Cost Estimating

Construction Engineering and Emerging Technologies

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Estimating

- Determination of probable construction cost
- To stay in business, a contractor
  - must be a low bidder on a certain number of projects
  - Must make a decent profit
- Estimating construction cost is a process subjected to:
  - Weather
  - Transportation
  - Soil conditions, water table
  - Labor unrest
  - Material availability
  - Subcontractors in the project area
  - Productivity
  - Construction methods

Types of Estimating

- Strategic Level
  - Ideas & Master Plans
- Conceptual Estimate
  - Prior to design
  - The Square Foot (Meter) Method
- Preliminary Estimate
  - At +/- 40% design
- Engineer's Estimate (Owner Estimate)
  - After detail design
  - Total project cost minus markup (+/- 3% accuracy)
  - To check owner's resources
  - To establish a reference point

Types of Estimating (Cont'd)

- Bid Estimate (Contractor estimate)
  - Based on tender documents
  - 0.25 % of the total bid price -> must be recovered as overhead
- Contractor Progress Estimate
  - Periodic checks on the progress of the work
- The Final Estimate
  - At the completion of the contract

Specifications

- Construction Specification Institute (CSI) developed a uniform specification
- MasterFormat: 50 divisions (16 divisions until 2003):
  1. General requirement
     - Project management coordination, etc.
  2. Existing Conditions
     - Surveys, geotechnical investigations, etc.
  3. Concrete
  4. Masonry
  5. Metals
  6. Wood, Plastics & Composites

Specifications (Cont'd)

7. Thermal & Moisture Protection
   - Waterproofing, roofing
8. Openings (Doors & Windows)
9. Finishes
   - Plaster, flooring, tile, painting
10. Specialties
    - Visual display surfaces, signage.
11. Equipment
    - Bank, library, theater, medical equipment
12. Furnishings
    - Artwork, light control, site seating and tables
13. Special construction
    - Clean rooms, sauna, towers
14. Conveying equipment
    - Elevators, escalators, moving walks

Specifications (Cont'd)

22. Plumbing
23. HVAC
26. Electrical
27. Communications
31. Earthwork
32. Exterior Improvements (Retaining wall, etc.)
33. Utilities (Ponds and reservoirs, etc.)
34. Transportation (Vehicle barriers)
35. Waterway & marine
41. Material processing and handling equipment (cranes and hoists)
44. Pollution control equipment

Detailed Estimate

- Direct Costs
- Indirect Costs
  - –Job overheads
  - –General overheads
- Mark-up

Direct Costs

- Direct Costs of all the resources
  - –Labour L
  - –Equipment E
  - –Material M
  - –Others (O&P)

Indirect Costs

- Bond Premiums
- Insurance premiums
- Fees for licenses and permits
- Services such as water, electricity, telephone, maintaining site office
- Home office overheads allocation

Steps in developing an estimate

- Break the project into cost centers
- Estimate the quantities required for cost centers that represent physical end items (Quantity Take-off)
- Calculate a unit price
- Calculate the total price for each cost center by multiplying the required quantity by the unit price

PBS

Work Package

- Sub-division of the project that is used both for cost control and time control
- Unit of a PBS at the lowest developed level
- A work package may contain various individual work tasks
- Work packages may follow standard "Divisions" of work defined by the tendering documents

Quantity Take-off

- Measure quantities of work to be placed in appropriate units
- Review drawings and specifications
- Steps
  - Identify the materials required by each estimating account or work package
  - Relevant dimensions
  - Quantity calculations
- Minimize errors

Errors in Quantity Take-off

- Arithmetic
- Transposition
- Errors of omission
- Poor reference
- Unrealistic waste or loss factors

Pricing (Cost Determination)

- Use historical data, vendor quotations, suppliers catalogs, pricing books, in-house databases, experience.
- Pricing can be unit price basis or lump sum basis
- For unit price, resource analysis may be required

How To Get the Unit Price?

- Assume work composition to include number of workers and equipment (Crews)
- Estimate the hourly production based on crew composition and size
- Make an estimate of the efficiency to be achieved on the job considering all factors.
- Calculate the effective unit price

Methods of Detailed Cost Determination

- Unit Pricing
- Resource Enumeration
- Work Package/ Assembly-based Method

Estimating a Task (Unit Pricing)

Cost of a Task = Quantity * Rate ($)

Unit Rate of a Task = Sum of the Unit Rates of Labour, Equipment, Material, and Other Costs

Estimating References

- R.S. Means Company, Construction Cost Data
- F.R. Walker's Building Estimator's Reference Book
- Richardson General Construction Estimating Standards