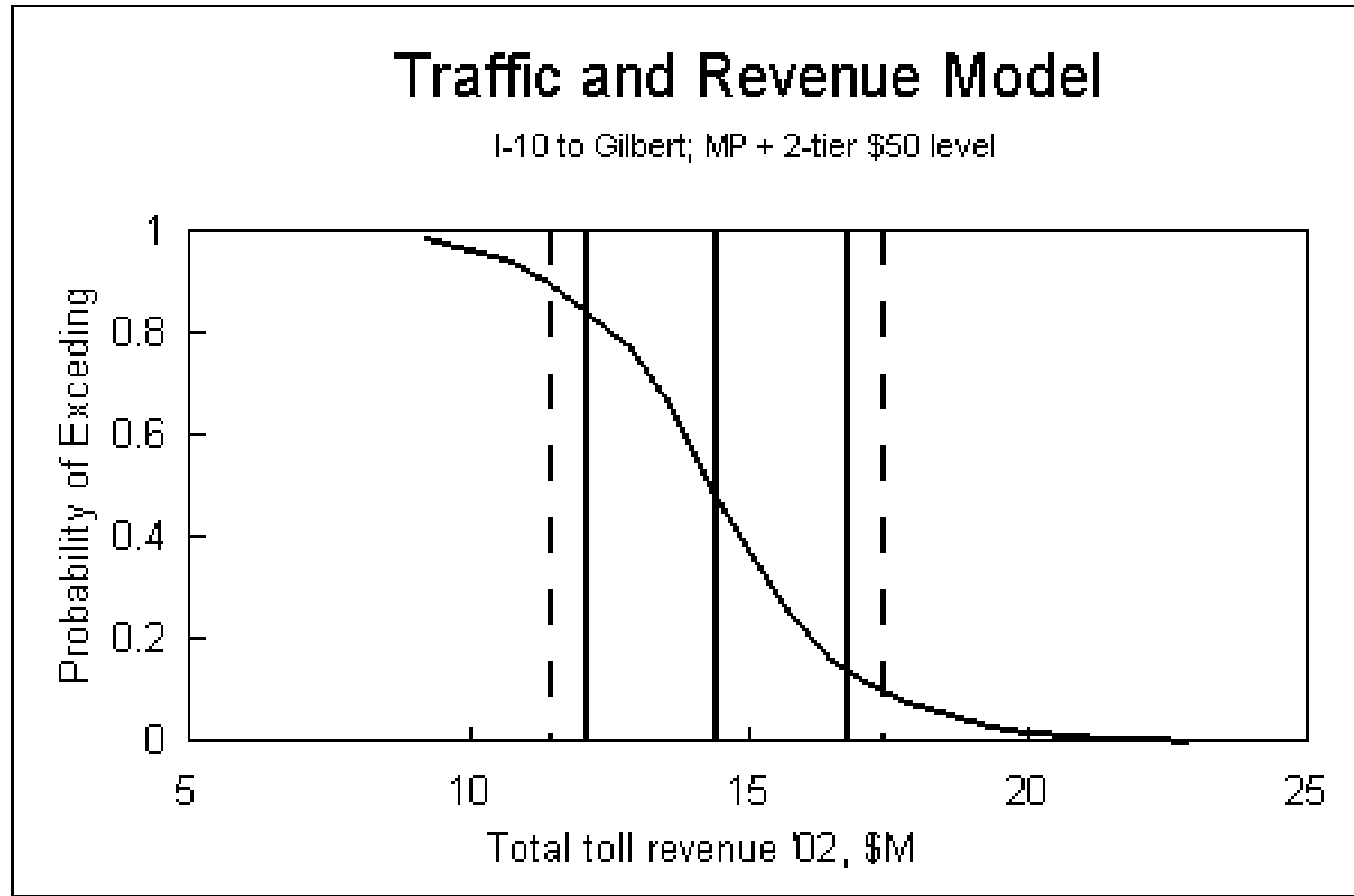
Risk Analysis of Toll Road
MetroRoad Analysis



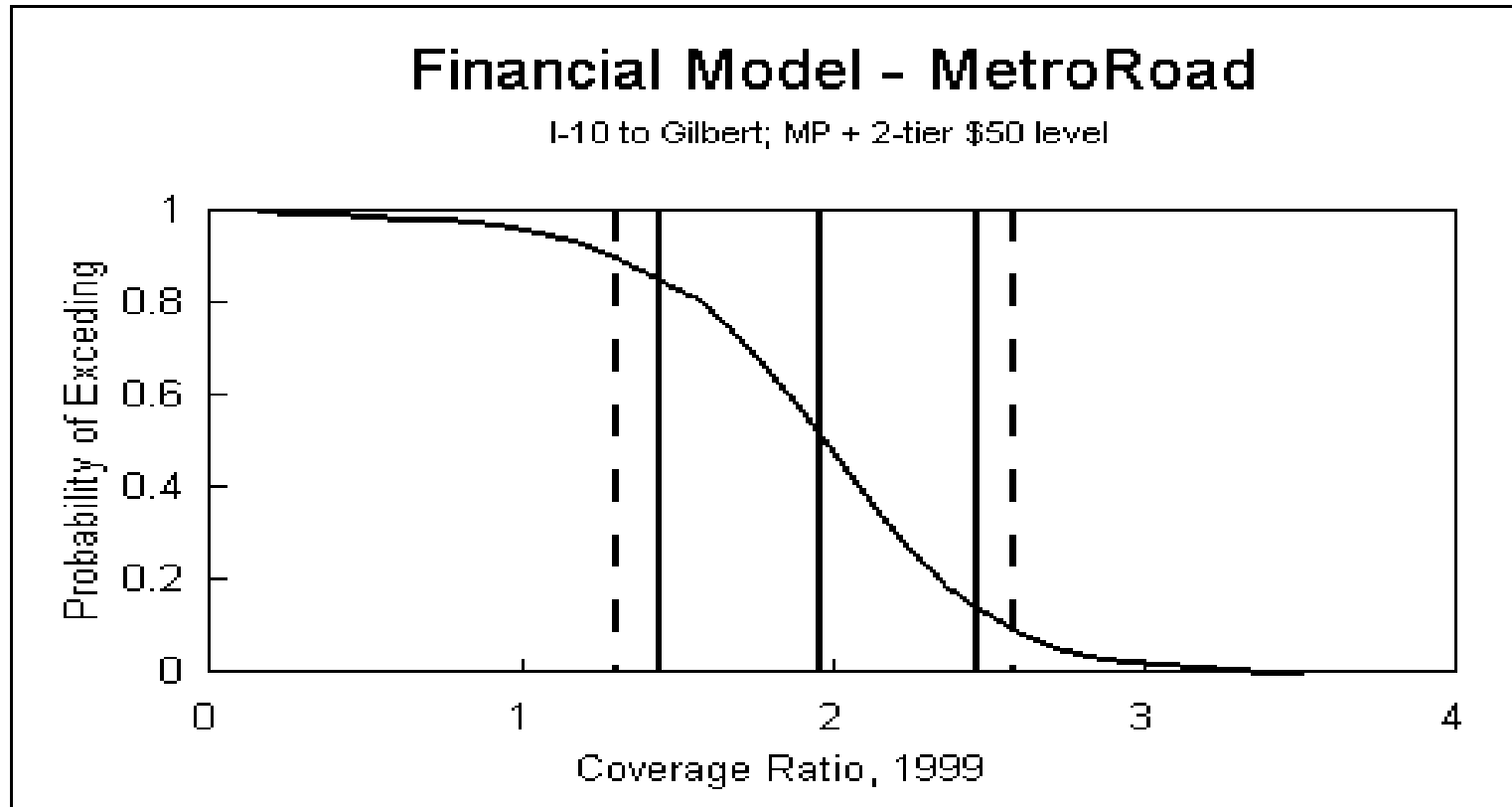
Risks Prowl in Packs



Risk Adjusted Outcomes: MetroRoad



Risk Adjusted Outcomes (Cont'd)



Baseline Portfolio

Descending Project Rank by Business Case Criterion (e.g., NPV)	Cumulative Project Capital Cost Per Year (in \$ millions)
1	10
2	25
3	50
4	250
5	275
6	400
*	*
*	*
112	*
113	*
114	1,920
115	*
116	*
*	* Sound Project Omitted From Budget Per Year
*	*
*	*
120	*
121	*
222	*
223	*
224	*
*	*

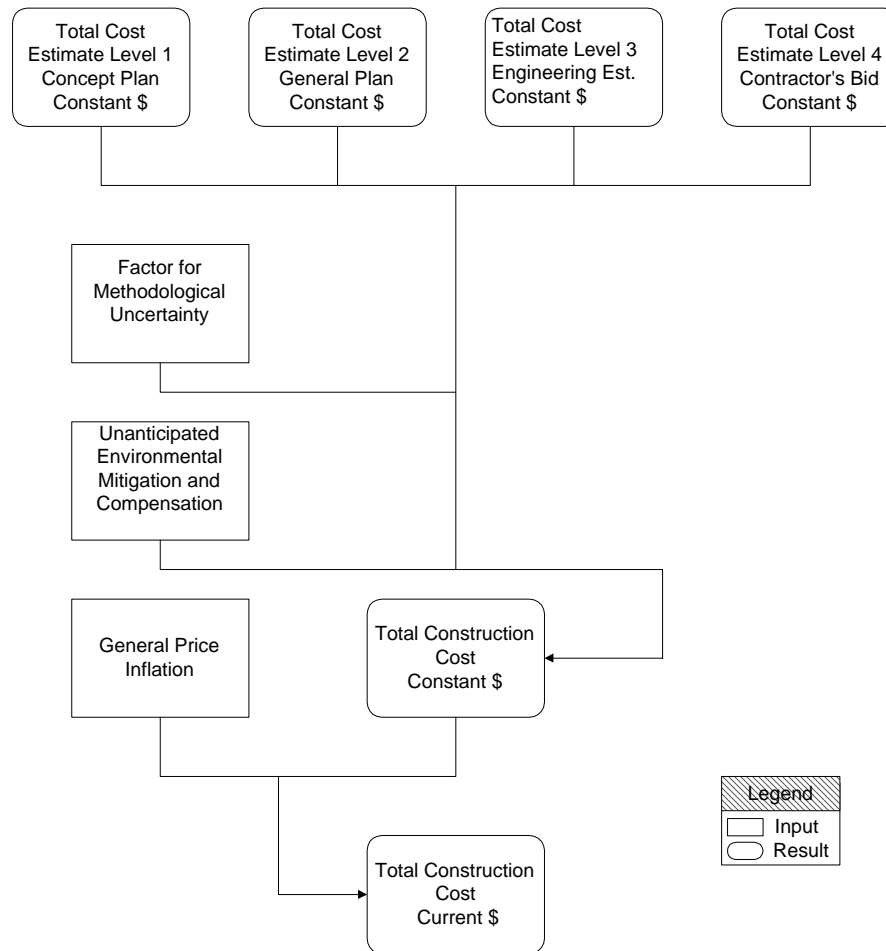
Portfolio Budgeting with Sub-Objectives

	Urbanized Areas		Suburban Areas		Rural Areas	
	Rank by NPV	Cumulative Capital Cost	Rank by NPV	Cumulative Capital Cost	Rank by NPV	Cumulative Capital Cost
Mega-Projects (more than \$10 millions)	1		1		1	
	2		2	Sub-budget cutoff	2	
	3	Sub-budget cutoff	-----		3	
	21		18		4	Sub-budget cutoff
			20		14	
Congestion Projects	Rank by NPV	Cumulative Capital Cost	Rank by NPV	Cumulative Capital Cost	Rank by NPV	Cumulative Capital Cost
	1		1		1	
	2		39	Sub-budget cutoff		
	50	Sub-budget cutoff	40		62	Sub-budget cutoff
			41		63	
Safety Projects	Rank by NPV	Cumulative Capital Cost	Rank by NPV	Cumulative Capital Cost	Rank by NPV	Cumulative Capital Cost
	1		1		1	
	67	Sub-budget cutoff	2		2	
	68		73	Sub-budget cutoff	89	Sub-budget cutoff
			74		90	
Environmental Projects	Rank by NPV	Cumulative Capital Cost	Rank by NPV	Cumulative Capital Cost	Rank by NPV	Cumulative Capital Cost
	1		1		1	
	2		101	Sub-budget cutoff	2	
	96	Sub-budget cutoff	102		113	Sub-budget cutoff
			103		114	

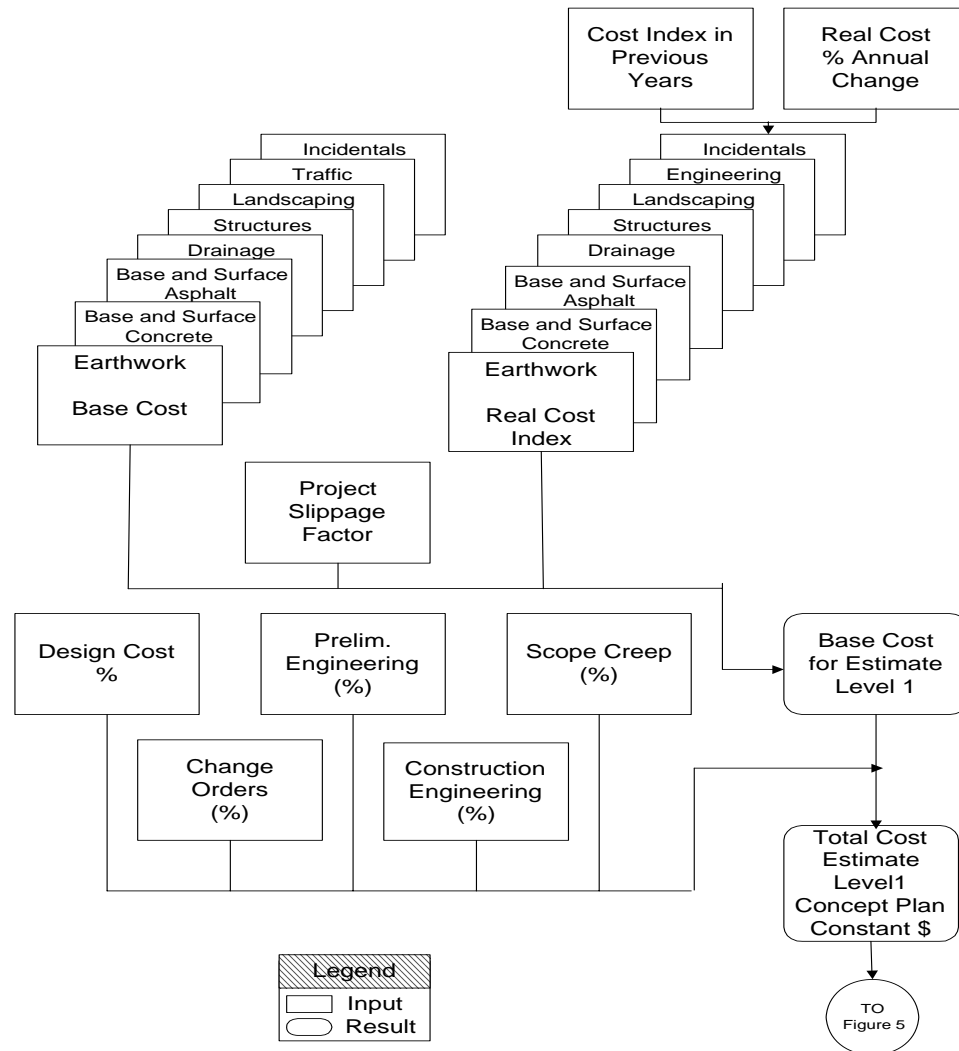
Portfolio Budgeting with Risk-Adjusted Sub-Objectives

	Urbanized Areas		Suburban Areas		Rural Areas	
	Rank by NPV	Cumulative Capital Cost	Rank by NPV	Cumulative Capital Cost	Rank by NPV	Cumulative Capital Cost
Mega-Projects (more than \$10 millions) P>90	1		1		1	
	2		2	Sub-budget cutoff	2	
	3	Sub-budget cutoff	-----		3	
	-----		18		4	Sub-budget cutoff
	21		20		14	
Congestion Projects P>75	Rank by NPV	Cumulative Capital Cost	Rank by NPV	Cumulative Capital Cost	Rank by NPV	Cumulative Capital Cost
	1		1		1	
	2		39	Sub-budget cutoff		
	50	Sub-budget cutoff	40	-----	62	Sub-budget cutoff
	51		41		63	
Safety Projects P>20	Rank by NPV	Cumulative Capital Cost	Rank by NPV	Cumulative Capital Cost	Rank by NPV	Cumulative Capital Cost
	1		1		1	
	67	Sub-budget cutoff	2		2	
	68	-----	73	Sub-budget cutoff	89	Sub-budget cutoff
	69		74		90	
Environmental Projects P>30	Rank by NPV	Cumulative Capital Cost	Rank by NPV	Cumulative Capital Cost	Rank by NPV	Cumulative Capital Cost
	1		1		1	
	2		101	Sub-budget cutoff	2	
	96	Sub-budget cutoff	102	-----	113	Sub-budget cutoff
	97		103		114	

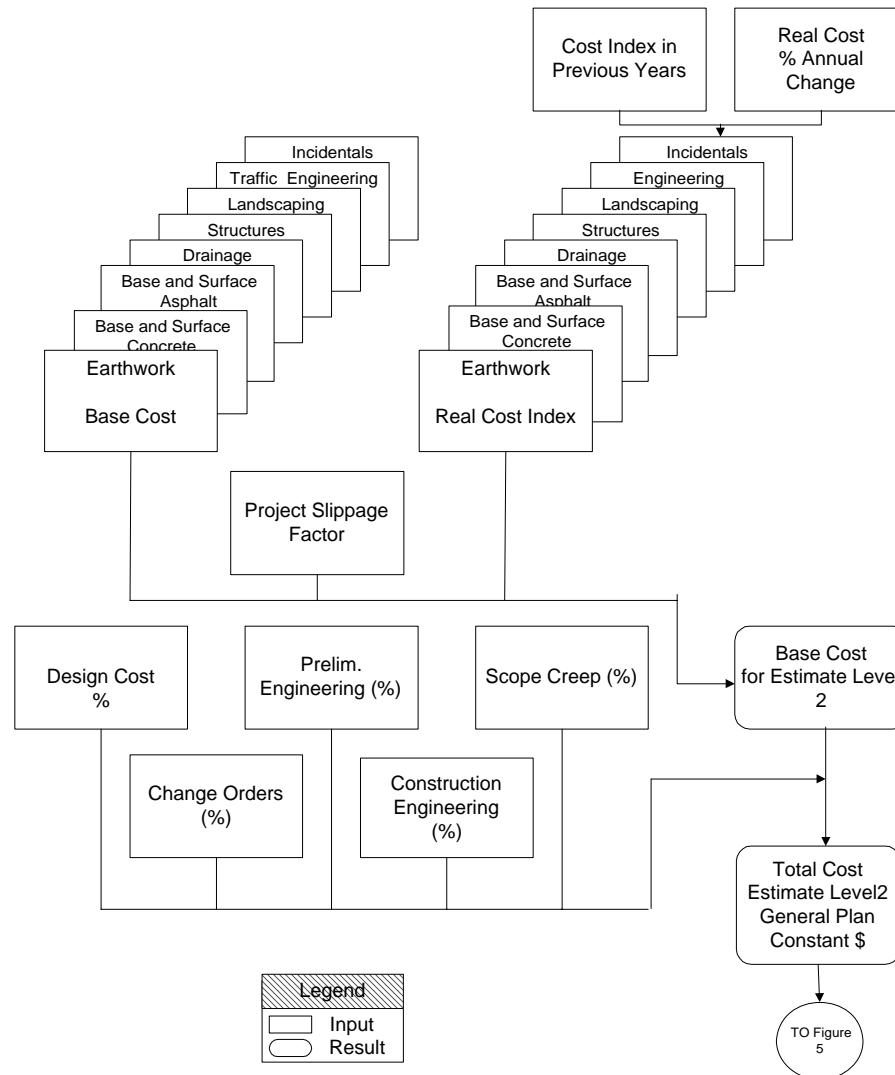
Structure & Logic Model for Total Construction Cost



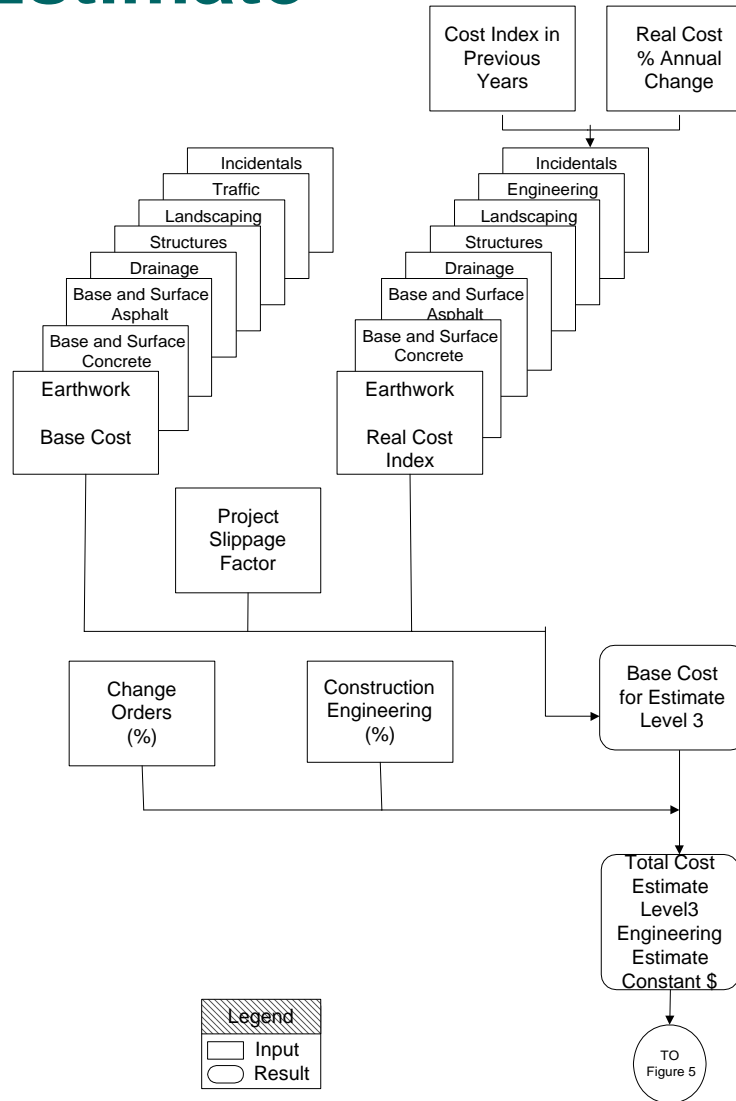
Structure & Logic Model for Base Construction Cost Estimate 1: Concept Plan



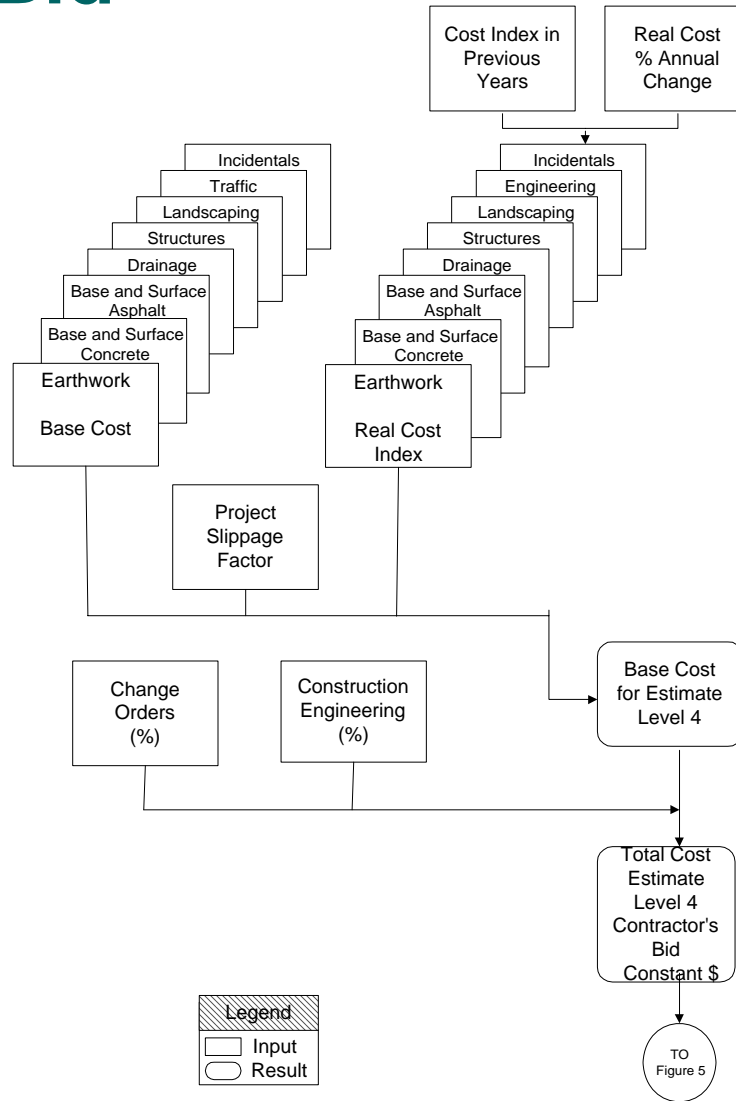
Structure & Logic Model for Base Construction Cost Estimate 2: General Plan



Structure & Logic Model for Base Construction Cost Estimate 3: Engineering Estimate



Structure & Logic Model for Base Construction Cost Estimate 4: Contractor's Bid



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