Chapter One
Basics of Cost Engineering

1. Fundamental Principles of Cost Engineering

1.1 Introduction

Before taking up any construction work for its execution, the owner should have a thorough knowledge about the volume of work that can be completed within the limits of his fund or the probable cost that may be required to complete the contemplated work. It is therefore necessary to prepare the probable cost or estimate for the intended work from its design plan and specifications. Otherwise it may so happen that the work has to be stopped before its completion due to shortage of funds and or materials.

There are many costs associated with construction projects. Some are not directly associated with the construction itself, but are important to quantify because they can be a significant factor in whether or not the project goes forward and feasible. These include the initial capital cost and the subsequent operation and maintenance costs. Each of these major cost categories consists of a number of cost components:

- Land acquisition, including assembly, holding and improvement
- Planning and feasibility studies
- Architectural and engineering design
- Construction, including materials, equipment and labor
- Field supervision of construction
- Construction financing including overhead costs
- Insurance and taxes during construction
- Owner's general office overhead
- Equipment and furnishings not included in construction
- Inspection and testing

The operation & maintenance cost in subsequent years over the project life cycle includes the following expenses:

- Land rent, if applicable
- Operating staff
- Labor and material for maintenance and repairs
- Periodic renovations
- Insurance and taxes
- Financing costs

- Utilities
- Owner's other expenses

It is important for design professionals and construction managers to realize that while the construction cost may be the single largest component of the capital cost, other cost components are not insignificant. Early on, the owner wants to understand the nature of these costs as well as have some indication of what the construction itself will cost in order to analyze the life cycle costs and determine the worthy fullness of the investment. The *Cost-Benefit Analysis* can serve as a decision making tool to address all the costs and the corresponding associated benefits worth to the owner.

Cost Engineering is a dynamic process that begins in the very early stages of a project and ends when the project is turned over to the owner. As a project moves along time, the amount of information generated increases. The information improves an estimate's accuracy but also costs more to develop and takes more time. Cost estimating is critical in the development of the project because it informs the owner of costs, which in turn guide design decisions.

Cost Engineers consider past projects while anticipating new factors. Some of these factors include:

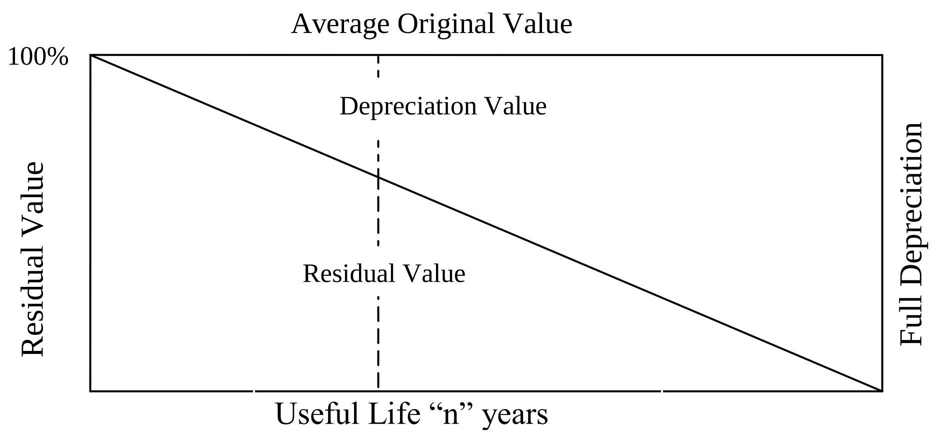
- Current technologies ,
- Market demand and supply of material and labor,
- Quantities of materials,
- Collective bargaining agreements of suppliers and buyers,
- Level of quality,
- Requirements for completion.

A good database of actual costs from past project experiences facilitate the preparation of a quick and accurate cost estimate. Cost Engineers spent considerable time and resources developing and protecting this database. Each new project provides a clearer picture of the actual cost of construction and adds to the value of the data. Larger design and construction companies maintain their own databases. Smaller companies may rely on the data developed from independent cost consultants and cost data suppliers.

1.2 Definitions and Terminology for Cost Engineers

Prior to the disposition of the overall concept of costing, it would be to the interest of Cost Engineers to define the following terminology for an ease reference and common understanding as they are used in the Construction Industry.

- Construction Costs: valued consumption of goods /material/ and performance /labor work/ of different kind and amount for the purpose of the production.
- Depreciation/ Depletion Costs: Costs of goods/equipment/ or plant distributed for the whole useful life to compensate its deterioration to the work. Although a nonlinear relationship exists, a linear or a straight-line method is often preferred.



Residual Value: refers to current value of goods determined by reducing the depletion cost from the original value.

- Interest Value/Rate: Value of goods foregone by not using resources at their best allocation. E.g. Opportunity Cost. An interest rate is accounted for cash deposited in any bank being a compensation granted for not using the money at its best allocation. (e.g. Investment)

- All-in Material Rate: A rate which includes the cost of material delivered to site, waste, unloading, handling, storage and preparing for use.

- Basic Material Price/Index: Unit price of the material including transportation, unloading, waste, handling, storage and preparing for use.

- All-in Labor Rate: A compounded rate which includes payment to operatives and the costs which arise directly from the employment of labor.

- All-in Plant Rate: A compounded rate which includes the costs originating from the ownership or hire of plant together with operating costs.

- Direct Costs: Costs directly rendered to the production of the work. It includes, all-in material costs, all-in labor costs and all-in plant costs.

- Overhead Costs: Costs incurred not to the direct itemized works but indirectly to the overall production and performance of the work. E.g.

    - Secretarial services,
    - Transportation facilities,
    - Administrative works,
    - Utility provisions: energy, water, communication, sanitation,

Two forms of Overhead Costs
- General Overhead Costs
- Site Overhead Costs

- General Overhead Costs: The cost of administering a company and providing off-site services. The apportionment of head office overheads to projects and to the company as a whole is decided by management as part of management policy.

- Site Overhead Costs: The cost of administering a project and providing general plant, site staff, facilities and site based services and other items not included in all-in rates.

- Mark-up Costs: the sum added to an estimate in respect of the general overhead costs including profit and risk.

- Production Costs: Costs representing the sum of direct costs (all-in costs) and site overhead costs. Costs required for production of the works on site.

1.3 Management Planning

The goal of a project manager is to complete projects on time and within budget. The best way to accomplish this goal is to plan for it, so the two key tasks in planning are ***costing*** and ***scheduling***. Therefore understanding the Cost Estimating and Cost Budgeting processes that develop the costing documents will help obtain ones goal.

Cost Estimating is the process of developing an approximation of the cost of the resources needed to complete project activities including the consideration of the possible fluctuations and other variances such as risk. Throughout the Cost Estimating process various alternatives are considered to assure accurate and effective estimates. This process is conjoined with the Activity Resource Estimating process and is foundational work necessary for Cost Budgeting.

> *The inputs to the* ***cost estimating*** *process are outputs from the other* ***planning processes***. These include the project *scope statement*, the project *management plan*, the *work breakdown structure*, *staffing management plan*, and *organizational process assets*. The main outputs of the cost estimating process are the ***Activity Cost Estimates*** and the ***Activity Cost Estimate Supporting Detail***.

- **Activity Cost Estimates -** These are assessments of the probable costs of the resources necessary to complete project activities.

- **Activity Cost Estimate Supporting Detail** - This provides a description of the activity's scope of work, documentation about how the estimate was developed, known constraints, explanations of any assumptions that were made, and a range of possible results.

Cost budgeting is the process of aggregating the estimated costs of individual activities or work packages to establish a cost baseline. It requires having all cost estimating processes completed. The difference between cost estimates and a cost budget is that the cost estimates portray costs by category, versus a cost budget which displays costs across time. The inputs into the Cost Budgeting process are:

- **Activity Cost Estimates -** These predict the cost for the project work.

- **Activity Cost Supporting Detail -** This provides useful data on how the estimate came about.

- **Project Schedule and the Resource Calendar** - Both dictate when project activities occur and when associated budget monies will be spent.

- **The Contract** This details purchasing requirements and associated cost.

- **The Cost Management Plan** -This reflects how project costs will be controlled.

The end result of the Cost Budgeting process is a Cost Baseline, which is a time-phased budget that will be used to measure and monitor overall cost performance on the project—usually displayed in the form of an S-curve.

Additionally, the Cost Budgeting process will produce Project Funding Requirements, including a management reserve amount that is included along with the cost baseline to compensate for either early progress or cost overruns.

The Estimating Problem

How does a cost engineer estimate the cost of a construction project?

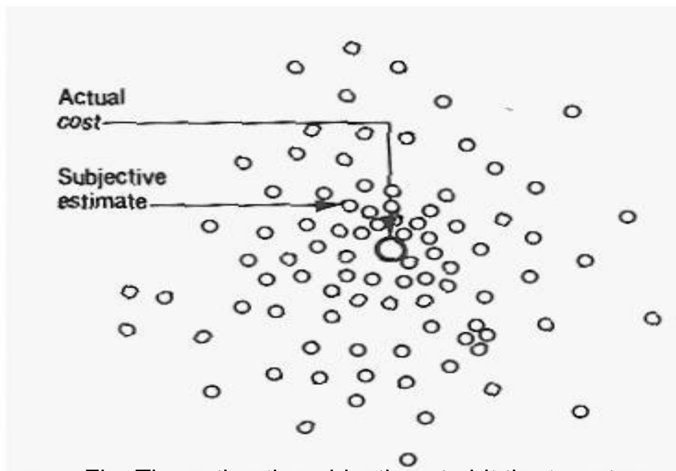


Fig. The estimating objective: to hit the target.

The Figure illustrates subjective estimates attempting to hit the target, which is the actual cost. The subjective value chosen by each estimator was considered to represent the resources required by each firm to complete an example office-building project. We can see that the estimates are all scattered around the target of actual cost. Hitting the target is not a common occurrence and is an inbuilt problem of estimating.

Let us briefly consider an estimator pricing a **brickwork** item.

What are the difficulties presented? They are as follows:

1. Choice of work method.
2. Output of crew (given the firm's unique efficiency).
3. Cost of labor
4. Cost of material and selection of an appropriate wastage allowance.
5. Addition of overheads and profit

Choice of work Method

There may be many or only a few work methods available. For instance, should the estimator assume a three-man or a four-man crew, composed of two or three bricklayer with either one or two laborers? Will there be central mortar mixing or individual mixers for each crew? How will the brickwork be constructed? Will trestles or proper standing scaffolding be used? Where will work commence from? What restrictions will the other trades impose on the masonry work?

All possibilities must be investigated, and the **most economical** possibility should be chosen.

Output of crew

The output chosen will be based on past performance, since the estimator will assume that this performance will be repeated in the future. As will be explained later, recording and properly documenting job site performance is helpful to the estimator when he or she considers future projects. Manipulation of these historical data may occur; for example, decreasing output to allow for restricted working condition. Whatever manipulation occurs, the estimator is faced with the difficulty of trying to assess what output will be achieved.

Cost of labor

How much will the contractor be required to pay for labor? The estimator must predict this cost. The labor cost will vary depending on job location, availability of skilled labor, contract wage regulations, union or open shop labor requirements, general market conditions, and so on.

Cost of Material

This can be predicted with a fair degree of accuracy if the material in question is in ready supply and is frequently purchased. The quantity of material required must be accurately measured from the drawing and is not dependent on the crew performance or work method adopted. Although the estimator must not only consider the finished in -place quantity of material, but also must allow for a wastage factor, this factor can vary dramatically and is highly dependent on the performance and work procedures adopted by the crew.

Addition for overheads and profit

This amount will depend on company policy, market condition, and many other variables that will be discussed later. It is, as you can imagine, very important to incorporate overhead and profit into the final estimate.

Variances between estimates and actual costs do occur. The estimator, unfortunately, always appears to be incorrect, since an estimate is an “estimate”, which is a forecast of the anticipated future cost. Many forces can, in reality, because the actual cost to vary from the estimated cost.

It sometimes appears to owners and management that, when the estimate does not equal the actual costs, a mistake has been made. Because it is an estimate, it should always be expected that the actual cost will vary somewhat from the estimated cost. It is the job of the estimator to minimize the extent of variance between estimate and actual cost. Any data collection system must be able to recognize that variances exist.

Variability of Estimates

The following are where cost variances between one estimate and another can occur:

1. Quantity take off.
2. Material Costs.
3. Labor Costs.
4. Labor productivity forecasts.
5. Work Methods.
6. Construction equipment costs.
7. Indirect Job costs.
8. Subcontractor quotations.
9. Quotations from material suppliers.
10. Unknown site conditions.
11. Locational Factors.
12. Cost associated with the time element of the construction project and escalation costs.
13. Staging and project startup costs.
14. Overheads.
15. Profit element.
16. Contingency and risk allocation.
17. Errors in estimate formulation.
18. Basis of information used to formulate estimate.
19. Market forces.

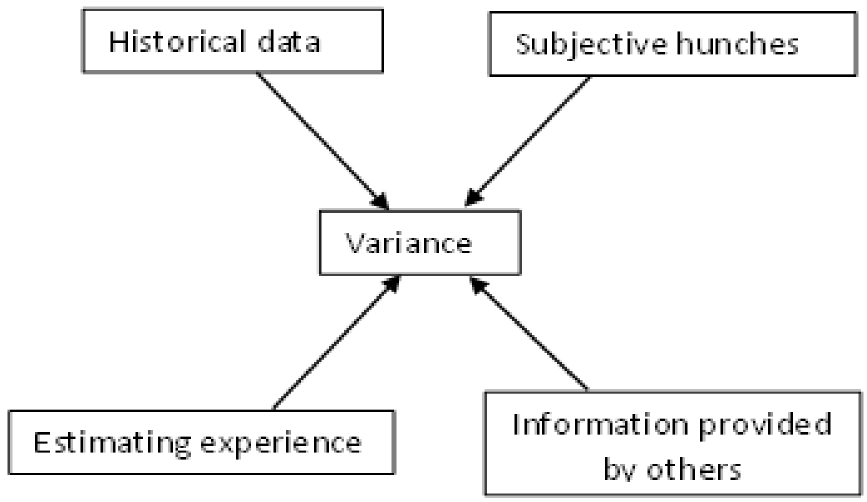
The total cost estimate is made up of numerous smaller cost estimates for each activity required to complete the overall project. The estimating equation is therefore composed of a series of calculations, the estimator has to assess and propose a monetary solution. The total cost estimate is the total of all the minor monetary solutions.

The estimator performs each assessment based on:

- Previously recorded data (historical data)
- The estimators own past experience.
- Previous experience of others.
- Hunches/intuition/Guesses

The final assessment is subjective. The estimator will decide what productivity to allow, or what birr allowance or unit price to use. This subjective act is the main reason why estimates vary. If you give identical drawings and specifications to 100 estimators, you will get 100 different cost estimates.

Figure below indicates the factors influencing variance in an estimate.

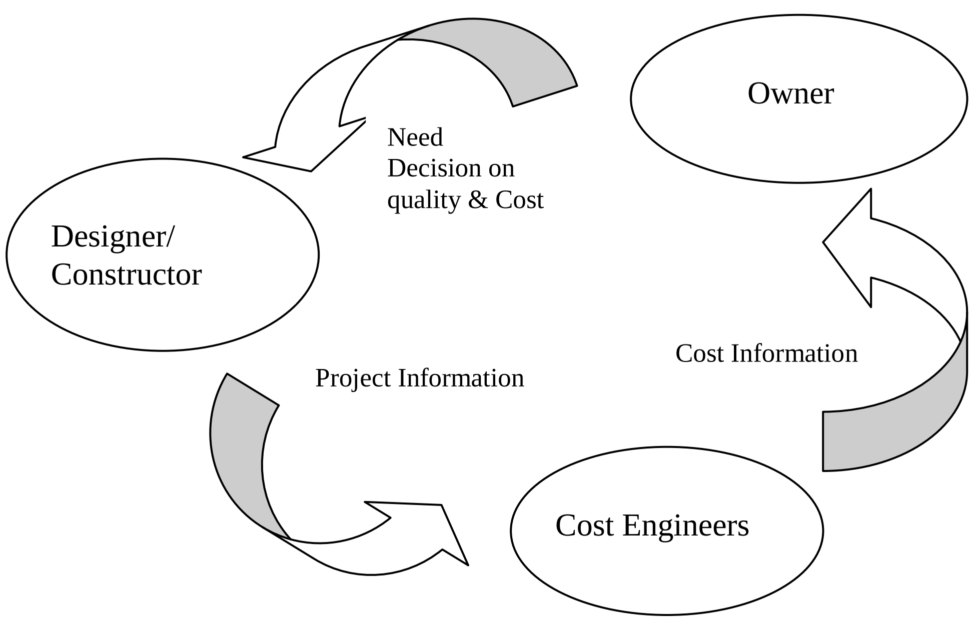


Basic reasons for variances being introduced into cost estimates – the subjective assessment.

1.3 Cost Engineering Traits

Cost Engineering shares common traits of the following:

- ***Conflicting Issues of quality, size, performance and cost****:* As projects develop, there is continual competition among issues of quality, size, performance and cost. Owners want to have the biggest facility with the best finishes and systems that will perform over time with least possible amount of money. With these criteria, it is likely that conflicts are bound to arise.



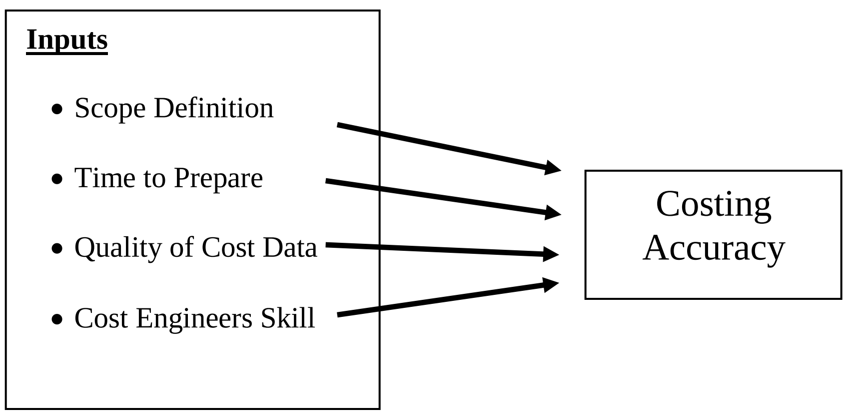
The design and construction team uses estimates to ensure that good cost information developed and a feedback loop established so that these conflicts can be addressed as quickly as possible. As project information becomes available, it is passed through a costing exercise. The owner can then decide to proceed based on this information or ask for some alteration in the design. The designer can then devise ways to meet the cost targets. Through this feedback loop, conflicting demands of cost versus performance can be resolved.

- ***Cost Engineering combines both science and art:*** Cost estimates are a product of information supplied by the designer, the owner and the suppliers. Experienced Cost Engineers use much judgment in interpreting and configuring this information.

- ***Cost Engineering does not offer guarantees of costs:*** Used properly, however, can be important tool in bringing a project under or at budget. The costs developed during design and even at the bidding stage are almost never the final and complete costs of the project.

- ***Costing can only be as accurate as the information upon which it is based**:* Cost accuracy depends on many factors. Document completeness, data base accuracy, the skill and judgment of the Cost Engineer.

- ***Cost estimate accuracy increases as the design becomes more precisely defined:*** A normal feature of the design process is that earlier stages of design are less precise than later stages. Cost information provided at schematic and preliminary design will by nature be less accurate than the ones provided at design developments.



- ***Cost estimate is based on previous estimates:*** A good, accurate estimate does not stand alone. It is the product of lessons learned from previous estimates.

- Costing requires standard computing methodology and procedures: As the design proceeds, the level of details increases. Costing as a consequence becomes more complex reflecting the many different factors that go into each unit of work. Calculations increase in number and the potential to leave something out becomes greater. Only through adherence to strict methods and procedures that mistakes can be minimized.

1.4 The Function of Cost Engineering in Construction

- From an owner's perspective, ascertain the necessary amount required to complete the proposed work for his decision and arranging finance for the same. For public construction works, cost estimates are required to obtain administrative approval, allotment of fund and technical sanction.

- It can guide the decision among two or three possible options. Identifying costs early facilitates sound decision making, but such estimates will have little hard design information.

- Cost Engineering offers guidelines to the designer, who selects materials and sizes the project to fall within the owner's budget. As the project proceeds, the design must be continually compared to this budget. If it begins to exceed the budget, the designer must determine the best alternatives for cost reduction.

- At the end of the design process, estimates are prepared to figure the bid prices of individual contractors under the competitive bidding.

- Cost estimates form the base core for negotiation between the signing parties in a contract agreement. The project management team often prepares a detailed estimate at this point to verify the accuracy of the bid prices and to negotiate with the trade contractors.

- Cost engineering can be used by the project manager to define the scope of the work for each subcontractor as well as determine fair pricing. Because each estimate is broken down by units of work, the project manager can extract information regarding quantity and cost for the particular situation. Cost Engineering can also be used as a planning tool. Procurement specialists use to define how much of a given item will need to be purchased. In the field, superintendents consult the estimate to determine the total quantity of work to be built in a particular location, the total number of hours needed to do the work, and the materials required.

- Cost Engineering can also help to fix up completion period from the volume of works involved in the estimate.

- Cost Engineering helps to justify investments from cost-benefit analysis.

- Estimate is required to invite tenders and prepare bills for payment.

- Cost Engineering helps for valuation of existing property which itself is for a number of purposes.

1.5 Considerations in Costing

Project price is affected by the size of the project, the quality of the project, the location, construction time, and other general market conditions. The accuracy of costing is directly affected by the ability of the Cost Engineer to properly analyze these basic issues.

1. Project Size

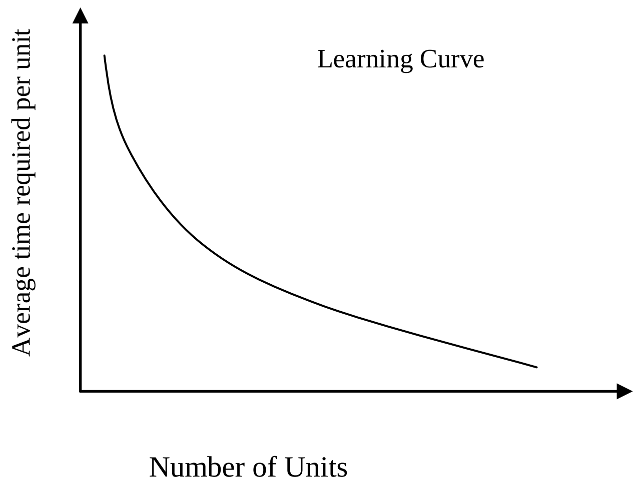
The size of the project is a factor of the owner's needs. At the conceptual stage, size is an issue of basic capacity, such as apartment units for a real estate developer or kilometers of roadway for highway engineering. As the project becomes better defined, its size begins to be quantified more accurately.

The principle of **economy of scale** is an important factor when addressing project size. Essentially as projects **get bigger**, they get **more expensive** but at a **less rapid rate**.

This occurs because the larger the project, the more efficiently people and equipment can be used. Also as people repeat task, they get better and faster, reducing **the cost of labor**.

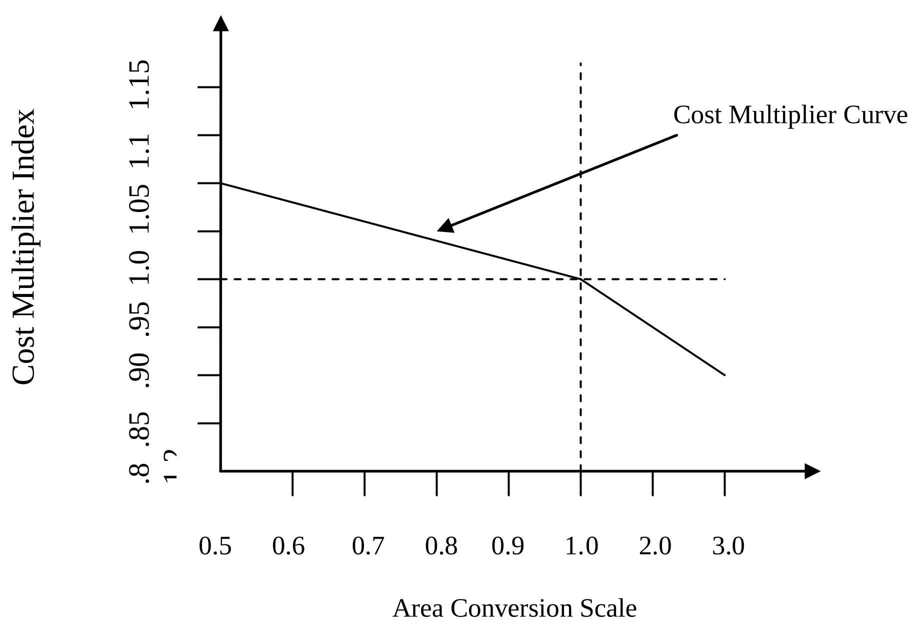
On large commercial building and heavy engineering projects, worker productivity is plotted into learning curves.

Cost Engineers treat project size by establishing tables that recognize the typical size of a project and a respective price and then adjust up or down from this norm.



As operations continue, crews learn so that the time **required to complete the next like unit is less**. In general for buildings built to the same specification in the same locality, the larger building will have the lower unit area cost. This is mainly to the decreasing contribution of the exterior walls plus the economy of scale usually achievable in larger buildings.

As an example, the area conversion scale shown below will give a factor to convert costs for the typical size building to an adjusted cost for the particular project.



Building Type	Median Cost per M^2 (USD)	Typical Size Gross M^2
Apartments	550	1890
Banks	1233	378
Colleges	1074	4,500
Gymnasiums	770	1728

Table: Typical project size and method for modifying for economy of scale.

Example One: Determine the cost per m^2 of 3780 m^2 apartment building.

Area Conversion Scale = Proposed Area / Typical Size

= 3780 / 1890 = **2.0**

From the conversion curve, one can get a cost multiplier index of **0.95**

Adjusted Cost per m^2 = 0.95 x 550 = **522.5** USD

2. Project Quality

An owner may require a high quality project to create a specific image or may need facilities for a specific use. Whatever the reason, the consequences are always the same: an increase in costs. Early in the project, the Cost Engineer must discuss expectations of quality with the users, the designers and applicable government agencies.

3. Project Location

Constructing a facility in a locality is very different from constructing one on other areas. The differences are in labor costs, the availability of materials and equipment, delivery logistics, local regulations, and climate conditions. Material costs are a factor of availability, competition, and access to efficient methods of transportation. Labor costs, particularly unionized labor, are a factor of the strength of the local bargaining unit. The cost of labor is also a factor the degree of sophistication and level of training found at the project location. On some projects the numbers and the skill levels of workers required are not available locally and must be imported. Understanding the need for such importation adds significantly to the accuracy of an estimate.

Local conditions can influence the costs of the project. The need for citizen involvement, local taxes or fees, and government requirements all can cost the project money. Extreme climatic conditions, political instability, and earthquake zones all add to the cost in ways that may not be entirely obvious without some investigation.

The cost of labor and material in different locations can be predicted by establishing 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 design and construction companies have developed an accurate record of location indices, which they use for their pricing, or they buy this cost data from national pricing suppliers. To predict the costs of other local factors, such as political instability, a company either uses its own experience in the locale or teams up with a local partner who knows how the local atmosphere can affect project costs.

Various locational difficulties are described:

1. Remoteness
2. Confined sites
3. Labor availability
4. Weather
5. Design considerations (related to location).
6. Vandalism and site security

Remoteness

A remote construction site, for example, a project site located in valleys of Gibe River, poses a contracting organization with a difficult set of problems to cope with.

Communication Problems

If adequate communications such as telephone are not available, then a radio or cellular-type installation is required. A telephone is a requisite to any construction project: lack of communication during the construction process can result in major, costly errors. In addition, because the project location is further away from the head office, additional long-distance telephone charges will be incurred.

Transportation Problems

All material and labor must be transported to the building site. If the transport route is poor (if, indeed, any route exists at all), then delays in material deliveries may occur; large vehicles may damage narrow bridges. It may be necessary for the contractor to widen the existing route or construct a bridge to allow material trailers access into the job site.

The route that is proposed should be studied carefully by the estimator. Existing capacity of existing bridges on route should be established to verify if equipment loads can be accommodated of if the bridge needs to be strengthened by the contractor. Finally, the cost of hauling items of equipment to the job site increases as the distance increases. Given these considerations, the requirement for management to make the correct equipment selections becomes very important.

Increased Material Cost

Increased material cost is primarily due to increased transport charges such as when distance for haulage from the depot to a remote job site is longer than the haulage associated with other construction projects the estimator has previously worked on. Avery[4] found that if the material was fragile or hazardous, then transport costs fluctuated widely depending on distance. He also discovered that the bulk materials with low initial cost, such as sand and gravel, tend to be the most adversely affected by distance and difficult transport conditions. Ferry crossing or bridges with tolls increase the basic cost of materials.

Power and Water

Power and water are a necessity for building construction. Water is needed for materials such as concrete, for cleaning the building, and for many other uses. Salt water is not acceptable in most specifications for concrete or mortar mixing, so remote projects without a convenient domestic water supply, even if the site has access to thousands of gallon of seawater; require water to be trucked to the job site. The cost of water depends on the hauling costs. In some instances wells can be dug to pump water to the surface; of course, the costs involved must be considered in the estimate.If no power source is available, then power must be provided by generators.

Confined Sites

The problems associated with confined sites generally take the form of congestion resulting in restricted working areas resulting in low productivity from labor and equipment. These difficulties are generally associated with downtown sites, but this need not always be the case.

In extreme cases, congestion can limit the choice of work methods, types of equipment used, and size of crew to be employed. Careful investigation of the problems likely to be associated with each particular site will allow a realistic assessment of factors such as productivity to be made. Project startup requires a careful utilization of resources in order to provide production outputs that maximize profits. Confined sites create logistical problems. Material movement should be minimized: each time an item of material is moved, its cost to install in place increases. When materials are delivered to a confined site, the material should be used immediately. If this is not possible, a storage area should be available to receive the material, or, if possible, the material should be offloaded directly at its intended utilization point.

The estimator needs to consider the unique logistical problems associated with each job site. These problems, including restricted access, restricted material lay down area, restricted equipment storage areas, and restricted location for site trailers, affect the type of equipment that can be used, the effective management of the job, the worker productivity, and the amount of labor involved in handling material. Since confined sites nearly always pose logistical problems, the unit prices used by the estimator must account for the increased costs.

Labor Availability

Each location has varying amount of available skilled and unskilled labor, depending on the condition of the local economy. If labor of any kind is not available locally (as may be the case in remote areas), then labor must be imported from other location. In order to move labor from one area to another, a financial incentive is usually required. The magnitude of this incentive will vary depending on the state of the labor market. If labor is imported, accommodations may have to be provided. Labor camps comprising full time kitchen staff, dormitories, leisure facilities, etc., have been set up on major construction project to house the contractor’s labor force. The leisure (Rest / Vacation) facilities keep the labor force relaxed and occupied during any rest periods. Living and working on a remote construction site can be very demoralizing, after a while, and by keeping the morale level high, labor turnover is reduced. Generally, the cost of importing labor will follow the laws of supply and demand.

Weather

Since the building process is highly weather dependent, extreme conditions can greatly affect building costs. These extreme weather conditions include large amount of rain or snow, occurrences of ice and frost, and high humidity and heat. Their effects on cost include the following situation. Concrete pours in temperatures below 40 degrees Fahrenheit require special precaution.

With cold weather concreting, the cost of admixtures, insulation the formwork, removing ice from formwork, and protecting the freshly placed concrete from dropping below the specified temperatures must be taken in to account by the estimator. Not only does cold weather affect concrete, but hot weather concreting has its associated problems as well.

During periods when the temperature exceeds 80 degrees Fahrenheit, special precautions are required to reduce and maintain the concrete below this temperature. For example, ingredients such as the water may be cooled or chopped ice can be utilized. Another alternative is to use liquid nitrogen to cool the concrete. Admixtures and low heat cement can be used to control the set and hardening times of the concrete to achieve the design strength and quality. All these precautions and procedures increase the cost of pouring, placing, and curing concrete.

Exposed sites may have problems associated with high winds, which affect crane and hoisting operations, and the contractor’s dust control program. Additional temporary bracing to partly completed structures may be required to prevent a collapse due to high wind gusts. In areas where hurricanes occur, the estimator should consider the cost of temporary measures required to prevent damage to a structure before, during, and after a hurricane.

It would be prudent (Practical) to allow for the costs involved in bracing, tying down structures providing sand banks, garaging equipment, and storing particular materials such as doors and windows off the job site, unless safe, dry, and secure storage exists on the project.

Labor productivity is also associated with the weather. During poor weather when it is cold, damp, and windy, the morale of workers exposed to adverse elements, drops, which in turn results in a decline of productivity. During days when it may be impossible to work, such as during a torrential rain, the productivity is zero.

Design Considerations (related to location)

The location of a project has certain aspects that must be considered by a designer. For example, in historic sites all designs must harmonize with the existing historical buildings (example around Lalibela). Planning committees may dictate the material selections and configurations that designers must abide by to suit certain local conditions.

These design considerations can create estimating problems in historic districts. The estimator must know if the materials specified are, in fact, locally available of if local labor exists to carry out complicated historical work, such as ornate plaster work; if not, a specialist will be required.

Traditional building techniques tended to be labor intensive. If the same techniques must be repeated, then the estimator must be familiar with the procedures involved. If workers are required to use traditional, building methods with which they are unfamiliar, then a learning curve cost needs to be built into any unit price.

The local climate also dictates the designer’s choices in mechanical and electrical systems and in the choice of materials and design of the building envelope. Material resources will fluctuate from location to location throughout the country, and the designer must investigate what materials are locally and economically available.

Finally, each locality tends to have its own construction trade practices, and the estimator should be familiar with them.

Vandalism (Destruction) and Site Security

Site integrity is an important problem in urban areas. Protective measures can be expensive, for example, when 24-hour guard service and perimeter enclosures, are required. The level of security will depend on the risk to the project from the surrounding neighborhood. The local police should be consulted.

4. Construction Time

A project is estimated at a given point in time, but usually the actual procurement and field construction occur at some point in the future. Sometimes this future can be years away, especially in the case of a very large or phased project. The estimate, then, must take into consideration when the actual project will be built. Labor and material costs usually escalate in time; so by examining past and current trends, the estimator can predict where these costs will be at the time of actual construction.

Other:

An estimator who accurately incorporates project size, project quality, location, and time has an estimate that reflects the fair value for the project. In a normal market without any unusual circumstances, this estimate should reflect the price that is paid.

Market conditions, however, shift; and owners, designers, and contractors all look at a given project from different perspectives. In a market without much work, contractors may bid a project at cost or with little profit to cover their overhead and keep their staff employed.

On complicated projects, contractors may bid the work low in hopes of making significant profit on future changes. Conversely, they may bid a work high to cover the increased risks of a complex project. It is not unusual for contractors to offer very competitive prices when they hope to enter a new market or establish a relationship with a new owner. Such issues are very difficult to quantify but should be considered in the preparation of the estimate. They are usually treated as a percentage applied at the end of the estimate, included in either overhead or profit or in a final contingency.

END OF CHAPTER

STAY SAFE FROM COVID-19