Office of Project Letting:

Cost Estimating Process

August 12, 2010
Current Practice

- Estimates Created by Project Team
- Central Review is Performed
- Commodity Prices Updated/Adjusted
- Plans & Specifications are Reviewed
Some Methods Used

- CEVP Used on Some Projects
- Anticipated Items Used to Manage Risk
- Have Not Chased Market
- Use A+C Contracting to Manage Risk
- Seeking FHWA Input on Approaches
OTIA III State Bridge Delivery Program:

Cost-Risk Analysis
Cost Risk Analysis

What is Cost Risk Analysis for OTIA III?

Method Used to Quantify Unit Cost Component Elements in order to Bridge the Engineer/Construction Contractor Expectations Gap, and to Improve Estimating Efficiency
Why Perform Cost Risk Analysis

![Highway, Street, and Bridge Construction Materials Price](chart)

- PPI
- Year

- 2003 to 2010
- Price Index
Why Perform Cost Risk Analysis

- 30% Rise in Material Costs 2003-2006
- 86% Rise in Material Costs 2003-2008
- Utilized as a Tool for Management Decision Making in Fixed Budget Environment
- Utilized as a Tool for Planning and Cost Management
- Allowed for Active Management of Risk Drivers
- Provides Early Indication of Problems on Program/Project for Proactive Response
Why Perform Cost Risk Analysis

• Identifies Program/Project Cost Risks
• Utilized as a Tool for Management Decision Making
• Utilized as a Tool for Planning and Cost Management
• Allows for Active Management of Risk Drivers
• Provides Early Indication of Problems on Program/Project for Proactive Response
Why Perform Cost Risk Analysis

Bundle 210 – Sandy River

• Initial Analysis Showed High Cost for Concrete Bridge Due to Amount Needed for Footings
• Determined Steel As Less Expensive Alternative
• Redesigned to Steel
• Bids Came in Much Lower Than Originally Estimated
Risk Analysis Process
A Four-Step Process

Step 1
Structure and Logic of Forecast Model

Step 2
Materials Market Forecast Developed

Step 3
Analytical Estimates & Probability Analysis

Step 4
Risk Analysis and Decision Support
The Context – Risk Exposures
For Individual Project Cost Estimates

Risk Causes
- Technical issues
- Pricing uncertainty
- Industry Capacity
- Available resources
  - Labor
  - Unit Quantities
- Location
- Market Volatility
- Regional Market Conditions
- Historical Pricing Trends
- Seasonality
- Time of Construction Bid
  - Year
  - Time of Year

Risk Impacts
- Individual Unit Cost Risks
  - Risk that budget elements (unit prices, quantities) will deviate from the estimate.
- Volatility and Pricing Risks
  - Risk of labor and material markets rapidly changing by the time a project goes to construction.
- Location and Timing Risks
  - Risk of significant cost premiums due to time of bid, year of bid, industry capacity, and location of project.
Summary of Process for Performing Cost Validation

- Obtain cost estimate from A&E firm
- Identify specific problems (missing items, misidentified items)
- Set up cost-risk model to run using Risk Analysis software
- Develop Cost Ranges on Each Line Item
- Develop report to give to internal engineering staff regarding results
- Iterate through process throughout the design phase
Economic Analysis

• Cost Ranges Developed Considering Market factors such as
  - NW Market conditions (for materials & escalation)
  - Location & duration of work
  - Time frame of when work is bid (early vs. late)
  - Capacity of the construction industry in the State
  - Materials (steel vs. concrete)
  - Economies of scale obtained
Engineering Input

• Input from engineers is incorporated into the formulation of risk model:
  
  – Information which may drive costs that engineers know, but is not apparent looking at cost data alone
  
  – Information regarding the project that may be unique (tightly curved bridges, isolated location with unique issues, etc.)
    • Spliced reinforcing steel or staged pours
    • Limited work window
Results

- Each independent line item has its own unique distribution determined by the defined price parameters
- High Risk (to overall cost) Items Are Identified in Report
- A&E Firm Makes Adjustments to Estimate
- Process re-run at Advance Plans and Final PSE
Results

Tornado Diagram developed to show highest risk items in the Project

![Tornado Diagram](image)

Regression Sensitivity
(Based on Correlation to Total Cost)
Cost Risk Validation/Analysis

Why Use Cost Risk Analysis

- Identifies Program/Project Cost Risks
- Helped Capture Fast Moving Material Costs
- Utilized as a Tool for Management Decision Making
- Utilized as a Tool for Planning and Cost Management
- Allows for Active Management of Risk Drivers
- Provides Early Indication of Problems on Program/Project for Proactive Response
Real Benefits

• Difference between engineering cost estimates and construction bids drastically reduced.
  – Down from differential of more than 30% to 7%

• Aids in realizing true ‘market’ cost of a project

• Material risks realized early in the design phase

• Provides discussion piece for value engineering
Results

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<th>DAP*</th>
<th>Advance Plans</th>
<th>Final PS&amp;E</th>
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<td>A&amp;E Firms</td>
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<td>OBDP ESG</td>
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*OBDP DAP Estimates don’t include Bundles 205 and 222. Bundle 205 added 14 repair bridges after DAP analysis was performed. Bundle 222 had a change in scope, as well as additional materials to be utilized after DAP analysis. This will be updated – I can use through 2008 which is latest update now.
Results II

<table>
<thead>
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<th>Differential to: Low Bid</th>
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<tr>
<td></td>
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<td>DAP*</td>
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<td>OPL Estimate</td>
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<td>-</td>
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</table>

*OBDP DAP Estimates don’t include Bundles 205 and 222. Bundle 205 added 14 repair bridges after DAP analysis was performed. Bundle 222 had a change in scope, as well as additional materials to be utilized after DAP analysis. This analysis includes bids through June 2010 and the difference between this and the other table is largely related to how low bids have come in since 2008.
QUESTIONS?