



Minimizing Risks Inherent in Tunnel Projects

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The Global Leader in Managing Construction Risk™

Risks

- “....hazards that have been assigned a probability of occurrence and potential impact”
- Sources
 - Scope
 - Costs
 - Duration/Schedule
- Need to be managed to reduce impacts and costs

Scope Risk

- Tunnel construction
 - higher risk of unforeseen site conditions
 - 8 to 12% added work contingency
- Method of Construction
- Owner Contingency

Costs Risks

- Changes in
 - unit price, quantities, escalation, and
 - basis of budget estimate
- Estimating Methods
 - Parametric's
 - Assemblies
- Contingency Management

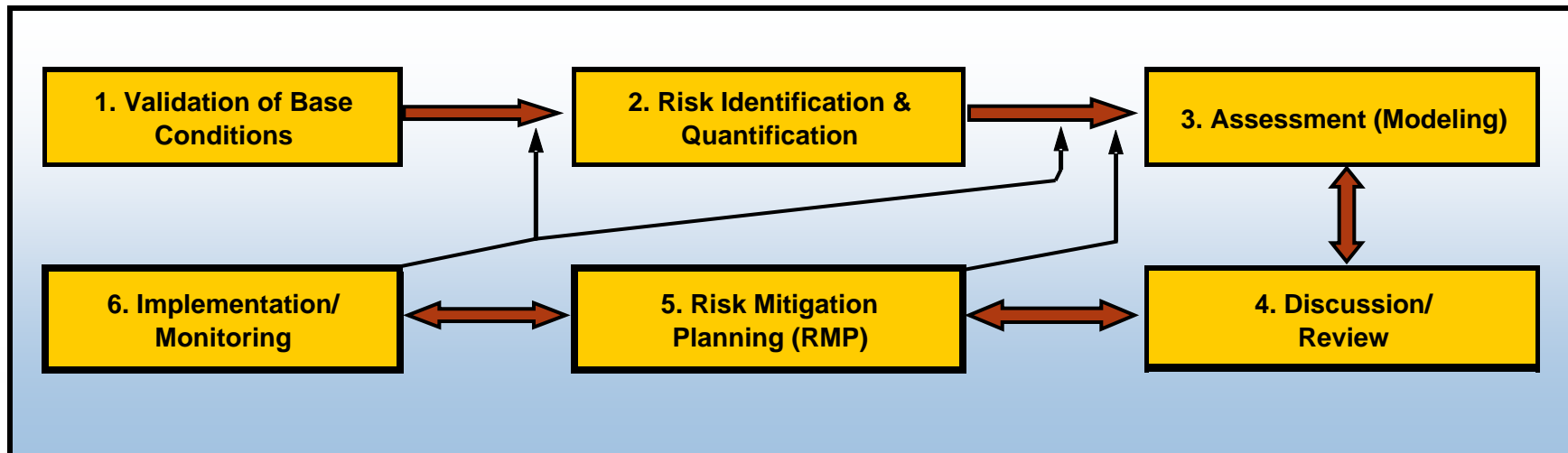
Schedule Risks

- Accuracy of Estimates
- Added Scope
- Early Critical Path
- Differing Site Conditions
- Hours of Work

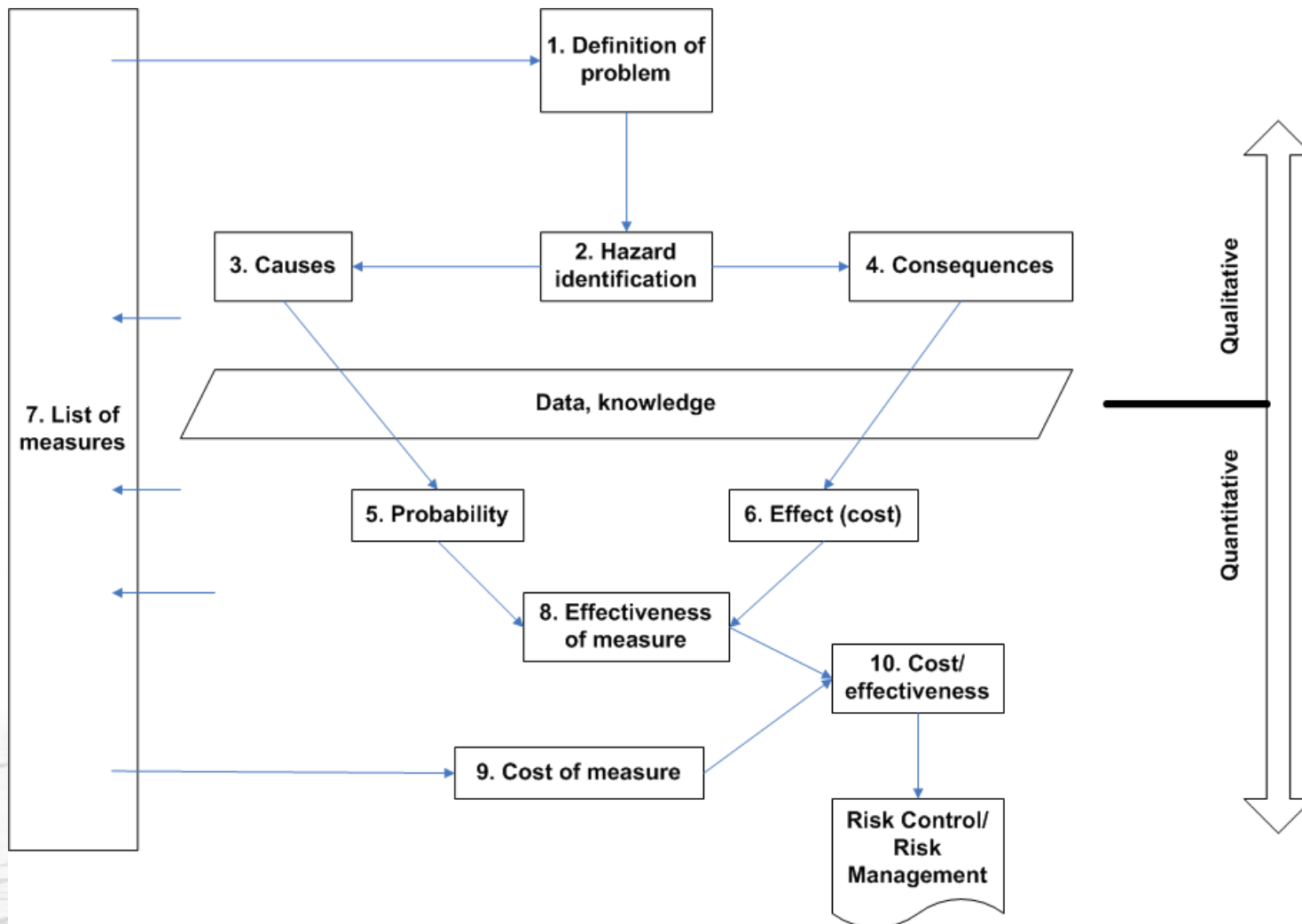
Management Approach

- FTA Procedure
- Construction Industry
- Tunneling Industry

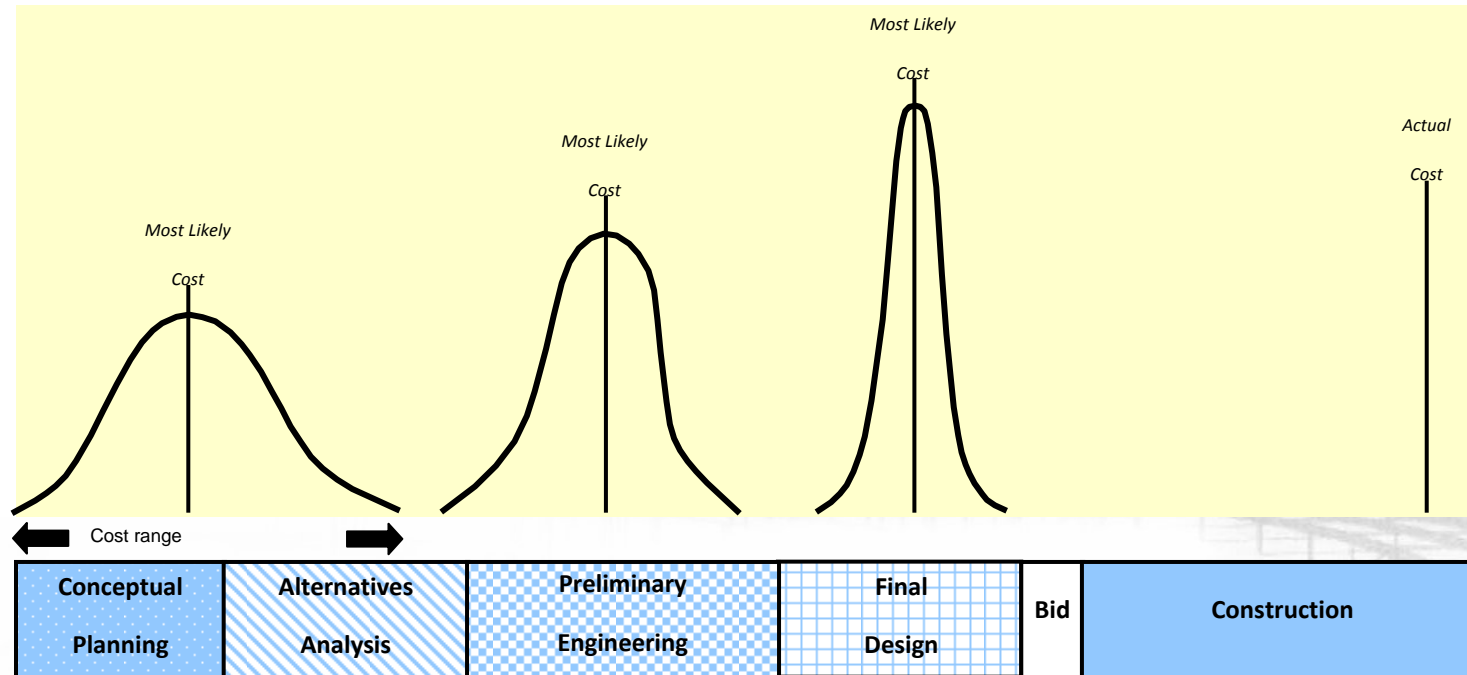
FTA Procedure



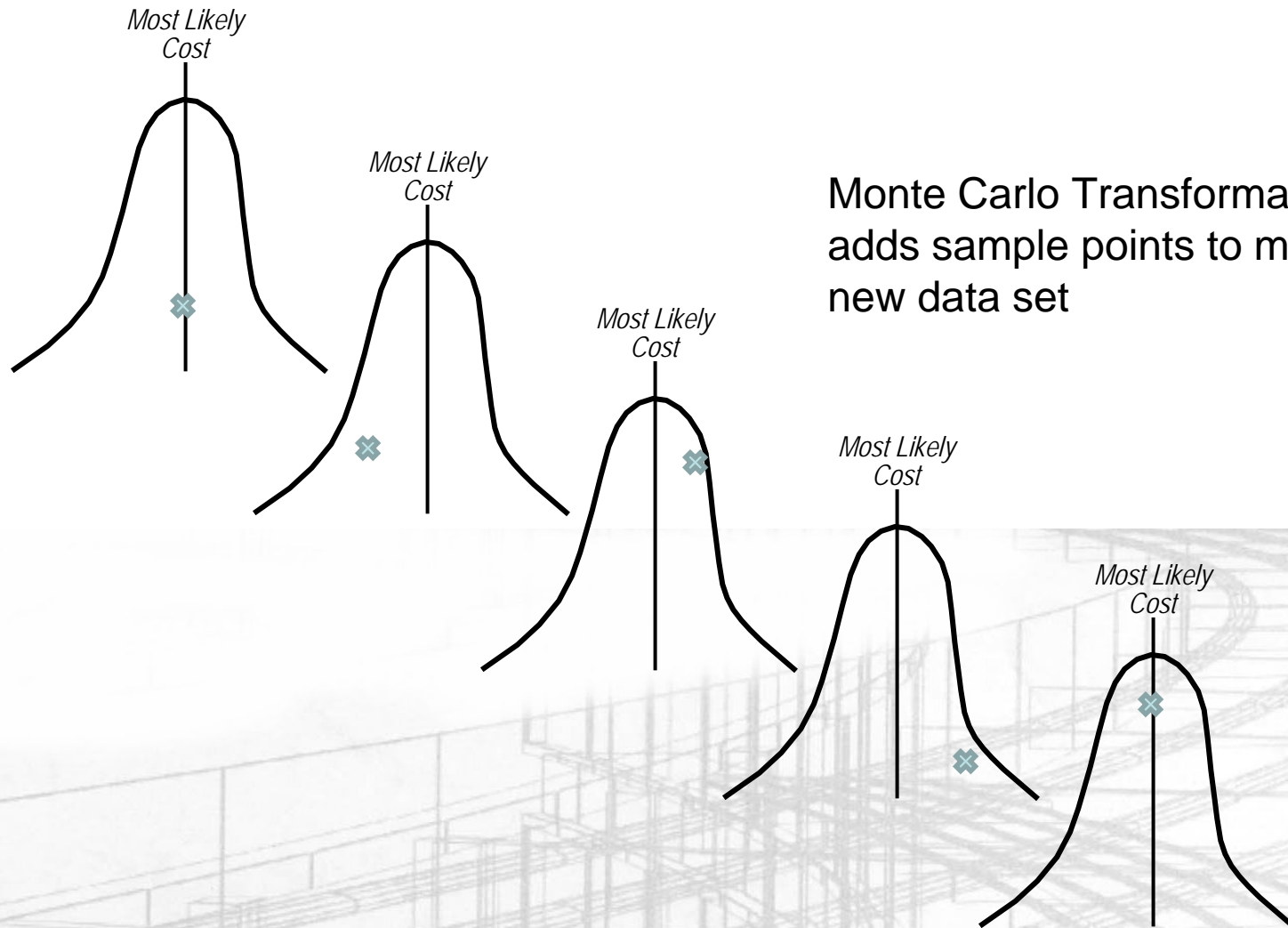
Process per CII



Project Uncertainty



Stochastic Method



Monte Carlo Transformation adds sample points to make new data set

Construction Practice

- Predicting the cost and the schedule.
- Defining risks and their probability.
- Managing the critical path items
- Risk sharing strategies

Estimating

- All project knowledge should be included in the estimate
- Vet the estimate with the Project Team
- Estimate to the level of detail necessary to reduce risk

Scheduling

- The schedule and the estimate should reflect each other
- Estimate strategies above need to be followed for the schedule
- Key components.
 - Third-party issues require detailed development
 - Construction staging should be worked out in preliminary engineering

Risk Sharing

- Span of control relates to cost.
- Insurance and bonding are keys for big jobs
- OCIP that includes professional liability
- Delivery Strategy, Procurement Plan

Procurement Plan

- Owner's Profile matched to the Job
- Clear Contract Documents
 - Define the boundaries
 - Payment strategy reinforces control and performance
 - Dispute resolution plan affects bids and delays
- 3rd Party Requirements are kept away from the Critical Path

Tunnel Practice

- “The Owner owns the Ground”
- Tunnel Risks arise out of:
 - Actual ground conditions
 - Characterization of the expected ground
 - Contractor’s Methods and Means
- Site investigation and ground characterizations needs to be iterative

Risk Factors

- Differing Site Conditions
- Contractor Experience
- TBM Selection

Geotechnical Hierarchy

- Geotechnical Data Report
- Geotechnical Baseline Report
 - 2 step for design-build
 - May require adjustments based on the Contractor's chosen methods and means
- Process trades off Owner's Risk Tolerance with Bid Costs

Differing Site Condition Clause

“the contractor shall promptly and before such conditions are disturbed give a written notice to the contracting officer of

- (1) subsurface or latent physical conditions at the site which differ materially from those indicated in this contract, or*
- (2) unknown physical conditions at the site of an unusual nature which differ materially from those ordinarily encountered and generally recognized as inhering in work of the character provided for this contract.”*

Dispute Resolution Boards

- Needs to be
 - chosen at the start of construction
 - Involved as work progresses
- Establishing at point of dispute prolongs process and reduces effectiveness

TBM Selection

- The quality, capability and suitability of the TBM has a direct influence on risk

versus

- Clearly part of Contractors means and methods
- The more restrictive the TBM spec is the more risk the Owner buys in it's performance



Questions?

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