Conceptual Estimates
- To bid or not to bid
Lecture 2
09/11/06

Should we bid?
- Bonding capacity
- Nature of project and available expertise
- Contractual terms
- Contractor responsibilities – relationship to owner/other players
- Conceptual estimate of time and money to be invested

Bid Documents
- Invitations to bid
- Instructions to bidders
- Bid forms
- Drawings
- Specifications
- Requirements for bonds and insurances
- Appendices

Contract Documents
- Bid documents after contract has been signed
  + Change orders during the construction process
  + Signed agreements, bonds, insurances, plans, specs. (CSI, DOT etc)

Types of Contracts
- Lump sum
- Unit-price
- Cost + Fee
- Incentive Contracts
- Guaranteed Maximum Price (GMP)

Reading for next week: The Process (Chapter 3)
- Preliminary workload assessment
- Workload breakdown
- Preliminary work-plan
- Gather expertise around: material suppliers, vendors, contractors etc.
- Laying down expectations
- Establishment of estimate work plan, staffing requirements
- Iterate
**Bid Forms**

- **Lump-sum Contracts**
  - Base bid prepared for entire project (At-Risk)
  - When quantity of work to be performed is definite and well defined
- **Unit-price Contracts**
  - Specify unit costs for necessary work
  - Be careful to specify all work units
  - Direct cost +

**Players**

- Owner (Provides the money: Project financing!!)
- Architects/Engineers (Provides all plans/specs.: contract documents)
- Contractors (Builds in accordance with the contract)
- Sub-contractors

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**What is a Project Delivery System?**

- Definition of scope and project requirements
- Procedures, actions, and sequence of events
- Contractual requirements, obligations, responsibilities
- Inter-relationships between “players”
- Mechanisms for managing time
- Forms of agreements and documentation of activity

**Defining characteristics**

- Are design and construction under separate contracts?
- What is the final selection criteria for the constructor?

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**Project Delivery Systems**

- Design Bid Build (Traditional)
  - Separate contracts, lowest bid
- Construction Management at-Risk (GMP)
  - Separate contracts, not just lowest cost
- Design Build
  - Combined contracts
- Design Build Operate
  - Combined contracts

**Agency Construction Manager**

- Not at-Risk
- Responsible for managing the construction project
- Activities include: Scheduling, estimating, cost control, documenting paper work
- May have an incentive clause
**Bid Analysis**

- **CSI Format (slide)**
- **Conversion ratio (CR):**
  - Ratio by which raw materials are converted to the finished product
  
  \[ CR = \frac{TB - MC}{MC} \]
  
  - **TB**: Total Bid Price
  - **MC**: Material Cost including taxes

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**Conceptual Estimates**

- Based on primary function
  - Hospitals: cost/bed
  - Schools: cost/sq-ft
- Based on area/volume
- Modified for:
  - Time
  - Location
  - Capacity
  - Size

**Broad Scope Estimates**

Unit Cost (UC) forecast = \((A + 4B + C) / 6\)

- **A**: Minimum unit cost of previous projects
- **B**: Average unit cost of previous projects
- **C**: Maximum unit cost of previous projects

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**Cost Index**

- Used to update historical cost data
- Take into account inflation \((i)\)
- Base year Jan 1, 1913
- Page 437 of RS Means (See announcements for latest ENR construction cost index)

**Adjustment: Time**

- \[ I(2006 + n) = I(2006)(1+i)^n \]
- \[ I(2006) = 7763.15 \quad i = 3.0\% \ (0.03) \]

\[ \text{Cost(Year B)} = \frac{\text{Cost(Year A)}[(\text{Index B})/(\text{Index A})]}{\text{Cost(Year A)}} \]
Adjustment: Location

- To adjust for local differences
- RS Means page 458
- 49931: 92.2

\[ \text{Cost}(\text{City B}) = \frac{\text{Cost}(\text{City A}) \cdot (\text{I}(\text{City B}) / \text{I}(\text{City A}))}{\text{I}(\text{City B}) / \text{I}(\text{City A})} \]

Adjustment: Process Unit Capacity

\[ \text{Cost}(\text{Process Unit B}) = \text{Cost}(\text{Process Unit A}) 
\times \left[ \frac{\text{C}(\text{Project B})}{\text{C}(\text{Project A})} \right]^a \]

- \( \text{C}() = \) Process unit capacity
- \( a = \) Slope of cost capacity curve

Relationship of plant cost vs unit production assumed linear over narrow capacity ranges


Adjustment: Unit cost for size

- Unit cost goes down for higher outputs
- Use historical data to build linear relationship
  - \( Y = mX + c \)
  - \( Y: \) Cost per unit \( X: \) Number of units
  - For given \((x_1, y_1)\) and \((x_2, y_2)\) calculate \(m\) and \(c\)

Payment Schedules

- Working on borrowed money
- Payments made on % completion
- An agreed schedule of payment:
  - Owner’s Bid Price \((\text{pre O&P)/Division Reqmt. = Cost Allocation per division (CA/div})\)
  - \(\text{CA/div} \times \text{Contractor’s estimate = Division payment sched.}\)
- Balanced/Un-balanced bids

<table>
<thead>
<tr>
<th>Division</th>
<th>Owner’s Estimate</th>
<th>Cost Allocation</th>
<th>Payment Schedule</th>
<th>Contractor’s Estimate</th>
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</thead>
<tbody>
<tr>
<td>1. General Engineering</td>
<td>357,300</td>
<td>7.1</td>
<td>270,484</td>
<td>305,242</td>
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<td>2. Plant Construction</td>
<td>399,100</td>
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<td>358,143</td>
<td>3,028,762</td>
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<td>3. Chemistry</td>
<td>504,800</td>
<td>1.0</td>
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<td>4. Heating</td>
<td>3,702,000</td>
<td>15.7</td>
<td>1,971,000</td>
<td>2,424,000</td>
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<tr>
<td>5. HVAC</td>
<td>5,472,000</td>
<td>33.0</td>
<td>9,103,000</td>
<td>1,657,000</td>
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<tr>
<td>6. Structural</td>
<td>2,843,000</td>
<td>15.8</td>
<td>1,179,000</td>
<td>3,083,000</td>
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<td>7. Plumbing</td>
<td>321,000</td>
<td>2.4</td>
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<td>8. Utilities</td>
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<td>321,000</td>
<td>32,100</td>
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<td>9. Electrical</td>
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<td>10.6</td>
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<td>10. Fire Protection</td>
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<td>11. Special Combustion</td>
<td>12,375</td>
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<td>1,202,000</td>
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<td>12. Elevating Systems</td>
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<td>13. HVAC</td>
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<td>16.3</td>
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<td>14. Electrical</td>
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<td><strong>Total for all Div</strong></td>
<td><strong>16,032,000</strong></td>
<td><strong>89.9</strong></td>
<td><strong>18,104,000</strong></td>
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*Cost and Profits (15%) = 4,458,700

*Final Bid Price = 17,088,700

Figure 2.3: An Example of a Payment Schedule Calculation
Cost Control

- Controlling on-going expense
- Information required:
  - % Completion
  - Estimate of cost of material stored on-site
  - Accrued expense (so far, independent of payment)
  - Estimated cost
- Check Accrued Expenses so far vs. Estimated Expense

Cost Control

- Accrued expense/div
  - + Cash expenditures
  - - Inventory valuation
  - + Accounts payable

- Estimated expense/As-planned expense:
  - % completion x
  - Estimated expense/div.

Compare