ARE 431 BUILDING ECONOMY-I

ARE 431Building Economy
Building Estimating part

Presented by Dr. Al-Hammad
King Fahd University of Petroleum and Minerals

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Introduction to Cost Estimating

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Estimating Fundamentals

Introduction

- What is an Estimate?
- Purpose of Estimating.
- The Estimator.
- What the Estimator Must Know?
- Why Estimates are Important

Types of estimates

Estimates Consideration

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Estimating Fundamentals

Introduction

What is an Estimate? 1/3

Is estimating an art or a science?

What is an Estimate? 2/3

An estimate involves calculating the costs of work on the basis of probabilities.

Thus it can be defined as

- an educated guess,
- an appraisal,
- an opinion,
- an approximation as to the cost of the project prior to its actual construction, or
- a forecast cost of a project's "actual" cost

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What is an Estimate? 3/3

Two activities are involved when carrying out an estimate:

- **Measurements: all measurements is approximate.**
- **Pricing: the degree of approximation is even greater because of the difficulty in predicting all the probabilities of items such as labor productivity and site conditions.**

Costs of construction work are classified as:

- **Materials costs.**
- **Labor costs.**
- **Equipment costs.**
- **Overhead (general and job) costs and profit.**

Data on all of these costs are required to make an estimate.

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Purpose of Estimating

The purpose of estimating is to forecast the cost required to complete a project in accordance with the contract plans and specifications.

There are two distinct tasks in estimating:

- **To determine the probable real cost of the project.**
- **To determine the probable real time to build the project.**

Because construction estimates are prepared before a project is constructed, an estimate is, at best, a close approximation of the actual costs.

The true value of the project will not be known until the project has been completed and all costs have been recorded.

Therefore, the estimator does not establish the cost of a project; he simply establishes the amount which the contractor will receive for constructing the project.

The Estimator 1/4

Preparing an estimate is expensive involving many people throughout the organization.

($200 millions project needs $ 0.5 million for estimating)

The estimator must have the characteristics of the artist(imaginative and creative) and that of the scientist (methodological and organized).

The estimator must have the ability to visualize the project, to think multi-dimensionally.

The estimator's job is to prepare estimates of building project costs.

The success of a contractor's business depends on the accuracy of these estimates.

The Estimator 2/4

The estimator's success will be based on his previous experience in and knowledge of the construction industry.

A contractor or estimator lacking this experience may over-, or under-estimate his project costs.

In either case, this could be detrimental to the success of his company:

- If costs are too high, his jobs will be few and far in between.
- If costs are too low, he will not be able to stay in business.

The Estimator 3/4

All cost data is acquired from experience. If an estimator does not have cost data from his own experience, he must use cost data from price books and handbooks.

A good data base of past project experiences is essential to preparing a quick and accurate estimate.

All preconstruction estimates start with a data base of past projects.

The Estimator 4/4

The more valid data the estimator has available, the better he will be able to estimate the probabilities of costs arising from the following factors:

- Site, location and accessibility.
- Subsurface and soil conditions.
- Time and season.
- Climatic conditions.
- Wage agreements.
- Strikes.
- Market prices of basic materials.
- Availability of money.
- The demand for construction.

What the Estimator Must Know? 1/3

He must have a thorough knowledge of the building trades.

- **This includes types of construction and methods of construction.**

He must be able to read building plans and notes and understand the specifications.

- **If he finds any discrepancies between the plans and specifications, he will bring them to the attention of the architect or owner for solution. When all the questions are answered and problem solved, he can then prepare and finish the cost estimate.**

He must have a thorough understanding of the building codes and ordinance in the area the building project is to be constructed.

What the Estimator Must Know? 2/3

He must have a thorough understanding of construction materials.

- **He must understand the sizes, strengths, and the capabilities of the materials with which he works. He must be able to substitute equal quality materials when specified material are not available.**

He must keep up with the new construction products and materials that are continually being developed.

- **To keep current, he should visit trade shows and subscribe to building magazines.**

He has to possess some basic mathematical ability.

What the Estimator Must Know? 3/3

He has to have at his fingertips reference materials, books, tables, and tabulating equipments to speed his job.

- In time he will acquire reference materials in the form of material catalogs, brochures, and manufacturer specification sheets for the product he uses.

Finally, he must project labor cost changes.

- The estimator must realize that labor costs may vary in different geographical areas of the country. He must also realize and project in his estimates future increases in labor costs because of upcoming events.

Why Estimates are Important 1/3

As mentioned earlier, an estimate is

- an educated guess,
- an appraisal,
- an opinion,
- an approximation as to the cost of the project prior to its actual construction, or
- a forecast cost of a project's "actual" cost

From an owner's prospective, an early estimate serves:

- Is the project is affordable?
- How large a project can be constructed for money available?
- What levels of quality can be included in a project?
- What project options make the most sense?
- An aid in budgeting cash flow needs throughout the project

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Why Estimates are Important 2/3

From an a designer's prospective, it provides guidelines

- **As project is being designed, it is important that the designer select materials and size project within the budget of the owner.**
- **A change in either forces a change in the other**
- **It will help the designer to communicate and make the presentation to the owner in different stages of the design**
- **At end of the design phase the designer must prepare a detailed estimate to verify the accuracy of the bid prices and to negotiate with the bids contractors**

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Why Estimates are Important 3/3

From an a contractor's prospective, it helps to prepare

- **A detailed estimate to determine a price to bid based on the completed construction documents.**

Types of Estimates

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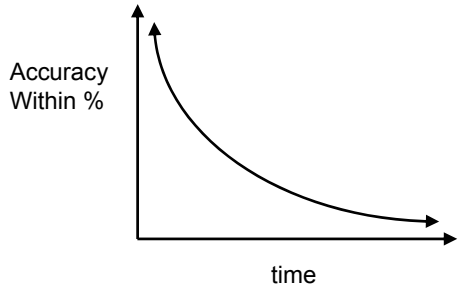
Types of Estimates 1/2

When beginning to prepare an estimate, it is important to understand its intended use.

An estimate can be prepared at any point throughout the life of a project.

Depending on the information available and the time spent preparing the estimate, the accuracy it provides will vary.



Types of Estimates 2/2

There are four different stages at which estimates take place:

- Conceptual phase.
- Schematic phase.
- Design development phase.
- Procurement phase.

Conceptual Phase Estimate 1/2

This type of estimate is called a conceptual or rough order of magnitude and is generally prepared long before the construction starts.

The owner needs cost information very early on in a project so that decisions as to the location and scope can be made before money is spent on design or property purchase.

This estimates will be prepared with very little information, relying mostly on historic data.

The description of a project may be a sketch or a brief written description.

Conceptual Phase Estimate 2/2

The size of the project is generally known, although it may be described in terms of capacity such as:

- The number of beds for a hospital.
- The number of students for a school.

The time needed to prepare this type of estimate is short, generally in the range of a half day or less and accuracy +,- 20%.

The presentation is generally informal for the purpose of a providing a target budget.

Estimates are often prepared for many different program options so that the best alternative(s) can be selected.

Schematic Phase Estimate 1/3

As the project moves into the schematic stage, the designer and possibly the construction manager have become involved in the design and estimating of the project.

The program for the project has been provided by the owner.

The project team may be incorporating different design alternatives into the basic design.

A schematic estimate will be based on a design that is approximately 30% designed and include the following information:

- 1/16" Floor plans, elevations, and sections.
- Outline specification for most trade sections.
- One-line Drawings for mechanical and electrical systems.

Schematic Phase Estimate 2/3

This estimate include some area take-off, and calculating of the major project elements such as:

- The gross area of the building.
- The exterior wall area.
- The gross cubic meters of earth to be excavated.

At this stage, some of the key subcontractors might be asked for input for complicated systems.

This estimate will take one to two weeks and will carry a 10% contingency for unknown design and engineering details that will be developed during the next design stage and accuracy +,-15%.

At the end of the schematic design stage, the presentation of the design to the owner is accompanied by an estimate of the cost of the project.

Schematic Phase Estimate 3/3

Any design alternatives will also be accompanied by an estimate, so the owner can make the decision.

Before the project team moves on to the next phase of design, the owner will decide on the basic design parameters and on the project budget.

Any cost reduction ideas will be presented and priced by the estimators.

- Some of these ideas may be accepted or rejected at this stage, and some may be carried forward to be better defined in the next phase.

Design Development Phase Estimate 1/3

The estimate that is developed in this stage is based on much more defined information.

Because of this, the time to prepare the estimate is longer but the accuracy is greater.

The estimate in this stage will be based on a design that is 60% complete and includes the following information:

- 1/8" Floor plans .
- Elevations, sections, and details at a larger scale.
- All relevant specification sections.
- Mechanical and electrical systems well defined.

It is similar to schematic phase estimate, however information is more defined.

Most of the major project items will be quantifiable, and the more important unit prices should be known at this point.

Design Development Phase Estimate 2/3

The preparation of this estimate should take two to three weeks and the accuracy is within 5 to 10% of the final cost.

With the presentation of this estimate the costs of the materials and methods will be known and should be compared to past similar projects.

Network schedule will begin, allowing a better understanding of the overall duration of the project as well as when each of the major project elements is to be constructed.

Major assumptions should be noted and compared to what was assumed at the schematic design stage.

Design Development Phase Estimate 3/3

The estimate (at this stage) is a tool to be used to verify that the design is within the owner's budget, and to identify any good cost saving ideas.

Procurement Phase Estimate 1/3

This estimate is prepared based on a complete set of contract documents.

In this stage, an estimate would be prepared by the owner team (designer/engineer firms), as well as all the contractors who are bidding the work.

The contractors prepared the estimate to identify a price to bid, and the owner team prepares an estimate (a fair cost estimate) to be in a position:

1- to negotiate a fair price, and

2- to verify the accuracy of the contractor's price.

-- It is less accurate than the bid estimate, but enough accuracy to serve the check. It will be done in house rather than on subcontractors and suppliers.

Procurement Phase Estimate 2/3

The contractors bidding the project will break the project down into work packages. Such as:

- Excavation.
- Foundations.
- Structural steel.
- Roofing.
- Wall systems.
- Mechanical systems.
- Electrical systems.
- Finishes.

The contractor request bids from pre-qualified subcontractors for each package.

Most contractors will do some of the work with their own workforces and therefore will not request bids in these areas.

Procurement Phase Estimate 3/3

Estimates done for bidding require a complete understanding of material quantities, which is taken from the drawings.

Estimates also require accurate unit prices, which usually involves input from local material suppliers.

An exact schedule will be prepared (to help identify the duration of the project and estimate the general condition items).

This will be used to identify the duration of the project.

Depending on the size of the project, a bid estimate can take three weeks or longer to prepare.

These detailed estimates are extremely accurate.

The difference between bidders is often only the profit margin that the contractor includes.

Estimate Considerations

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Estimate Considerations

Every estimate, whether it is generated in the conceptual phase of a project or at bid time, must consider a number of issues.

Project price is affected by:

- **The size of the project.**
- **The quality of the project.**
- **The location.**
- **The construction start and duration (time).**
- **Market conditions.**

The accuracy of an estimate is directly affected by the ability of the estimator to properly analyze these basic issues.

Project Size 1/6

As a general rule in construction, as a project gets bigger, the cost of the project increases.

The size of the project is a factor of the owner's needs.

Size is handled differently depending on the stage in the project's life at which the estimate is being conducted.

At the conceptual phase, size will be an issue of basic capacity, such as:

- Apartment units for a real estate developer.
- Miles of roadway for a highway engineer.

Project Size 2/6

As the project becomes a little better understood, the project's size will begin to be quantified more accurately.

The basic capacitates will begin to be thought of in terms of more specific parameters such as:

- Square footage of floor or roof.
- Quantity of excavation.

Further design leads to more specific quantities, eventually ending with exact numbers for every project item.

Project Size 3/6

When addressing project size, the following must be consider:

(1) The principle of economy of scale (learning curve) for labor

(1) Buying materials in large quantities (bulk materials)

Project Size 4/6

(1) The principle of economy of scale (learning curve) for labor

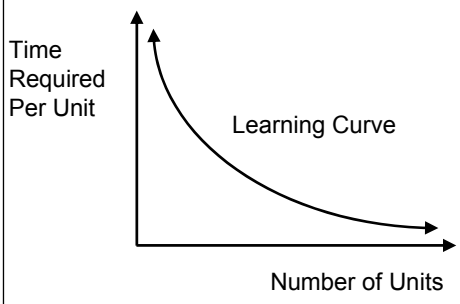
Essentially, as projects gets bigger they get more expensive.

The larger the project, the more efficiently people and equipment can be utilized.

As people repeat a task, particularly many times over, they get better and faster at it, reducing the cost of labor

Project Size 5/6

On large commercial building and heavy engineering projects, worker productivities are plotted into what are called learning curves.



Learning curves show that as the number of repetitions or units a worker needs to accomplish increases, the time required to perform that repetition decreases.

Project Size 6/6

Estimators treat project size by establishing tables which recognize the typical size of a project and a respective price and then adjust accordingly from norms.

Project Quality 1/5

As the quality and complexity of a project increases, so does the project's cost.

A high level of quality may be required for:

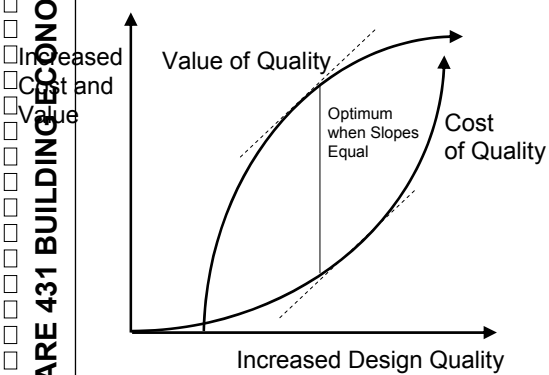
- **Aesthetic reasons as specified by the project architect.**
- **The safety of the project users or the public.**

As the expected quality of a project increases, the cost of providing this quality increases as well, but at a progressively greater rate. On the other hands,

As the quality of the project increases, the user experiences increased project satisfaction, but at a lesser rate.

Project Quality 2/5

The optimum level of design quality is the point at which the slope of the two curves is equal.



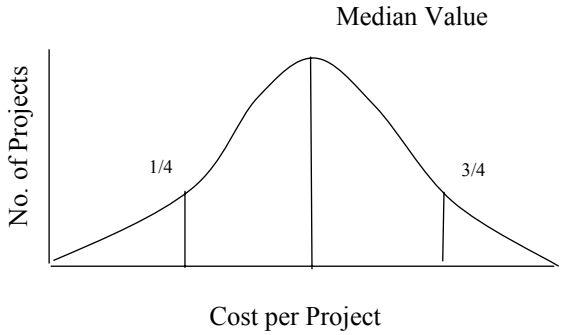
Project cost vs. value

Beyond that point, the cost of providing one more unit of value far exceed its corresponding value.

This can increase the project's cost substantially while not providing a corresponding value to the client.

Project Quality 3/5

In the early stage of the project, the estimator must compare the project to the other projects broken down into quality level such as ¼, median, ¾.



Project Quality 4/5

A ¼ project cost would indicate that 75% of similar projects would be of a higher quality.

A median project cost would indicate that 50% of similar projects would be of a higher quality and 50% of similar projects would be of a lesser quality.

A ¾ project cost would indicate that 75% of similar projects would be of a lesser quality.

Project Quality 5/5

As the project becomes further designed, the designer will begin to specify materials and systems each with corresponding material and installation prices.

As the estimator moves to the bidding stage of a project, quality must be precisely quantified per individual unit.

That is why detailed estimate takes longer time to be prepared.

Project Location 1/2

The location of the project is a major consideration in the preparation of an estimate.

Depending on the location, a great variation exists in:

- The purchasing of materials and their delivery: material costs are a factor of availability, competition, and access to efficient methods of transportation.
- Rental or purchase of equipment.
- The cost of labor: the cost of labor is a factor of the level of training found at the project location. On some projects, the number and the skill levels of workers are not available locally, so labor forces have to be imported.

Project Location 2/2

The cost of constructing projects in different locations can be predicted by establishing what are called location indices for different cities and parts of the country.

An index is created for a particular city by comparing the cost of labor, equipment, and material for that city to the national average.

This allows an estimator using national average costs to adjust the estimate to a particular location.

Most major design and construction companies have developed an accurate set of location indices which they use for their pricing, or they buy this cost data from national pricing suppliers.

Time 1/3

When a project is built can have a major impact on the cost of the project.

Since estimates, by definition, are prepared in advance of the actual construction, the estimator must "project" to the future what the cost of the work will be.

The estimate must predict what the cost of material and labor will be when these costs will be paid – not when the estimate is prepared.

Time 2/3

Initial project estimates are often two or more years in advance of the start of construction, and if the project takes three years to construct, the estimator therefore must identify costs as far as five years into the future.

Historical indices are developed in house or by professional companies (such as R.S. Means or ENR) can be used to adjust the cost of a past project to one today.(example Fig. 4-5)

Time 3/3

This concept is similar to the location indices.

This adjustment combined with the location adjustments allow an estimator to estimate the cost of a new project today in one location by looking at a similar project built several years ago and hundreds of miles away.

Sometimes, it is difficult to project with accuracy what the index will be for a future year, so the best an estimator can do is to look at the current trends and anticipate future labor and material prices.(example Fig. 4-5)

Other Market Conditions 1/2

An estimator who accurately incorporates the four major considerations that we just identified:

- Project size.
- Project quality.
- Project location.
- Time.

Will have an estimate that reflects the fair value of the project. Assuming a normal market without any unusual circumstances, this estimate should reflect the price to be paid.

Market conditions, however, shift, and owners, designers, and contractors all look at a given project from a different perspective.

Other Market Conditions 2/2

In a market without much work, contractors may bid for a project at a cost with little profit to keep their staff employed.

On complex projects, contractors may bid the work low in the hopes of making additional profit on future change orders.

Sometimes, contractors provide very competitive prices when they look to enter a new market or work with a new owner.

These issues are difficult to quantify, but should be considered in the preparation of the estimate and maybe included as % apply at end of the estimate.