

Teaching and Learning the Foundation of Construction Estimating

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ABSTRACT

This article provides an overview of construction estimating as it is performed today and a framework for learning and teaching estimating. Individuals in the construction industry must always continue to learn and adapt due to the constantly changing world of construction. Learning construction estimating continues to be an extremely difficult process and lifelong endeavor.

Key Words

Estimating, Construction, Computer Estimating, Take offs

INTRODUCTION

In the world of construction, estimating and the ability to estimate is the single most required skill of individuals who seek a profession in construction. The requirements for learning and understanding estimating are the most difficult concepts to understand, even for people who have actually worked in the field. Estimating is an area of construction that develops from a technical processing skill to an art when an individual's knowledge and experience peaks. This paradigm explains the lack of clear and definite methods for teaching, learning, and understanding estimating. This article will develop, for the student of construction estimating, a learning path that, if followed, will provide clear understanding to the process, technical skills required, and basic methodologies. It must be stressed that this article will attempt to provide a systematic approach to real world estimating that is being performed in the construction field today. In order to be successful in our industry, the ability to estimate is certainly the heartbeat of construction.

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Estimating abilities can be learned by individuals who have little construction experience (quantity take off personnel) and represent the beginning of becoming an estimator. There is complete truth to the belief that one must have construction experience to become a true estimator capable of providing estimates to owners for approval. The responsibility for the future of a construction company rests with the accuracy of those estimates. Obviously, the final estimate would be reviewed and approved by upper management or the construction company owner.

WHAT IS ESTIMATING?

Estimating is the knowledge, skills, ability, and art of determining the cost to perform some type of construction work. Included in this cost requires: A scope of work, working conditions, materials required, labor required, equipment required, payment schedule, completion schedule, type of work, owners, contractor capabilities, and profit and overhead requirements. With all these variables and others, the purpose of this article is to provide for the reader a learning system for estimating.

Taking the body of estimating knowledge required for success and developing a beginning base of working knowledge typically requires classification and organization of key concepts, terms, and systems. It is very easy for individuals to understand some of the simple calculations but have an extremely difficult time mastering the total estimate requirements of a complete construction project. For example, calculation of concrete is a relatively simple calculation and should take only a few examples for an individual to understand the units we use to calculate (cubic yards) and be able to perform the simple math involved. Yet, with these calculations, some basic general knowledge is needed. This knowledge begins with the ability to read plans (so dimensions can be found for the formula) and knowledge to convert math units to the correct units needed for the various formulas. Finally knowledge that the answer found is a theoretical amount which must be adjusted for installation, waste, overhead and profit. This example demonstrates how one material in a construction project can require an extensive base of knowledge. Carefully reading and reviewing the contract documents and understanding the construction schedule along with the methods of construction are the last facets of being an estimator/manger. This provides a logical path for one to develop this estimating knowledge.

HOW IS IT PERFORMED?

Estimating is performed in phases, pieces, systems, etc. and is performed by every contractor and construction worker. For the beginning estimator, a starting point for learning can be established with a list of knowledge requirements for success. Therefore, for complete use and understanding the following concepts and principles are needed.

Basic Knowledge Requirement: (Quantity take off estimator)

1. Ability to read and understand plans and specifications.
2. Capability of performing algebra math calculations (contractors do not use calculus).
3. Capability of organizing data in a logical flow once the system has been identified.
4. Understanding of the basic construction process.
5. Understanding of the basic construction materials.
6. Understanding of the basic building systems.

The knowledge requirements may be obtained in the classroom environment or from work experience. Estimating is performed with a pencil, calculator, or computer depending on the type of construction and company.

WHO PERFORMS ESTIMATING?

Estimating, in some form, is performed by virtually everyone in a construction organization. The best estimates are typically a result of a team collaboration of construction personal (i.e. foreman, superintendents, project managers, and owners, etc.). Unfortunately, there is never enough time to estimate. Estimating is one of the key functions a construction company must perform well; yet could be considered nonproductive when bids are not won. For example, if you hire an estimator for \$600.00 per week and it takes four weeks for that individual to develop an estimate, the company overhead would require a large annual volume of work to cover the weekly overhead loss. In developing an estimate, normally a line item for an estimator is not included, which means their salary will be paid from the overhead and profit of the company or profits from another project. If the estimate has too many errors, the company may lose money and even go out of business. For these primary reasons, estimating duties in a small company, (an annual volume under five million dollars a year), will normally be performed by upper and mid management. A perfect estimate does not exist. The estimate which documents the final profit/loss on the project is the real estimate.

Estimating becomes the first step in a construction company's process for staying solvent and earning a profit. The estimate becomes the budget for the construction project a construction company will be building. Without the proper

on-site management, correct buyout, project management, and collection of monies due, estimates normally result in loss of profit. Evaluation of a construction company and its abilities to perform estimating is paramount for a successful company.

Estimating is not only done in the office, but in the field. Many winning estimates which have mistakes (for example, items left out) can be saved to actually generate a profit when a veteran superintendent or project manager suggests alternate construction methods or products that may save on the budget, schedule or labor. Never hesitate to ask opinions, methods, and suggestions for all components in an estimating situation. Many times a subcontractor or supplier will suggest solutions that can bring an estimate back to a profitable or break even course.

Those who perform the estimate should be a team of individuals who focus on obtaining work and generating a profit. Normally, one person is in charge of bringing the estimate to its final form, but it takes the cooperation and assistance of many people to make it a success. Estimating must be a team effort.

A student graduating from a construction management program will have the ability to organize an estimate, obtain subcontractor quotes, perform quantity takeoffs on basic construction materials, and provide upper management or the owner an estimate for their review. The final adjustments and review will rest with the owner or upper management. Today's construction firms expect long hours and positive results from their estimators. Construction estimating is the heart of all construction work. Construction professional must have the ability to estimate for a successful career.

KNOWLEDGE REQUIRED

In order for an estimating teacher to evaluate what is needed to perform estimating basic knowledge levels are required.

1. Knowledge of basic mathematics.
2. Knowledge of the basic sequence of building or constructing.
3. Knowledge of reading plan and specification.
4. Knowledge of interpreting plans and specifications.
5. Knowledge and acquisition of organizational and planning skills.
6. Knowledge and ability to communicate with others.
7. Knowledge of scheduling.
8. Knowledge of the work and labor environment.
9. Knowledge of the estimating process and how to analyze data.

10. Knowledge of construction contracts.
11. Knowledge of various construction processes.
12. Knowledge of construction materials and equipment.

Understanding the gestalt of any body of knowledge demands focused time and effort. The basic building blocks needed for learning estimating are never complete. Individual effort and work are mandatory for anyone to become an estimator. The odds are that most students of estimating will not have all the knowledge and skills needed. The individual who desires and has the drive will achieve success as an estimator and contractor.

STEPS FOR ESTIMATING

It is critically important in learning a complex body of knowledge that a clear objective be provided. The steps for estimating should provide a clear path to learn and understand. As noted earlier, the basic knowledge for learning estimating would constitute **step one**.

Step two involves a classification of what is being estimated. For example, if it is concrete, then where are the plans, what are the working conditions, what are the costs associated with the materials and subcontractors? Is concrete the only item being estimated, or is it one component in a larger estimate? During what phase of this project is the concrete needed? How do we organize the data such that we can record and update this data? These questions are normally followed by **step three**: what type of construction are we going to perform? Each type has its own unique form and format.

Step four is determining the various systems and components needed and what line item amounts are needed. Are second quotes needed? How many quotes are needed to provide the lowest competent estimate? Obtain costs and analyze the pricing of the various components or systems. **Step five** follows with the placement of everything into an organized format. This is usually a prepared form either on a computer program or company form. Of course the type of estimate; design build, competitive bid, negotiated, lump sum, cost plus, construction management, etc. will have a major impact on each of these sections. The final step, (**step six**), involves the careful review of the final estimate, application of profit (how much?), overhead amount (how is this allocated?), and check for omissions and errors. The above steps provide the general sequence and framework required in developing an estimate for most construction projects.

Learning estimating for the novice requires a tremendous amount of time, effort and practice. Having the ability to provide a cost estimate for performing some type of construction work is not a foundation our educational system provides at the lower grade levels. Yet, the basic knowledge tools is provided and when coupled with at least one technical oriented estimating class a student can perform estimat-

ing functions or tasks. The term 'estimating' takes on many different meanings, applications and the following scenarios will provide examples...

The first example is the estimating performed on the construction site. A project where a superintendent has carpenters and laborers to form and pour 10 feet of wall 8 inches thick and 10 feet high. In order to actually make this happen, the superintendent would determine labor requirements, schedule requirements, order the correct amount of material, decide what form system will be used, equipment needs, and so on. The next step would be to estimate the schedule for the materials delivery, labor needs, location, inspections, concrete delivery, and form stripping. Individuals performing this type of estimating must have detailed knowledge of construction techniques, systems, and complete understanding of normal, everyday construction work practices. How can the typical university student or novice begin to estimate a process of which they have little or no knowledge? Therefore, this type of estimating normally requires actual work or on site experience. Teaching methodologies such as videos, internet sites, site tours, lectures, discussions, and reading enable beginning estimators to learn.

The next scenario is quantity take off estimating, which is normally the type of estimating that universities provide to their students. In this scenario, basic plan reading, basic math, common formulas, and the common units that are used are typical areas where classroom knowledge is required. Of course, the answers are theoretical and will need to be modified for waste, actual on site adjustments, and further adjustments for the different ways materials are purchased. For example, demonstrating to students how to calculate how many linear feet of 2x4 double top plate are needed to frame a room, the answer would be the length of the walls as found on the floor plan and then double since there are two plates. If that number were determined to be 140 linear feet, while that is the correct amount, which is not the way this material would be purchased. A 2x4 is normally purchased in lengths of 8, 10, 12, 14, or 16 feet. The final linear feet purchased would probably be different based on the lengths selected. Certain parts of the building will dictate different size or length materials and this data is not on a set of bid documents. The problems of relating construction materials, local practices, and waste must be developed from experience and study. Even with the best instruction in the world, it is suggested a potential estimator needs as much hands on experience as possible.

A final scenario involves the actual estimating performed in a small general contracting company. If the work is competitively bid, the process (briefly outlined) requires obtaining contract documents, performing quantity take offs, calling many subcontractors and vendors for quotations, analysis of these quotations, calculation of critical areas (i.e. concrete, etc.), evaluations of the construction systems to be used, determination if this project is one that the company does well, evaluation of the competition, analysis of the