

Improving Early Estimates

Implementation Resource 131-2

Construction Industry Institute

Best Practices Guide 

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*Prepared by the
Construction Industry Institute
Improving Early Estimates Research Team*

Implementation Resource 131-2

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Chapter 1

Introduction

Importance of Early Estimates

For any capital investment, an early estimate is prepared to enable the business unit to make sound economic decisions. The estimate is important to the business unit because it becomes the basis for analyses of return on investment. The early estimate is also important to the project team as well because it becomes one of the key project parameters. It helps formulate execution strategies and provides a basis to plan engineering and construction. The early estimate often serves as a baseline for identifying changes as the project continues to develop.

Because the estimate impacts the work of all participants in the project, this publication is written for multiple parties. Although portions often may apply to one party more than another, it contains information that can contribute to project success for owner, designer, and contractor organizations.

Classification of Early Estimates

Numerous names are given to estimates as a project progresses from inception to completion. Individual companies define and use their own estimate names and percent variations. Various organizations also have defined classifications of cost estimates. Two examples are the cost estimate classifications by the Association for Advancement of Cost Engineering (AACE) International shown in Table 1, and the Construction Industry Institute (CII) shown in Table 2.

Table 1. AACE International Cost Estimation Classifications (18R-97)

Estimate Class	Level of Project Definition (%)	End Usage (Typical Purpose of Estimate)	Expected Accuracy Range (%)
Class 5	0 to 2	Concept Screening	-50 to +100
Class 4	1 to 5	Study or Feasibility	-30 to +50
Class 3	10 to 40	Budget, Authorization, or Control	-20 to +30
Class 2	30 to 70	Control or Bid/Tender	-15 to +20
Class 1	50 to 100	Check Estimate or Bid/Tender	-10 to +15

Table 2. Construction Industry Institute Cost Estimate Definitions (CII SD-6)

Estimate Class	Percent Range	Description / Methodology
Order-of-Magnitude	± 30 to 50	Feasibility study — cost/capacity curves
Factored Estimate	± 25 to 30	Major equipment — factors applied for costs
Control Estimate	± 10 to 15	Quantities from mech./elec./civil drawings
Detailed or Definitive	± <10	Based on detailed drawings

For this guide, an early estimate is defined as “any estimate that has been prepared from inception of the project up to and including funding approval.” This definition applies to Class 5, 4 and early Class 3 estimates of AACE International. This definition also applies to Order-of-Magnitude and Factored estimates described in CII publications.

1.3 Estimating Work Process

Estimating is a process, similar to any other endeavor that requires an end product. Information must be assembled, evaluated, documented, and managed in an organized manner. For a process to work effectively, key information must be defined and accumulated at critical times. CII Research Team 131, Improving Early Estimates, identified the following as primary factors in preparing estimates:

- Standardization of the cost estimate preparation process.
- Alignment of objectives between the customer and team.
- Selection of estimate methodology commensurate with the desired level of accuracy.
- Documentation and communication of estimate basis and accuracy.
- Review and checking of estimate.
- Feedback from project implementation.

These best practices are illustrated in the Estimating Work Process in Figure 1. The chapters in this guide will address the issues shown in boldface.

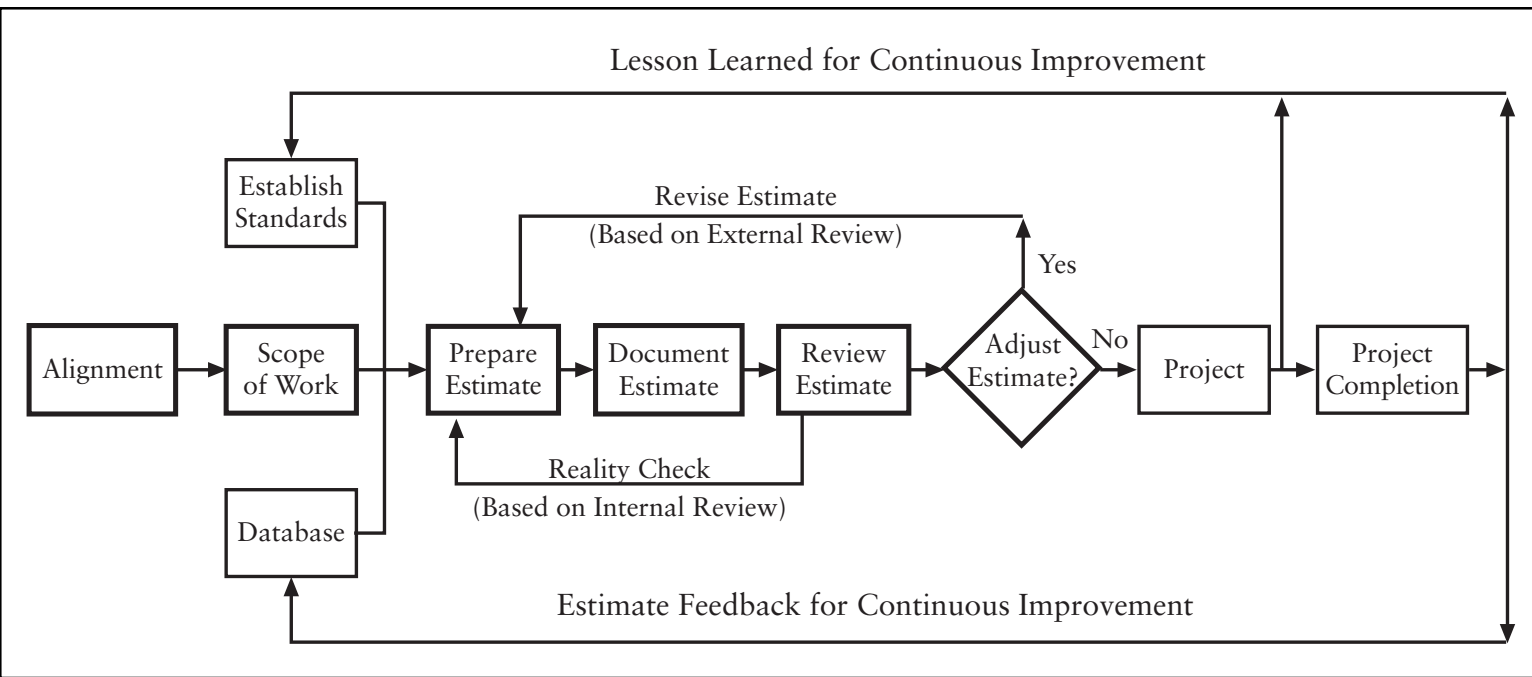


Figure 1. Estimating Work Process

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The first step in the estimating process is **alignment**. CII defines **alignment** as “the convergence of the strategy, structure, systems, and culture of an organization.” For the estimating process, the key words are **convergence of the strategy and culture of an organization**. A successful process provides a clear understanding of the work to be performed and the products that will be produced. Chapter 2 presents issues to be addressed in alignment and methods of achieving alignment.

The level of scope definition for an early estimate is low compared to scope levels that accompany later estimates. The business unit and the estimator must have a mutual understanding regarding the level of scope definition. The estimator must communicate to the business unit the expected range of accuracy based on the level of scope definition. Chapter 3 discusses level of scope definition and early estimates.

Prior to starting an estimate, a work plan for preparing the estimate should be developed to identify the work that is needed to prepare the estimate. The estimate work plan identifies the work to be accomplished, who is going to do it, when it is to be done, and the budget for preparing the estimate. The plan also includes the tools and techniques that are appropriate for the level of scope definition and the expected accuracy of the estimate. The leader of the estimating team is responsible for developing the estimate work plan. Chapter 4 discusses issues to be resolved and elements that should be included in the estimate work plan.

Effective communication is necessary during the estimating process. A document that defines the basis of the estimate is essential for presentation, review, and future use of the estimate. The documentation for an estimate improves communications among project participants, establishes a mechanism for estimate reviews, and forms a basis for early project cost control. The estimating team should develop a standard cost estimate presentation format that is easily understood by both internal business and engineering management. Chapter 5 addresses issues related to documentation and presentation of an estimate.

Contingency is a real and necessary component of an estimate. Assessing risk and assigning contingency to the base estimate is one of the most important tasks in preparing early estimates. Typically, risk analysis is a prerequisite to assigning contingency. Based on the acceptable risks and the expected confidence level, a contingency is established for a given estimate. The lead estimator for a project must assess the uniqueness of each project and select the technique of risk analysis that is deemed most appropriate. Methods of risk analysis and assigning contingency are discussed in Chapter 6. That chapter presents a system of scoring the quality of an estimate that was developed by CII Research Team 131. Also presented is the ESP software program, a tool that provides a new method of assigning contingency based on the estimate score.

No estimating process is complete without the continuous feedback loops shown in Figure 1. To improve early estimates, the estimating process must be a continuous cycle as presented in Chapter 7. Actual cost information from completed projects must be captured in a feedback system that can be integrated into the cost database for use in preparing future estimates. Lessons learned during project execution also must be documented and incorporated into estimating standards and procedures. The lessons learned during construction must be communicated back to the estimating team to enable it to establish a better system for preparing future project estimates. The procedure developed by the research team for scoring the quality of an estimate provides a process for continuous improvement of early estimates.

Chapter 8 provides conclusions for improving early estimates and producing more reliable estimates.

Chapter 2

Alignment

Importance of Alignment

Communication early in a project between the team and the customer is essential to the success of any estimate, particularly Early Estimates. This early communication is necessary to ensure a clear understanding of the customer's expectations and the team's ability to meet those expectations. Alignment provides the following benefits:

- Establishes a clear understanding between the customer and the team of the project's parameters.
- Assists in determining the level of effort required of the estimating team to deliver the estimate.
- Enables the estimating team to establish a work process and staffing plan to provide the deliverables required to meet the customer's expectations
- Highlights issues that might not otherwise have been considered in the development of the estimate.
- Improves and documents the level of scope definition and the information that is known about the project.
- Assists the customer's understanding of what is included in the estimate, and what is not included in the estimate.
- Establishes the responsibility of all project team members and the customer in the preparation of the estimate.
- Serves to establish a cohesiveness between the project team and the customer.

How Is Alignment Accomplished?

To achieve alignment, a special effort must be made to resolve all issues that can impact the team's work and the customer's understanding of the contents of the estimate. This can be accomplished by two-way, open communications before starting the estimating process.

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The level of scope definition of the project is one of the key issues that must be resolved early because the accuracy of the estimate is dependent on scope definition. The customer must provide the level of accuracy and detail that is expected in the estimate. The estimating team must clearly communicate to the customer what will be provided in the estimate. The customer also must define the required deliverables of the team and the type of decisions that will be made based on the estimate. Critical questions that must be addressed early are:

- What is the level of scope definition of the project?
- What level of accuracy and detail is the customer expecting?
- What deliverables are required from this effort?
- What decision will be made based on this estimate?

The estimate kick-off meeting is an effective method of achieving alignment by addressing the issues shown in the checklist in Figure 2. The estimate kick-off meeting between the customer and the team provides an exchange of information regarding the customer's expectations and the team's ability to meet those expectations. Regularly scheduled progress meetings after the kick-off meeting ensure continued alignment throughout the estimating process.

Project management should initiate open communication between the customer and the team to assist in identifying and documenting the issues to be resolved. Early involvement of the customer reduces the potential of giving conflicting instructions and directions to the team.

Checklist of Issues for Estimate Kick-Off Meeting
1. What are the customer's driving principles and expectations?
2. What is the level of scope definition of the project?
3. What level of accuracy and detail is the customer expecting?
4. What deliverables are required from this effort?
5. What decisions will be made based on the estimate?
6. Does the project have unique or unusual characteristics?
7. What is the estimate due date and the anticipated project start/completion dates?
8. What level of confidentiality is required by the team?
9. Who are the customer's contacts with the team?
10. What other organizations need to interface with the team?
11. Are there other information sources that can aid the estimating team?
12. What is the budget for developing the estimate and who is paying for it?
13. Have similar projects/estimates been developed previously?
14. What customer furnished items are to be excluded from the estimate?
15. What customer furnished costs are to be included in the estimate?
16. Are there specific guidelines to be used in the preparing the estimate?
17. Are there special permitting requirements that may affect the cost and schedule?
18. Are there any special funding requirements that might influence the final total installed cost?
19. Are there other issues which could affect the cost or schedule of the project?
20. What level of effort is required to meet the desired accuracy?

Figure 2. Checklist of Issues for Estimate Kick-Off Meeting

Pitfalls in Alignment of Early Estimates

Alignment requires a cooperative effort between the team and the customer. Common pitfalls in alignment of early estimates include the following:

- Early estimates that are heavily influenced by a preconceived number developed by individual outside the estimating team.
- Failure to include business decision-maker early in the estimating process.
- Failure to resolve issues early.
- Excessive constraints on the estimating team, such as inadequate time for preparing estimate or lack of cost data.
- Failure to hold an estimate kick-off meeting.
- Failure to identify information required of the estimating team to prepare the estimate.
- Inadequate understanding of the expected accuracy based on level of information, estimate methodology, or other factors that impact the estimate.
- Failure to identify costs and scope to be captured in the estimate.
- Failure to identify scope that is not to be included in the estimate.
- Failure to communicate the estimating methodology to be used in preparing the estimate.

Chapter 3

Scope Definition

Impact of Scope Definition

The accuracy of any estimate depends on the amount of information that is known about the project when the estimate is prepared. Any cost estimate usually is assigned a range of accuracy ($\pm$ percentage). These ranges narrow as the quantity and quality of information increase through the life of a project. This infers that estimate accuracy is a function of available information (scope definition), a generally accepted fact in engineering and construction.

During the past 30 years, numerous papers have been published emphasizing the importance of scope definition. The lack of scope definition has been identified as the root cause of cost overruns, late completion dates, excessive rework, unnecessary disputes, poor team alignment, and other problems associated with engineering and construction projects.

Determining the level of scope definition is a progressive activity. It starts at the inception of the project, when a project is an idea of the project sponsor for a product to be produced. As engineering progresses, the level of scope definition increases. For example, in the process industry good scope definition is not considered possible until the piping and implementation drawings (P&IDs) are available, yet early estimates are prepared before these drawings are finalized. Consequently, early estimates are often subject to high variability.

Scope Definition and Estimates

The estimator must address limited scope definition and clearly communicate to the customer the level of scope definition that was used in preparing the estimate. For early estimates, scope definition reflects a broad picture rather than an emphasis on details.

Because good scope definition is important in preparing estimates, the research team focused initially on issues related to scope definition. However, the research team also recognized that early estimates are often prepared based on very limited