Conceptual Cost Estimating
A conceptual estimate is also known as a top-down, order of magnitude, feasibility, analogous, or preliminary estimate. A conceptual estimate is usually performed as part of the project feasibility analysis at the beginning of the project. The estimate is usually made without detailed design and engineering data. However, the owner must know the approximate to evaluate the economic feasibility of proceeding with the project. Consultant to compare design alternatives.
Definition

- A “conceptual estimate” is an estimate prepared by using engineering concepts and avoiding the counting of individual pieces.
- The forecast of project costs that is performed before any significant amount of information is available from detailed design and with incomplete work scope definition.
- It is used as the basis for important project decisions like go/no-go and the appropriation of funds decisions.
- A conceptual estimate is also used to set a preliminary construction budget.
Conceptual Cost Estimating

Characteristics

- Early project stages
- Accuracy ± 25%
- The availability of a good, complete scope definition is considered the most crucial factor for conceptual estimating
- Conceptual estimating is a resource restricted activity
- The time and cost available for making the estimate is restricted
- Therefore, the estimate, although important, cannot be given much time and resources
Estimate preparation

- Request made by management to estimate the cost of a project
- The first task for the estimator is to study and interpret the project scope and produce an estimating plan
- The next task is to collect historical data related to similar past projects
- It is very important to describe in detail all the information, assumptions and adjustments considered in the estimate
- The outputs from this stage are the project conceptual cost estimate
Estimate Basics

- Unit cost should be determined as an average of previous projects data not depending on one project

\[ UC = \frac{(A + 4B + C)}{6} \]

- \( UC \) = forecast unit cost
- \( A \) = minimum unit cost of previous projects
- \( B \) = average unit cost of previous project
- \( C \) = maximum unit cost of previous projects
Conceptual Cost Estimating

**Estimate Basics**

- **Example**
  - Use the weighted unit cost to determine the conceptual cost estimate for a proposed parking that is to contain 135 parked cars.

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Cost (LE)</th>
<th>No. of cars</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>466,580</td>
<td>150</td>
</tr>
<tr>
<td>2</td>
<td>290,304</td>
<td>80</td>
</tr>
<tr>
<td>3</td>
<td>525,096</td>
<td>120</td>
</tr>
<tr>
<td>4</td>
<td>349,920</td>
<td>90</td>
</tr>
<tr>
<td>5</td>
<td>259,290</td>
<td>60</td>
</tr>
<tr>
<td>6</td>
<td>657,206</td>
<td>220</td>
</tr>
<tr>
<td>7</td>
<td>291,718</td>
<td>70</td>
</tr>
<tr>
<td>8</td>
<td>711,414</td>
<td>180</td>
</tr>
</tbody>
</table>
Conceptual Cost Estimating

Example

- **Unit cost per car**

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Unit cost (LE/car)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3,110.4</td>
</tr>
<tr>
<td>2</td>
<td>3,628.8</td>
</tr>
<tr>
<td>3</td>
<td>4,375.8</td>
</tr>
<tr>
<td>4</td>
<td>3,888.0</td>
</tr>
<tr>
<td>5</td>
<td>4,321.5</td>
</tr>
<tr>
<td>6</td>
<td>2,978.3</td>
</tr>
<tr>
<td>7</td>
<td>4,167.4</td>
</tr>
<tr>
<td>8</td>
<td>3,952.3</td>
</tr>
</tbody>
</table>

- *Then, the average unit cost = 30,431.5 / 8 = LE3,803.94 / car*

- *The forecast unit cost = (2,987.3 + 4 × 3,803.94 + 4,375.8) / 6 = 3,763.14.*

- *The cost estimate for 135-cars parking = 135 × 3,763.14 = LE508,023*
Time adjustment

- The adjustment should represent the relative inflation or deflation of costs with respect to time due to factors such as labor rates, material costs, interest rates.

- Time of value of money

- Index numbers are used to reflect changes in money values

- Various organizations publish indices that show the economic trends of the construction industry with respect to time.
Time adjustment: Example

- The indices for building projects these economic trends. It is required to use the cost of a LE843,500 project completed last year to prepare a conceptual estimate for a project proposed for construction 3 years from now.

<table>
<thead>
<tr>
<th>Year</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 years ago</td>
<td>358</td>
</tr>
<tr>
<td>2 years ago</td>
<td>359</td>
</tr>
<tr>
<td>1 year ago</td>
<td>367</td>
</tr>
<tr>
<td>Current year</td>
<td>378</td>
</tr>
</tbody>
</table>
Time adjustment: Example

- The equivalent interest rate can be calculated based on the change in the cost index during the 3-year period as follow:
  \((378/358) = (1 + i)^3\)
- Then \(i = 1.83\%\)
- Accordingly, the cost of the project should be adjusted for time as follows:
  \(\text{Cost} = \text{LE}843,500 \times (1 + 0.0183)^4 = \text{LE}906,960\)
**Location adjustment**

- Tender price levels vary according to the region of the country where the work is carried out.
- The use of cost information from a previous project should be adjusted to represent the difference in cost between the locations of the two projects.
- The adjustment should represent the relative difference in costs of material, equipment and labor of the two locations.
- Indices that show the relative difference in construction costs with respect to location is published by many organizations.
**Conceptual Cost Estimating**

**Location adjustment: Example**

- The indices for different location of construction costs are shown below. The construction cost of a project completed at city A is LE387,200, it is required to prepare a conceptual estimate for a similar project proposed in city D.

- The cost of the proposed project:

  - **Cost =**

  $\text{LE}387,200 \times \left( \frac{1.105}{1.025} \right)$

  $= \text{LE}417,420$

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<table>
<thead>
<tr>
<th>Location</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>City A</td>
<td>1.025</td>
</tr>
<tr>
<td>City B</td>
<td>1.170</td>
</tr>
<tr>
<td>City C</td>
<td>1.260</td>
</tr>
<tr>
<td>City D</td>
<td>1.105</td>
</tr>
<tr>
<td>City E</td>
<td>1.240</td>
</tr>
</tbody>
</table>
Size adjustment

- **In general,** the cost of a project is directly proportional to its size.
- **The use of cost information from a previous project to forecast the cost of a future project will not be reliable unless an adjustment is made that represents the difference in size of the two projects.**
- **The adjustment is generally a simple ratio of the size of the proposed project to the size of the previous project from which the cost data are obtained.**
Combined adjustment: Example

Prepare the conceptual cost estimate for a building with 62,700 m² of floor area. The building is to be constructed 3 years from now in city B. A similar type of building that cost LE2,197,540 and contained 38,500 m² completed 2 years ago in city E.

Estimate the probable cost of the proposed building.

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<td>1.105</td>
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<td>City E</td>
<td>1.240</td>
</tr>
</tbody>
</table>
Combined adjustment: Example

- Original building:
  - Area: 38500
  - Year: 2 years ago
  - City: E (1.24)

- Proposed building:
  - Area: 62700
  - Year: 3 years from now
  - City: B (index 1.17)
  - Inflation: 1.83%
Conceptual Cost Estimating

Combined adjustment: Example

- Proposed cost
  \[ \text{Proposed cost} = \text{Previous cost} \times \text{Time adjustment} \times \text{Location adjustment} \times \text{Size adjustment} \]
  \[ = \text{LE2,179,540} \times (1 + 0.0183)^5 \times (1.17 / 1.24) \times (62,700 / 38,500) \]
  \[ = \text{LE3,700,360} \]

- Without time and location adjustment
  \[ \text{Without time and location adjustment} = \text{Previous cost} \times \text{Size adjustment} \]
  \[ = \text{LE2,179,540} \times (62,700 / 38,500) = \text{LE3,549,537} \]
Unit cost adjustment

- Although the total cost of a project will increase with size, the cost per unit may decrease.
- For example, the cost of an 1800-m² house may be LE535/ m² whereas the cost of a 2200 m² house of comparable construction maybe only LE487/ m².
- Certain items such as furniture, garage, etc., are independent of the size of the project.
- The estimator must obtain cost records from previous projects to develop appropriate adjustments for new projects.
Unit cost adjustment: Example

Cost records from previous projects show below. Find the adjusted unit cost

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Cost (LE)</th>
<th>Size, no. of units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2,250</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>1,485</td>
<td>60</td>
</tr>
<tr>
<td>3</td>
<td>2,467</td>
<td>120</td>
</tr>
<tr>
<td>4</td>
<td>2,730</td>
<td>150</td>
</tr>
<tr>
<td>5</td>
<td>3,401</td>
<td>190</td>
</tr>
</tbody>
</table>
Unit cost adjustment: Example

Plot these points and find the linear equation

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Unit cost (LE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22.5</td>
</tr>
<tr>
<td>2</td>
<td>24.75</td>
</tr>
<tr>
<td>3</td>
<td>20.56</td>
</tr>
<tr>
<td>4</td>
<td>18.20</td>
</tr>
<tr>
<td>5</td>
<td>17.90</td>
</tr>
</tbody>
</table>

Unit cost = \[(17.9 - 24.75) / (190 - 60)\] x + 24.75

= -0.0526 x + 24.75

where 60 < x < 190, then y = 24.75 - 0.0526 (S - 60)
Unit cost adjustment: Example

- Using Excel curve fitting
- Add trend line
- Write the equation

Unit cost = -0.056x + 27.81
Interpolation

- It requires a good deal of skill and experience and is the process of adding in or deducting from the cost analysis to arrive at a budget for a new project
- Using data from previous projects
- Add or deduct to adjust cost
- Using unit costs, etc.
**Conceptual Estimating Methods**

**Unit method**

- Depends on the cost per functional unit of the building, a functional unit being, for example, a hotel bedroom.
- It is suitable for clients who specialize in one type of project; for example, hotel or supermarket chains.
- Schools – cost per pupil.
- Hospitals – cost per bed.
- Note that, all other adjustments must be also made (time, location and unit).
Superficial method

- The superficial method is a single price rate method based on the cost per square meter of the building
- the most frequently used method of approximate estimating
- quick and simple to use
- Similar to the unit rate method
Conceptual Estimating Methods

Superficial method: Example

- Gross floor area for office block =
  \[10.0 \times 25.0 - 2 \times 3.0 \times 7.50 = 205.0\ m^2\]

- Area of 5 floors \(205.0 \times 5 = 1025.0\ m^2\) \(\times LE\ 1100/m^2 = LE\ 1,127,500.0\)

- Basement \(7.00 \times 25.0 = 175.0\ m^2\) \(\times LE\ 1300/m^2 = LE\ 227,500.0\)

- Estimate for block = \(LE\ 1,355,000.0\)
Approximate quantities

- Most accurate method of estimating, provided that there is sufficient information to work on

- Group items corresponding to a given operations and relating them to a common unit of measurement

- Rates are built up for these items

- All measurements are taken as gross
**Conceptual Estimating Methods**

**Parametric cost estimate**

- The parametric model uses historical data as the basis of the model's predictive features.
- Parametric models calculate the dependent variables of cost and duration based on one or more independent variables.
- These independent variables are quantitative indices of performance and/or physical attributes.
- The output of parametric models includes the cost of major phases, duration of project major phases, total project cost, and resource requirements.
Conceptual Estimating Methods

Parametric cost estimate

- A parametric model, for a construction project, would use the data provided by the user on any or all of the following characteristics: project type, frame material, exterior material, ground conditions, desired floor space, and roof type.
- Then, using the general relationships developed between these input and output variables, the model provides an estimate of some or all of the output variables.
- Depending on the organizational environment and on the nature of targeted projects, these models use different statistically derived algorithms.