AACE INTERNATIONAL RECOMMENDED PRACTICE

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BASIS OF ESTIMATE – AS APPLIED IN ENGINEERING, PROCUREMENT, AND CONSTRUCTION FOR THE PROCESS INDUSTRIES

AACE INTERNATIONAL

AACE® International Recommended Practice No. 106R-19

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TCM Framework: 7.3 – Cost Estimating and Budgeting

Rev. August 18, 2021

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TABLE OF CONTENTS

1. INTRODUCTION

1.1. Scope

This recommended practice (RP) is a guideline for the development of cost estimate basis for engineering, procurement and construction (EPC) projects for the process industries. A basis of estimate is considered to be a *required document* as a part of the estimate package, For the purposes of this document, the term *process industries* is assumed to include firms involved with the manufacturing and production of chemicals, petrochemicals, hydrocarbon, and wastewater processing. The common thread among these industries (for the purpose of estimate classification) is their reliance on process flow diagrams (PFDs) and piping and instrument diagrams (P&IDs) as primary scope defining documents. This estimating methodology is also suitable for other equipment-centric industries such as mining process plants, power generation, pumping stations etc.

The main body of this document refers to deterministic (Class 3, 2, and 1) estimates. Conceptual (Class 5 and 4) estimates require a very different approach and are defined in Appendix A and B. These sections provide basic guidelines for the development of a basis of estimate for some of the more common methodologies used in the development of these classes of estimate. Conceptual estimating is a highly creative process, and these sections do not reflect the wide variety of possible methodologies.

1.2. Purpose

The *Total Cost Management (TCM) Framework* [1] section 7.4.4, *Outputs from Cost Estimating and Budgeting* highlights the need to develop a basis of estimate (BOE) document. This document addresses the need to develop effective estimate basis and addresses the steps before and after the *Outputs from Cost Estimating and Budgeting* step to the extent necessary for an effective estimate basis. A key principle is that the reader is able clearly understand the underlying basis behind the estimate, including any deficiencies in estimate preparation that may impact the estimate.

This recommended practice (RP) is intended to provide a guideline (i.e., not a standard) for establishing and communicating how to prepare, review and approve an estimate basis. After estimate completion the estimate plan is transformed into the basis of estimate. The basis of estimate is prepared by the estimate provider in alignment with the approved estimate plan and estimate requirements document.

1.3. Background

The BOE is characterized as a deliverable that *documents the scope and cost of the project*, and ultimately becomes *the basis for change management*. When prepared correctly, any person with capital project experience can use the BOE to understand and assess the estimate, independent of any other supporting documentation. A well-written BOE achieves those goals by clearly and concisely stating the purpose of the estimate being prepared (e.g., cost study, project options, funding, etc.), the project scope, pricing basis, allowances, assumptions, exclusions, cost risks and opportunities, and any deviations from standard practices. In addition, the BOE is a documented record of pertinent communications that have occurred and agreements that have been made between the estimator and other project stakeholders.

The BOE should be aligned with the estimate plan document which is prepared by the estimate provider; and documents the basis of all decisions and basis made in the preparation of the estimate.

The main body of the document is focused on deterministic (Class 3, 2, and 1) estimates where the primary method of cost development is through the use of semi-detailed or detailed unit costs. Conceptual (Class 5 and 4)

estimates are primarily developed through the use of cost estimating relationships (CER's) and the estimate basis will be significantly different than for a deterministic estimate. A guideline for some common methods for both Class 4 and 5 can be found in Appendices A and B. These appendices are intended to replace the sections from *Cost Basis* through *Engineering and Home Office* of this document. Note that the conceptual estimating process is a highly creative one, and these appendices give only an overview of suggested formatting of the document, based on some of the more common methodologies.

The extent to which the following sections of the basis of estimate document are completed will be dependent on the type of project, the class of estimate, and other variables. It is recommended to keep the document concise, but to include as much of the following relevant information as possible.

Note that the term *owner* refers to the estimate owner and may be an owner company, or a party within the providers organization. It simply refers to the party soliciting the estimate.

2. RECOMMENDED PRACTICE

The primary intent of this RP is to provide a guideline for the topics and contents to be included in typical BOE. However, before describing the template contents there are a few points worth noting. A well-prepared basis of estimate will:

- Document the overall project scope.
- Communicate the estimator's knowledge of the project by demonstrating an understanding of scope and schedule as it relates to cost.
- Communicate the uncertainty associated with the estimate and alert the project team to potential cost risks and opportunities.
- Align with the project implementation basis, including goals, objectives, and cost strategy.
- Identify estimating team members and their roles.
- Describe the tools, techniques, estimating methodology, and data used to develop the cost estimate.
- Identify other projects that were referenced or benchmarked during estimate preparation.
- Should be developed in parallel with the cost estimate.
- Provide documentation of the assumptions and exclusions.
- Provide a record of any communications made during estimate preparation.
- Provide a record of all documents used to prepare the estimate.
- Act as a source of support during dispute resolutions.
- Supports the establishment of the baseline for scope, quantities and cost for use in cost trending throughout the project.
- Provide the historical relationships between estimates throughout the project lifecycle.
- Facilitate the review and validation of the cost estimate.

This recommended practice is divided into three main sections:

1. The *Estimate Basis Development Process* defines the main steps and discusses issues to be considered in preparing a BOE.
2. The *Estimate Basis Format and Content* provides a suggested format for an estimate plan along with annotations. It is designed to allow practitioners to use and modify it as needed for their specific situation.
3. The *Appendices* contain sample formats for Class 5 and 4 estimates using some of the more common methodologies.

3. ESTIMATE BASIS DEVELOPMENT PROCESS

This section defines the main steps and discusses issues to be considered in preparing a BOE. In general, a separate BOE will be developed for each individual estimate, but the content for projects within a program should be integrated where appropriate. Some projects may lend themselves towards having a single estimate basis for all individual scopes of the project.

Figure 1 highlights the requirements of the estimate basis development process.

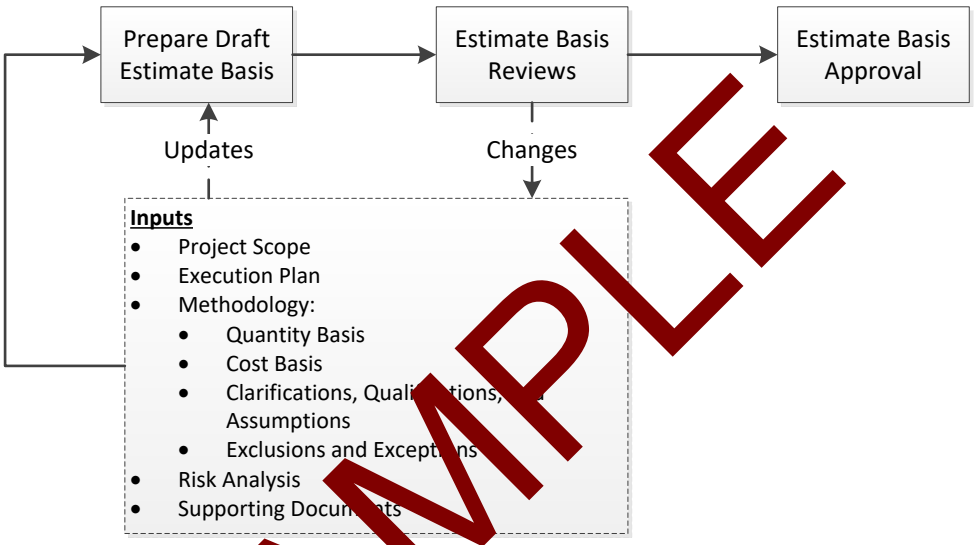

Figure 1. – Estimate Basis Development Process

3.1. Inputs to the BOE

The BOE should leave the reader with a clear understanding of the information and assumptions the estimator has used in developing the estimate. It should clearly define:

- Scope of the estimate.
- Methodologies used to develop the estimate.
- Sources and quality of supporting data.
- All inputs to the estimate.
- All required outputs.
- Any areas of uncertainty within the estimate including significant risks.

The quality of the estimate and BOE should be such that the reader can make clear business decisions based on the provided information and support project system analyses (lessons learned, claims, historical, etc.)

The BOE should reflect the owner's specifications for the BOE. It is the responsibility of the lead estimator to develop an estimate basis which will satisfy the owner's needs. Where multiple contractors are involved, the BOE must clearly define the scope of the estimate. The basis should note portions of the overall project scope that fall outside of the estimate, which the reader may otherwise expect to be included (e.g., mining equipment is included, but the initial mine excavation falls to another contractor and is excluded from the estimate).