NOVA DISTRICT COST ESTIMATE BEST PRACTICES
ACEC Project Development Forum – 6/4/19

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Overview

- Recent Lessons Learned
- SMART SCALE Validation
- Best Practices
- Tools
- What Can YOU Do
- Upcoming VDOT Actions
Recent Lessons Learned

- Recent projects have come in significantly over the Engineer’s Estimate
  - Route 7 Corridor Improvements
  - Route 7/Battlefield Parkway Interchange
  - (Other Projects in Other Districts)
- Beware of predetermined notions of a project’s cost
  - ‘It shouldn’t cost’ comparisons to older projects with different site conditions/constraints
  - ‘Rules of thumb’ that are out of date $1 million/lane/mile, $250/SF bridge
  - ‘Scope Creep’ without consideration of implications on estimate
Recent Lessons Learned

• Finding and Selecting the right unit price
  • Erosion and Sediment control items have been double the unit bid item cost based on review of the last couple months of bid tabs
  • Remember that 2-year bid history, District average sheet, or AASHTO Preconstruction (formerly TRNS*PORT) are a rolling 24-month average
  • Look at more than just one source for a variety of perspectives (FHWA, R.S. Means, Dodge, etc.)
SMART SCALE Estimate Validation Findings

- PCES (Project Cost Estimating System)
- Contingency
- Inflation
PCES

• Version during August/September 2018 validation was 8.0 (current version as of 5/28/2019 is 8.1.1)
  • Because the macros are self-contained, earlier versions increase the chances that prices are out of date.
• Several instances of applications using Versions 7 or 6
  • Need backup for all manual entries
PCES Excluded Items (Pages 58-60 PCES Users Manual)

- **Major Items that are not included in the late-mile cost per the User’s guide must be added to the ‘CONST-MISC’ tab such as:**
  - Rock Excavation
  - Removal/demolition of existing items
  - Major pipe crossings/box culverts
  - SWM/BMP
  - Impact attenuators
  - Retaining walls
  - Sound walls
  - VDOT Oversight on Locally Administered Projects
  - **Default Contingency is . . .**
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  - VDOT Oversight on Locally Administered Projects
- Default Contingency is 0%!
### PMO-3.5 Project Development Budgets and Estimates

(Source: Nick Roper 11/17/18 presentation to ASHE)

#### Expected Level of Cost Estimates by Development Phase

<table>
<thead>
<tr>
<th>Planning / Pre-Scoping</th>
<th>Scoping</th>
<th>Preliminary Design</th>
<th>Detailed Design</th>
<th>Final Design / ROW Acquisition</th>
<th>Advertise Project</th>
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</thead>
<tbody>
<tr>
<td>±40%</td>
<td>±30%</td>
<td>±25%</td>
<td>±20%</td>
<td>±15%</td>
<td>±10%</td>
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</table>

- Contingency should never be less than 30%
- Public Hearing – Contingency should be between 20%-25%

- Budget set for SMART SCALE projects
- Budget set for non SMART SCALE projects
- Current Dashboard
- Old Dashboard
Inflation

- Inflation percentage for PCES v8.1.1 is roughly 2.5%/year
  - Set based on federal financial forecasts
  - Historically has been between 2.3%/year – 2.7%/year between versions
- Must determine overall project schedule in order to inflate to correct year
- Per PCES Users Manual:
  - Projects with two year or less construction duration, inflate to AD Year
  - Projects with over two year construction duration, inflate to Mid-Construction Year
Best Practices
Things to Do, Things Not to Do
Best Practices

1. Define / Refine the Problem Statement
2. Use a Team Approach
3. Engage the Right People in the Effort
4. Use the Right Tools – Software, Checklists, etc.
5. Don’t Skimp on Due Diligence
6. Document Assumptions & Exclusions
7. Accuracy vs. Precision
8. Check Your Work
9. It’s Still Just an Estimate
Due Diligence

- Site Visits
- GIS Data & Related
- Record Plans, Reports, Etc.
- On-Line Resources
I-66 SE Auxiliary Lane Extension – Route 123 to Prince William Parkway
Conceptual Design Study & Cost Estimate II
July 30, 2018

Objective:
Provide a continuous auxiliary lane on SR 150 between Route 123 and Prince William Parkway to alleviate pinch points in advance congestion. The extended auxiliary lane will be accommodated by converting the existing shoulder to provide a continuous lane from the east of the existing gap from Rte. 123 and tying into the beginning of the existing off ramp to the Prince William Parkway.

Methodology:
Reconstruct the existing main line shoulder as an expanded 12’ auxiliary lane constructed in 10% gravel shoulder to the right of the new lane; relocate the existing guardrail and sign structures, and provide additional barrier of guardrail as needed.

Terminal:
Approximately 4.16 miles S. of Route 123 to approx. 1.064 ft. of Prince William Parkway.

Length:
Approx.: 4,136 ft. = 1.30 miles

Existing Conditions:
- Radius: ~400’
- Post-Mile Speed Limit: 65 mph
- Ename: 9%
- Transverse Grade: ± 3.8%

Assumptions:
- Minimal or no ROW acquisition required
- Existing shoulder to be demolished and replaced to full-depth and to maintain existing travel lane cross slopes.
- The existing pavement won’t support traffic, and the shoulder is aligned with the wrong way for use as a travel lane – the existing cross slope will only support speeds of ~30 mph.
- The existing minor offset (1 ft. > 2 ft.) from edge of lane to face of barrier will be maintained along the existing auxiliary lane from the end of the on ramp from Rte. 123 to a point beyond the Choozair Road bridge.
- From that point south, the existing shoulder will be transformed into 12 ft. travel lane with
  - A new 14’ power right shoulder adjacent to the extended auxiliary lane.
  - 1000’ long emergency pull off site. (500’ type length = 200’ full width=21’)
- Minimal utility impacts – most of the work to be within L/A line.
- Relocate O/R line structures in conflict
- Relocate Power control boxes in conflict
- Retaining walls to avoid impacts on the adjacent facilities
- Replace impacted traffic lighting
- New construction of noise walls required at certain locations within the project limits
Tools

Methodologies, Software, Checklists & Resources
Methodologies

1. Analogous Estimates (Parametric)
   • Use costs of similar completed projects as basis
   • Use factors or multipliers to account for variation in scale
   • Focus on differences between projects, rather than similarities
   • *Used for conceptual estimates, and as check later during project development*

2. Major Item / Component Estimates (Parametric)
   • Use limited number of items & some composite items, e.g. SY of pavement vs. tons of asphalt
   • May use percentages to estimate some project elements, e.g. Maintenance of Traffic
   • *Used for conceptual & pre-scoping estimates, and as a check on later estimates*

3. Unit Price Estimates (Parametric)
   • Uses detailed quantities and record bid item unit prices. AASHTO Pre-Construction (TRNS*PORT) estimates fall in this category.
   • *Used throughout project development when sufficient detail / data is available.*

4. Bottom-Up Estimates
   • Definitive estimate, based on production rates, etc.
   • *Used by contractors to prepare bids.*
1. Preliminary Design Software
   • Example – Bentley Concept Station. Used to develop conceptual design based on off-the-shelf data sets (topographic mapping, aerial imagery, etc.). Can generate quantities for use in early estimates. VDOT is just beginning to use this).

2. Spreadsheet Estimating Templates
   • Particularly useful for major item / component estimates; unit prices for composite items are developed from bid tab records).
   • Uses a ‘standard’ list of items – enter ‘zero’ quantity where item is N/A, add custom line items as needed.
   • Simple, easy-to-review format. Facilitates ‘high-level’ look at how project cost components come together.

3. VDOT PCES
   • Uses major project parameters to generate costs based on prior projects; roadway classification, lane-miles, etc. Estimates do not account for some project components, which have to be accounted for by manual input; these are identified in the Users Manual

4. AASHTO Preconstruction (TRNS*PORT)
   • Generates unit price-based estimates, used throughout project development as soon as sufficient information is available to build the estimate.
Checklists

- Help capture ‘hidden’ cost components, e.g.:
  - Support of Excavation
  - Work Restrictions
  - Unique Coordination or Permitting Requirements
  - Other items not covered by bid items
- Safeguard against major omissions
- User discretion advised

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<tr>
<th>Consideration</th>
<th>V/N</th>
<th>Remarks</th>
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<td>Access Restrictions?</td>
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<td>Unclassified Ordnance?</td>
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</table>
1. References
   • NCHRP 574 - Procedures for Cost Estimation and Management for Highway Projects During Planning, Programming and Preconstruction
   • WashDOT Cost Estimating Manual (http://www.wsdot.wa.gov/Publications/Manuals/M3034.htm)
   • Caltrans (http://www.dot.ca.gov/design/pjs/index.html)
   • FHWA (https://www.fhwa.dot.gov/majorprojects/cost_estimating/resources.cfm)

2. GIS Data
   • Aerial imagery, topographic data, drainage, floodplain, environmental data, traffic data, & more
   • Available on-line from ESRI, FEMA, state and local government websites

3. Unit Pricing Data
   • VDOT bid tab data available on-line
What Can **YOU** do? Upcoming VDOT actions
What Can YOU Do

- At early stages, use different types of estimates (parametric, major quantity, PCES, etc.)
  - Similar projects - make sure to note differences
  - Caution with using the same tool to perform a check
  - Check estimates with tools other than PCES and PreCon

- Keep a chronological list of estimate changes (PE, RW/UT and CN)
  - For Example at RW Milestone: June 4, 2019 - Right of way increased by $1M and Utility estimate increased by $3M due to discovering a Verizon duct bank.

- Adjust unit prices for quantity of items and location of project
  - Low quantities will still have mobilization costs
  - Is Borrow readily available?
  - Are adequate disposal sites close to project?

- Check Estimates
Upcoming VDOT Actions

- Task Force on Cost Estimating
  - Purpose: Review VDOT estimating procedures and develop an estimating system tailored to how we fund projects.
  - End product will include:
    - Estimate manual
    - Cradle to grave estimating system
    - Guidance document for all involved in estimating
    - Review of lessons learned
  - Engaging national experts
  - Exploring/Plan to include several factors (Risk, Market, Options, etc.)

- NOVA Project Controls Review of Cost Estimates at Each Milestone
  - Submit updated estimate with each milestone

- NOVA prefers PreCon at PFI stage