Estimating & Cost Control

• Design Estimates
  …… performed parallel with the feasibility and planning/design phases
  – screening or schematic estimates for determining order of magnitude
  – preliminary or conceptual estimates
  – detailed or definitive estimates
  – Engineer’s estimate

• Design Estimates
  – approximate cost methods
    • square-foot cost estimate
    • cubic-foot cost estimate
    • panel unit cost estimate
    • modular takeoff estimate
    • parameter cost estimate

• Design Estimates
  – cost-per-function estimate
  – time-referenced cost indices
  – cost-capacity factor
  – component ratios

• Bid Estimates
  ……prepared by contractor or CM for submission to owner for competitive bidding or negotiation
  – quantity takeoffs
  – subcontractor quotes
  – includes indirect costs and markup

• Sources of cost data
  ……generally based on historical information
  – in-house records
  – industry publications such as:
    • R.S. Means
    • Engineering News-Record (ENR)
    • many others

• Control Estimates
  ……for monitoring the project during construction
  – budget estimates for financing
  – budget estimates for cost control
  = prepared immediately prior to or during construction
• **Quantity Takeoffs**
  
  .......a detailed compilation of the quantity of each elementary work item called for on the project
  – also referred to as quantity surveys
  – procedure for compiling a detailed estimate
  – basic, organized, and systematic process
  – manual and/or computerized

• **Quantity Takeoffs**
  
  .......provides valuable information used during the job planning and construction periods including:
  – purchasing
  – planning and scheduling
  – cost control
  – resource allocation

• **Quantity Takeoffs**
  
  .......details addressed in the takeoff
  – include allowances for waste and anticipated yield factors
  – units, number of units, and dimensions

• **Quantity Takeoffs**
  
  .......prime contractors usually perform takeoffs of work to be performed by their own forces (direct work)
  – specialty subcontractors will perform their own takeoff (subcontract work)
  – vendors will often perform their own takeoff

• **Quantity Takeoffs**
  
  .......must be organized, consistent, and concise
  – clarity and legibility are critical…neatness counts!
  – organized according to CSI or other format
  – set up estimate sheets so that descriptions and dimensions are left-justified, right side is set up in columns

• **Quantity Takeoffs**
  
  .......when performing takeoffs, specifically measurements from scaled drawings….
  – be consistent, form good habits
  – first measure horizontally then vertically
  – consistently go clockwise (or counterclockwise)
  – always start on the same place on the drawing
Estimating & Cost Control

• Quantity Takeoffs
  ....when performing a building takeoff
  – begin by taking off the gross area.....this
  will be useful as check
  – takeoff perimeters, partitions, then floor to
  floor heights which will give “skin” area
  – use a highlighter for marking areas taken
  off.....using certain colors to represent
  specific items

• Quantity Takeoffs
  ....mentally build the project from the
  ground up
  – group by assembly
  – “$” should appear at the extension on the
  first line and total line only
  – use commas for clarity and to avoid
  possible errors

• Quantity Takeoffs
  ....work sheets should be organized so
  that...
  – all items can be tabulated for both material
  and labor
  – all similar material items can be
  subtabulated, then tabulated on one sheet
  – work performed by the same trade for the
  tabulation of total man-hours

• Pricing
  ....subcontracted work…
  – use quotations from reliable or reputable
  subs
  – be familiar with the scope and magnitude
  of the work
  – include any prime contractor cost
  associated with the item

• Summary Sheet
  ....should be organized to...
  – summarize all direct cost resulting from
  both direct and subcontract work
  – summarize all indirect costs, bonding,
  taxes, and contingency
  – profit
  = total estimated cost or bid price

• Materials
  – everything that becomes a permanent part
  of the constructed facility

• Labor
  – direct = basic wages for the various crafts
  determined by...
    • applicable union contracts
    • prescribed prevailing wage rates
    • established or current area practice
Estimating & Cost Control

- **Labor**
  - indirect = expenses added to the basic hourly rates that are paid by the employer including:
    - payroll taxes
    - insurance
    - fringe benefits
  - indirect labor costs can add 30 to 50 percent to the direct payroll costs

Estimating & Cost Control

- **Equipment**
  - owned or leased machinery used to accomplish the work
  - contractor-owned equipment incurs ownership and operating costs
  - ownership costs includes depreciation, interest, taxes, insurance, and storage
  - operating costs includes fuel, oil, lubricants, repairs (parts and labor), tire repair and replacement

Estimating & Cost Control

- **Project Overhead**
  - also referred to as job overhead
  - on-site expenses that do not pertain directly to any specific work item, but are necessary for ultimate job completion
  - generally contributes 5 to 15% of total project cost
  - computed by listing and pricing each item of overhead rather than arbitrary percentage of project cost

Estimating & Cost Control

- **General Overhead**
  - also referred to as office overhead
  - includes general business expenses such as office rent and utilities, office supplies, furniture, association dues, advertising, salaries of executives and office staff
  - generally contributes 3 to 10% of total project cost
  - included in the estimate as a percentage of the total estimated job cost

Estimating & Cost Control

- **Markup**
  - margin added at the end of the estimating process
  - allows for profit, contingency, and general overhead
  - comprises 5 to 20% (or more) of the bid price
  - affected by many factors, especially risk and bidding environment

Estimating & Cost Control

- **Bonding**
  - cost of contract bond(s)
  - contract may require performance bond only or performance and payment bonds
  - premium depends on project completion time, class of construction, total contract amount, and applicable bond rates
  - accounts for 0.5 to 1.0% of the contract cost
Lump-sum Bid Price Development

| Total Direct Cost + Job Overhead |
|-------------------------------|----------------|
| Job Cost                      | Markup         |
| Subtotal                      | Bond           |
| Subtotal                      | Tax            |
| Bid Price                     |                |

**Estimating & Cost Control**

- **Cost Control**
  - the application of procedures to track and minimize the cost in relation to the budget estimate prepared for a specific project
  - structured approach to recording and evaluating project costs
  - reporting and analyzing project costs to management/project team

**Estimating & Cost Control**

- **Cost Control**...function
  - maintain orderly system of records and reports
  - measure progress or work accomplished
  - forecasting periodic and total cost
  - cost engineers are the interface between management, line supervisors, schedulers, estimators, procurement, and accounting

**Estimating & Cost Control**

- **Cost Control**...principles
  - cost control or cost engineering should not be confused with financial accounting
  - cost engineers...
    - Must have solid technical understanding
    - emphasis on forecasting and trending

**Estimating & Cost Control**

- **Cost Control**...tools
  - WBS (work breakdown structure)
    - integrated control system interrelating costs, schedules, and other parameters
  - standard cost code (such as Masterformat)
  - project cost code

**Estimating & Cost Control**

- **Cost Control**...principles
  - accounts deal mainly with historical, documented facts to pay bills, generate invoices, complete tax returns, payroll...all down to the penny
  - cost engineers must....
    - deal with and interpret tenuous information
    - use judgement in interpreting and forecasting
Estimating & Cost Control

Project Control Codes
• Apply project cost code to reference and document….
  – expenditures and commitments for labor, material, equipment, subs, and indirect costs
  – procurement documents such as….
    • requisitions
    • purchase orders
    • receiving slips
    • invoices

Estimating & Cost Control

Project Control Code…components
  – Project number
  – Area-facility code
  – Work-type code (use standard code)
    • account hierarchy
      »prime account
      »subaccount
  – Distribution code

Estimating & Cost Control

Sample Project Code

<table>
<thead>
<tr>
<th>Project</th>
<th>Area-Facility</th>
<th>Work-Type Code</th>
<th>Distribution Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>98NB04</td>
<td>11</td>
<td>3320</td>
<td>2</td>
</tr>
</tbody>
</table>

Project Code:
- 98: Year
- NB: Negotiated Contract
- 04: Building
- 11: 11th Floor
- 3320: Concrete, lightweight aggregate
- 2: Material

Estimating & Cost Control

Control Budgets
  …basic reference standard for monitoring and controlling cost
  – derived from cost estimate
  – employs project code structure
  – used for recording and reporting….
    • actual performance, to-date and this period
    • projection or forecasts
    • variance and explanation of variance

Estimating & Cost Control

Sources of data for cost control
  • Time sheets
    – labor: name, ID No., craft, hours, and code
    – equipment: description, number, hours, code
    – material received: code and intended location
    – work completed for payment: description, location, code, and quantity
    – weather conditions
    – special notes or comments
Application of Engineering Economy
- time value of money
- comparative economic studies
- objectively and rationally evaluate scenarios
- assist financial managers in forecasting cash flow or borrowing needs

Engineering Economic Analysis Techniques
- present-worth analysis
- equivalent annualized costs
- benefit/cost analysis
- break-even or payout time
- rate of return on investment
- cash-flow analysis