Cost Estimating Considerations
Earthwork Projects

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WTBA

WisDOT comments included in red textboxes.

Estimating vs Bidding

Estimating
1) ...to calculate approximate amount or value of something
2) ... to form an opinion about or evaluate
3) ... How is Contractor Going to Bid (not found in any dictionary)

Bid
1) ...To offer or propose (an amount)
   (Contractually Binding)
How Do Contractors Estimate?

Calculate Known Costs (Labor, Machinery, Trucking, Materials, Soil Disposal Sites, Safety)

Consider Unknown Factors (Traffic, Weather, Schedule Compression, Soil Condition, Material Shortages)
  - Determine Potential Risk Associated With Unknown Costs Based on Experience
  - Assign Cost to Risks

Summarize Total Known and Unknown Costs

Add Overhead

Add Profit to Determine Bid Price
  - Profit Level Determined by Need for Work, Familiarity with Project/Location, Risk Level

The $Million? (or much more!)

How Attractive Have You Made The Project to the Construction Industry?

Your Design / Contract Affects Price!

Are You Promoting Competition (Primes and Subs)?
  - Accurate (Biddable) Plans and Quantities
  - Appropriate Risk Allocation (Too Much Risk Transferred to Contractor?)
  - Constructible Schedule
What Creates Variability In Bids? (The Big Three)

Schedule
- Staging – Shifts - Mobilizations
- Night Work
- Overall Schedule Compression
- Short Work Windows
- Large LD’s

Utilities
- Relocation During Construction?
- Unknowns – Trans 220 Recovery a Risk

Environmental
- Risk
- Work Limitations

Plan and Specs

Good Plans and Accurate Quantities Promote More Confident and Aggressive Pricing

Inaccurate Plans Cause Problems
- Lack of Confidence / Uncertainty Promotes More Conservative Pricing
- Contractors Find Problems Quickly and May Take Advantage of Mistakes

Undistributed Quantities Can Create Problems – Especially on Blended Items (Example Later)

Unusual or Unnecessary Incidental Items Cause Confusion and May Unnecessarily Elevate Prices
- Water
- MSE Wall Coping
- Granular Backfill for EBS

Pay Plan Quantity (FPQ) Items Increase Risk for Contractor
- Common Excavation
- Aggregate Base / Select Crushed / Breaker Run
- MSE Walls
- Ice for Structures

Ice for structures is **not** a pay plan quantity and rarely was a bid into projects this way. This should not be viewed as a risk to contractors.

This should not be viewed as a risk to contractors. MSE wall copings (not anchor slabs which have concrete parapets or steel railings above) are always bid as part of the wall cost. This should not be viewed as an “unusual” incidental item. There is no way a designer can calculate this quantity because the wall panel suppliers dictate panel layouts, which affects how much concrete is required for the coping.
Other Considerations

Urban Projects
- Lack of Staging Areas
- Pedestrian Accommodation Responsibility
- Traffic
- Buildings

Time of Year (Late Fall / Winter / Early Spring Conditions)
- Safety (Slip/Trip/Fall, Vehicle Traction, Frostbite)
- Constructability (Frost Removal/Protection, Soil Compaction)
- Productivity Reduction in Cold/Wet Weather

Time of Let - Let Complex Projects Early
- Contractors More Aggressive Earlier in the Year to Fill Backlog
- Early Projects Develop Cash Flow Early in Year – Good for Contractors

Project Staff

Who is Project Leader / Supervisors
- Will Disputes be Resolved?
- Will Quantities Be Measured and Paid Fairly?
- Will Extra Work Be Paid Properly Without Dispute?
- Will CRI’s be Accepted?
- Will Materials Penalties and Non-Conforming Work be Handled Reasonably?
- Will Project Be a Headache to Manage?
Additional Considerations

Historic Unit Prices Not Enough
- Consider Recent Risk Developments
- Specification Changes
- "Fancy Stuff" is expensive

Scheduling is Biggest Factor – Labor Costs and Risk
Commodity Prices can be Volatile and Very Difficult to Predict or Nail Down
Strongly Consider Addenda Requests and Constructability Review Comments

Important Earthwork Plan Considerations

- Major Earthwork Bid Items
- Earthwork Tables
- Measurement and Payment Methods
- New Technology
Major Earthwork Bid Items

- Pavement Removal
- Common Excavation
- Borrow Excavation
- Marsh Excavation
- Aggregates
- MSE Walls
- Topsoil / Salvaged
- Storm Sewer Removal
- Water
- Erosion Control Items

Pavement Removal

Item Includes:
- Mill or Remove Asphalt Overlay
- Break Concrete Pavement
- Remove Concrete Pavement
- Separate Steel Reinforcing if Necessary
- Trucking for Export or Stockpile for Recycling

Special Considerations
- Volume of Pavement in Cut Areas also Measured as Common Excavation
- Volume of Pavement in Fills not Measured as Common Excavation
- Remember to include Sawcutting Item Between Stages
Common Excavation

Item Includes:
- Asphalt Pavement Removal
- Excess Topsoil Removal
- Cut and Fill (Including Compaction)
- Export
- Excavation Below Subgrade
- Finish Grading of Subgrade
- Backfilling Curbs
- QMP Subgrade if Specified
- Placement and Compaction of Spoils from Structure and Storm Sewer used as Fill

Special Considerations
- Material Moved Between Stages Must Be Paid as Common Excavation — May require Double Handling
- Volume of Pavement in Cut Areas Paid as Common Excavation
- Excess Soil Can Be Placed Outside Design Slopes if Possible
- Special Compaction Incidental to Common Excavation
- Seeding, Fertilizer, Mulching of Dedicated Disposal Sites Paid Under Separate Bid Items

Borrow Excavation

Item Includes:
- Cost to Obtain Borrow Material
- Clearing and grubbing at Borrow Site
- Topsoil Stripping and Respreading at Borrow Site
- Load, Haul, Place and Compact Borrow Material
- Shaping and Grading for Borrow Area Restoration

Special Considerations
- Default Payment Based on Measurement at Borrow Site
- Erosion Control, Seeding and Fertilizer Paid Separately Under Contract Bid Items
- Water for Dust Control and Compaction Paid Separately Under Water Bid Item
- Contractor Responsible for Haul Road Maintenance and Restoration
Marsh Excavation

Item Includes:
• Excavate Wet Marsh Through Water to Firm Foundation
• Excavate Dry Marsh
• Load, Haul and Grade Marsh Material at Disposal Area

Special Considerations
• Marsh Material May Be Placed Outside of Design Slopes Where Possible
• Very Difficult and Messy to Haul Wet Marsh Material

Aggregate Base / Select Crushed / Breaker Run

Item Includes:
• Cost to Provide Delivered Aggregate from Off Site Sources
• Cost to Crush Concrete and Asphalt Rubble Generated On Site
• Cost to Load and Haul Recycled Material On Site
• Placement and Compaction of Aggregates
• Aggregate Base for Temporary Access
• Aggregate Base for Small Areas like Sidewalks, Driveways, Islands
• Finish Grading Surface Prior to Pavement Installation
• QMP Base Aggregate (No QMP for Select or Breaker)

Special Considerations
• Areas to Recycle Site Generated Aggregate are Often Hard to Make Happen
• Water for Dust Control and Compaction Paid Separately Under Water Bid Item
• Special Compaction Incidental (2014 Trial Projects)
MSE Walls (Mechanically Stabilized Earth)

Item Includes:
• Usually Excavation for MSE Wall is Incidental to Bid Item
• Concrete Footing Beneath Panels
• Furnish and Install Concrete Panels
• Install Reinforcement Straps, Geotextile Between Seams
• Granular Backfill
• Coping Sometimes Incidental to Bid Item
• QMP Wall (Very Intensive Testing of Backfill Material, Compaction Testing, Inspection)

Special Considerations
• Testing of Backfill Material Must be Done During Manufacturing Process to Meet Schedule
• Staging / Scheduling of Mural Type Panels Very Challenging

Salvaged Topsoil / Topsoil

Item Includes:
• Stripping and Stockpiling Topsoil (Salvaged Topsoil Item)
• Cost of Obtaining Suitable off Site Topsoil (Topsoil Item)
• Undercutting Excavations and Underfilling Embankments Necessary to Receive Topsoil
• Placement and Finish Grading of Topsoil
Miscellaneous Bid Items

Storm Sewer Removal
On Large Projects With Extensive Removals, Include Bid Item for Granular Backfill or Provide Depth of Storm Sewer to Be Removed

Water Item (Often Forgotten in Some WDOT Regions)
- Dust Control
- Compaction

Earthwork Tables

- Earthwork Tables Must Balance (i.e., Total Cut = Expanded Fill + Export + Recycled Pavement)
- Should Be as Simple as Possible
- Stage Movements / Payment (If Double Handling Required, Measured and Paid Each Time)
- Accurate Shrinkage / Swell Factors (Can Greatly Affect Borrow / Export Quantities)
- Conversion Factors for Aggregates
- Undistributed Quantities Can Have a Significant Impact on Unit Prices
- Temporary Alignments Must Be Included in Quantities and Earth Flows

(Examples of inconsistencies in this)
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<th>STATEN - SYSTEM</th>
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<th>EXCAVATION CUMUL.</th>
<th>MATERIAL</th>
<th>PAYMENT MATERIAL</th>
<th>STRUCTURE ELEV</th>
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Include temporary alignments - GOOD!

Undistributed quantities have potential to create problems.

Expanded Fill Factor probably too high.

Consider Breaker Run for EBS backfill unless there are drainage considerations.
Example of Bid Uncertainty
Blended Unit Price – Common Excavation Fill Factor Reduction

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<tr>
<td>Cut &amp; Fill - 100' to 500'</td>
<td>25000 CY</td>
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<tr>
<td>Common Excavation Quantity</td>
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<tr>
<td>Common Excavation Bid Unit Price</td>
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<td>$8.46 /CY</td>
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<td>Total Deficiency</td>
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<td>$0.67</td>
<td>($85,050.00) -7.88%</td>
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Example of Bid Uncertainty
Blended Unit Price – Common Excavation
EBS Increase

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Actual Cost for Increased EBS: 17500 CY | $15.00 | $262,500.00
Additional Payment for EBS: 17500 CY | $8.46 | $148,050.00
at Common Excav Unit Price

Difference: ($114,450.00)

Measurement and Payment

• Temporary Fills / Cuts for Staged Areas
• Sloped Areas
• Pay Plan Quanty
• Incidental Items
• ASP-5 – Fuel Cost Adjustment
• Contract Mods – Section 104
New Technologies

- Three Dimensional Models
- GPS Machine Control
- Lidar Survey Capabilities
- Aerial Survey (JAV – Unmanned Aerial Vehicle)
- SPAR Utility Location

How Can the Construction Industry Help?

WTBA is Willing to Work with WisDOT / Consultant Design Teams

- Accurate Estimates Are Important to Industry Also
- Bidding Information is Proprietary
- Anti-Trust Concerns

Questions?

WisDOT design teams who seek WTBA input need to contact their region.