Risk-Based Cost Estimating at MnDOT

CDOT Peer Exchange
May 10, 2016

We all have a stake in A→B

MnDOT – Methodology

- MnDOT is set up similar to CDOT in structure
  - Decentralized – 8 Districts, 1 Central Office

MnDOT – Methodology

- Districts – District Estimator/Estimating Coordinator
- Central Office
  - Cost Estimating Group
    - Provide PS&E estimates
  - NEW – Independent Estimating Group
    - Provide independent estimate reviews during project development
    - Risk-based cost estimating capabilities

Cost Management – Budget Setting

- Why?
  - MnDOT Wildly Important Goal, 2013–2015: Enhance Financial Effectiveness
    - Project Management – one focus on Project Cost Management
      - Between 2010 and 2013, only 35% of 738 projects let had bid awards within $\pm15\%$ of STIP amount
      - Between 2010 and 2013, 51% of 738 projects let had bid awards within $\pm 10\%$ of Engineer's Estimate
    - Tool to help PMs manage scope of project
    - Goal to be on budget

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‣ State funding program through special legislation, available from July 2014 to June 2018
‣ $300 million total available with 10 projects identified
‣ Objectives of program
  ◦ Identify baseline costs and risks for each project and the overall CoC program
  ◦ Establish construction budgets for program delivery, projects, and program contingency
  ◦ Develop processes and mechanisms to manage program contingency funds

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‣ Initial Cost range to deliver 10 projects: $270M – $356M
‣ Projects selected in various stages of development
‣ Worked with WSP/PB to conduct risk management process in order to:
  ◦ Determine if sufficient funds were available to deliver all projects
  ◦ Recommend budgets for projects based on available funds and risks associated with project
  ◦ Identify project risks for managing by PMs
  ◦ Recommend process and budget for managing program contingency

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- ‣ Risk-based cost estimates used to determine risk contingency for individual projects and overall program
- ‣ Risk contingency carried for overall program rather than in individual project budget
- ‣ Carrying risk at program level estimated 83% chance program costs would not exceed available funds

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Distr.	Project	Route	Construction Budget	Actual Letting Cost	Difference	% Difference
1	SP 3116-142	US 169	$ 8,264,558.00			
2	SP 1102-62	US 2	$ 10,457,000.00	$ 13,311,647.93	$ 2,854,647.93	27%
3	SP 2780-66	I-94	$ 32,352,704.00	$ 28,327,500.00	$ (4,025,204.00)	-12%
4	SP 0303-64	MN 34	$ 9,951,673.00	$ 7,918,423.51	$ (2,033,249.49)	-20%
6	SP 7402-30	US 14	$ 15,000,000.00	$12,010,983.48	$ (2,989,016.52)	-20%
7	SP 5203-104	US 14	$ 38,460,500.00	$ 31,659,659.79	$ (6,800,840.21)	-18%
8	SP 4206-22	MN 23	$ 10,339,000.00	$ 4,100,056.00	$ (6,238,944.00)	-60%
M	SP 2771-37	MN 610	$ 100,309,058.00	$ 80,725,000.00	$ (19,584,058.00)	-20%
M	SP 6285-143	I-694	$ 42,255,118.00	$ 34,695,022.00	$ (7,560,096.00)	-18%
			$ 267,389,611.00	$ 212,748,292.71	$ (46,376,760.29)	

Lessons Learned

‣ P80 is a high confidence level to set
  ◦ All but one project let has come in >12% under budget

‣ Overall methodology of using cost estimate, uncertainty and risk to determine budgets will work
‣ Saw support of budgets from staff who worked on CoC projects

Beyond Corridors of Commerce

‣ Budget setting for all projects MnDOT's program
‣ Started with pilot program of sampling from FY16 and FY 17 projects
  ◦ Pavement and Bridge projects
‣ Brought WSP/PB on board to help
  ◦ Budgets
  ◦ Risk Workshops
  ◦ Process and guidance information for cost management (risk, uncertainty, etc.)

Current MnDOT Approach

- Based on CoC idea of utilizing risk-based cost estimates to set project budget
- Project Categorization
  - Priority 1: <$10M
  - Priority 2: $10M to <$25M
  - Priority 3: $25M and up
- Include special programs, bond programs, areas of higher risk within Priority 2 requirements

Current MnDOT Approach

- Priority 2 and Priority 3 Projects
  - Cost Estimate
  - Risk Register
  - Quantitative risk analysis applied to estimate, estimate uncertainty and risks
  - Priority 3 projects also will need formal risk workshop or CRAVE workshop

Current MnDOT Approach

- Priority 1 Projects
  - Data
    - Cost Estimate
    - Risk Register
  - Developing scalability "analysis" of risk
    - Smaller, straight forward projects with small risk associated
    - Working to create ranges of factors for risk and uncertainty vs. general numbers off table or curve
      - Reviewing past projects of EE vs. bid
      - Categorizing by major work type

Project Development Phase	Project Maturity (% project definition completed)	Purpose of the Estimate	Estimating Methodology	Estimate Range
Scoping	10% to 30%	Design Estimating—Establish a Baseline Cost for Project and Program Projects (IRP and STIP)	Historical Bid–Based or Cost–Based (Mixed, but Primarily Stochastic)	−30% to +50%
Design	30% to 90%	Design Estimating—Manage Project Budgets against Baseline (STIP, Contingency)	Historical Bid–Based or Cost–Based (Primarily Deterministic)	−10% to +25%
Final Design	90% to 100%	PS&E Estimating—Compare with Bid and Obligate Funds for Construction	Cost–Based or Historical Bid–Based Using Cost Estimate System (Deterministic)	−5% to +10%

Other Lessons Learned

- Project Managers tend to be overconfident about estimates during scoping and preliminary design
  - Working to encourage PMs to review top pay items closely and use tighter uncertainty on those items
  - Lower pay items use higher range of uncertainty due to unknowns
- Centralized Cost Estimating
  - Pros – consistent estimating process; dedicated estimators
  - Cons – less ownership in estimates by districts

Other Items

- Continue to work with Districts to encourage buy-in for project budgeting
  - Pilot projects – met with sampling of Districts to discuss process and benefits
  - Budget setting is a change in how we do business