

Chapter One: Introduction

1.1 Introduction

Nowadays, before any construction work can begin, a methodical procedure must be followed. A portion of the work was done before construction, while part was done during. One of the most crucial components of construction management in the field of civil engineering is cost estimation.

Estimation in civil engineering is the process of determining the quantities and costs of various project work items before the job is started. The estimating process aims to determine the projected expenses of a construction project as accurately as possible, including the number of staff members, materials, and equipment required to complete the project successfully [1].

Pre-design cost estimates, another name for conceptual cost estimates, are created extremely early in a project, usually before the construction drawings and requirements are ready. At this point, cost estimates are required by the owner, contractor, designer, or financing institution for a variety of reasons, such as establishing an initial budget or determining if a project is financially feasible. Because of the unfinished project scope and the paucity of design knowledge available during the pre-design phases, conceptual cost estimates are imprecise yet nevertheless need to be rapid, affordable, and accurate [2].

The accuracy of the estimate of costs is a crucial factor that directly affects the outcome of the work and is necessary for the construction project to be successful. For a good estimate, the actual cost of the proposed work after completion should not differ by more than 5 to 10 % from its approximate cost estimate, provided there are no unusual, unforeseen circumstances [3]. Estimating is crucial for construction companies to ensure success in bidding and maintain a profit margin. It involves balancing high and low estimates to avoid financial loss and bankruptcy. The estimator is constantly walking a fine line between bidding too low and too high [4].

One of the most important staff members in any construction company is the estimator, who can understand the project and accurately estimate its cost. Several full-time estimators may work in an estimating department for large

companies. Creating all of the company's estimations is frequently the responsibility of the estimating department. In smaller companies, creating the estimates could fall within the responsibility of the project managers or the owner. Employees who are in charge of creating estimates are estimators, regardless of their title.[1]

1.2 Type of estimation

For various stages of project development, construction estimation involves a variety of methods, some of which are explained below.

- 1.2.1 Conceptual estimation: this is the first stage that gives a general overview of expenses based on the project's baseline specifications. During this stage, approximate size estimates are frequently provided, laying the foundation for more thorough evaluations.
- 1.2.2 A preliminary estimation: is a preliminary estimate from a partially completed set of drawings, typically 35% to 50% complete. It's used to check if the proposed design is within budget and identify necessary changes. Preliminary estimates can be performed before the bid and are more accurate than conceptual estimates due to more available design information.
- 1.2.3 Final or detailed estimation: involves a meticulous breakdown of costs, delving into specific components such as labor, materials, and overhead. This type is crucial for comprehensive project planning and accurate budgeting. They are prepared from a complete or nearly completed set of drawings and are the most accurate type of estimate.
- 1.2.4 Parametric estimation: based on project parameters, parametric estimating generates estimates using statistical relationships or historical data. It offers an approach based on data and is especially helpful when there is a lack of comprehensive information. The government frequently views initial cost estimates as the project's upper limit. Estimates are made using cost indicators from related projects and are based on the size and functional units of the buildings [5].
- 1.2.5 Analogous estimation: draws parallels between the current project and similar past projects, offering insights based on historical performance. This method relies on the assumption that comparable projects share cost similarities.

1.2.6 Bottom-up estimation involves a granular assessment of individual project elements, aggregating these to derive a comprehensive cost estimate. This method ensures a detailed understanding of each component's financial implications.

1.3 Thesis Objectives

Before starting construction, estimating and determining the cost of any project is necessary. This procedure can be carried out to demonstrate the budget. Different types of estimation are useful nowadays due to significant processes occurring at different times.

The study aims to determine the total amount of each structural component in a multistory structure (the Halabja University boys' dormitory). specifies the cost of each item based on the price of each item in Halabja and then clearly illustrates the estimation process. The preparation of the project's bill of quantities (B.O.Q.) will ultimately serve as the primary goal of this study, as it will help the University of Halabja in the future construction of a new dormitory.

1.4 Outline of the thesis

To address the fundamental problems and accomplish the research goals outlined in the previous section, this dissertation is divided into five chapters. Chapter 1: Introduction to the Project, including a description of estimation in civil engineering, the type of estimation, and the motivations and objectives of this research.

Chapter 2: A survey of previous studies as well as recent advancements in the cost of estimation in civil engineering is presented in this chapter.

Chapter 3: This chapter computes the estimation of different items in structural elements.

Chapter 4: This chapter illustrates how to determine the costs of each project component.

Chapter 5: The conclusion of the thesis was given.

Chapter Two: Literature Review

This chapter consists of a literature review of cost estimation. Cost estimation is the process of determining the expected quantities and costs of the materials, labor, and equipment for a construction project. Various researchers have studied cost and estimation theoretically and experimentally. The following are a few examples.

McKim [6] provided an example of how to use a neural network in cost engineering. His research yielded estimates that were compared to estimates from three other techniques, collectively referred to as pump scaling factor estimates: exponent scaling by the 0.6 rule, exponent scaling by the best-fit exponent, and exponent scaling by the best-fit equation. These three traditional approaches' outcomes were contrasted with those obtained using NN. According to the results, NNs provide a lot of promise for non-deterministic costing system estimation.

Creese and Li [7] utilized NNs to estimate timber bridge costs and contrast NN approaches with the regression method. According to the study's findings, NNs performed better at estimating the cost of timber bridges than the standard linear regression approach. The logarithm-neuron network was proposed by Yeh [8] who also evaluated the network's accuracy and efficiency in calculating the amount of steel and reinforced concrete in a building. The findings demonstrated that the network's logarithm neurons offer improved network design, which considerably raises these networks' performance in quantity estimate for buildings.

Adeli and Wu [9] developed a regularization neural network for calculating construction costs for noisy highways, revealing that accuracy increased with parameter number. A separate study presented a neural network model for parametric cost estimation of highway projects using spreadsheet simulation.

A study aimed at comprehending the elements influencing the cost-estimating procedures of contractors was provided by Akintoye [10]. Eighty-four UK contractors were categorized into four groups—very small, small, medium, and big forms—through a comparative analysis. The project's complexity is the primary element related to cost-estimating practice, according to the preliminary analysis of the 24 factors included in the study. Gunaydin and Dogan [11] used neural network methodology to estimate costs early in building design, achieving an average cost

estimation accuracy of 93%. Training and testing were conducted using cost and design data from thirty projects, specifically for reinforced concrete structural systems in 4-8-story residential structures in Turkey.

Multivariable regression and artificial neural network techniques were employed by M. Gunduz et al [12] Creating early cost estimation models for metro and light rail trackwork is the primary goal of this construction. Regression analysis calculated the cost of the validation projects with an error of 2.32% based on each method's results. However, the cost was approximated using artificial neural networks with a 5.761% error rate, which is a little greater than the regression error. Within the parameters of this paper, two successful models have been created based on the results.

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Estimating plays a key role in the operation of construction companies. Accurate estimates are needed for a company to be successful in the bidding process while maintaining a reasonable profit margin. If the estimates are too high, the company may starve to death because of the lack of work. If the estimates are too low, the company may lose money and go bankrupt. The estimator is constantly walking a fine line between bidding too low and too high.

The estimator is the person responsible for preparing the cost estimates. Large companies may employ an estimating department with one or more full-time estimators. The estimating department is often charged with preparing all of the company's estimates. In smaller companies, the project managers or the company's owner may be responsible for

preparing the estimates. Regardless of their job title, employees who are responsible for preparing estimates are estimators

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The data required for the estimate process is drawing, specification, rate, and method of measurement

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