

AACE International Recommended Practice No. 34R-05

BASIS OF ESTIMATE

TCM Framework: 7.3 – Cost Estimating and Budgeting

Acknowledgments:

Todd Pickett, CCC (Author)
Peter R. Bredehoeft, Jr.
Ted A. Downen
Larry R. Dysert, CCC
Bruce G. Elliott, CCC
John K. Hollmann, PE CCE

Stephen M. Jacobson CCC
Carlton W. Karlik, PE
Christopher L. Kinney
Donald F. McDonald, Jr. PE CCE PSP
Bernard A. Pietlock CCC
Richard A. Selg, CCE

BASIS OF ESTIMATE

TCM Framework: 7.3 – Cost Estimating and Budgeting



July 28, 2010

PURPOSE

AACE International's *Total Cost Management (TCM) Framework* identifies a basis of estimate (BOE) document as a required component of a cost estimate. As a Recommended Practice (RP) of AACE International, the template outlined in the following sections provides guidelines for the structure and content of a cost basis of estimate.

In the *TCM Framework*, the BOE is characterized as *the one deliverable that defines the scope 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 (i.e. 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.

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.
- Alert the project team to potential cost risks and opportunities.
- Provide a record of key 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.
- Establish the initial 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 RP is intended to be a guideline, not a standard. It is understood that not all organizations that prepare estimates employ the same processes and practices, and therefore, may opt to use this information either in part or in its entirety.

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 of significance worth noting. A basis of estimate should:

- Be factually complete, but concise.
- Be able to support facts and findings.
- 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.
- Be prepared in parallel with the cost estimate.
- Establish the context of the estimate, and support estimate review and validation.

- Qualify any rates or factors that are referenced either in the estimate or BOE; e.g. productivity can be expressed as either units/time (linear feet/hour) or time/units (hours/linear foot).

The following describes the suggested topics and contents included in a typical BOE.

Purpose

In this initial section of a basis of estimate, the estimator should provide a brief and concise description for the total project. The type of project should be identified (i.e., new facilities, addition to existing, revamp of existing, etc.), as well as the type and capacity of the process units, the location of the facility, and the overall timing of the project.

Project Scope Description

This section of the estimate basis should be organized to correspond with the project's work breakdown structure (i.e., plant, building, floor, etc.). A semi-detailed description of the scope of work should be provided for each major segment of the project. Identify any major pieces of process equipment or components. It's also good practice to indicate the primary trades that will be involved with the project. Be as thorough as necessary, without being overly descriptive, so as to adequately explain the scope of work being estimated.

Methodology

The BOE should indicate the primary estimating methodology used to prepare the cost estimate. This should include documentation of the use of cost resources, historical data and project benchmarking. Documenting the level of effort or man-hours used in preparation of the estimate may also be helpful.

Estimate Classification

The AACE International estimate classification should be identified, along with reasons or justification used in the selection of the estimate classification.

Design Basis

Company standards will typically specify the technical and project information required for the classification of the estimate that is being prepared. In this section, the estimator will identify the types and status of engineering and design deliverables that were provided to prepare the estimate including any design basis assumptions. Two attachments to the estimate basis should be referenced: 1) an estimate deliverables checklist that is aligned with the company's standard project process; and 2) a listing of all engineering drawings (including revision number and date), as well as other design information, such as specifications, equipment lists, units of measure (imperial vs. metric), etc.

In addition it may be useful to document specific quantity metrics for particular projects, such as overall excavation and backfill quantities, overall concrete volumes, overall piping quantities, etc. These may be organized by facilities, process train or manufacturing unit.

If material take-off's (MTO's) are provided to the estimator, identify specifically who developed the MTO's and the methodology used.

Planning Basis

This section documents the project management, engineering, design, procurement, fabrication, and construction approaches to the project. The contracting and resource strategies should be identified, as well as any assumptions that were made with regard to the workweek schedule (hours worked per day, days worked per week, shifts worked per day, etc.) and planned use of overtime. Any assumptions made regarding constructability, modularization, use of specialized construction equipment should also be noted here.

The overall project schedule and key milestones should be identified.

Cost Basis

Describe the methods and sources used for determining all material, labor and subcontract pricing. Identify the following:

- Pricing sources for all major equipment (vendor quotes, historical data, etc.).
- Bulk material and commodity pricing sources, including any discount strategies.
- The pricing source for all labor hours, and all labor productivity adjustments. Provide appropriate detail if productivities vary by trade and/or location within the project (plant, etc.).
- All wage rates used (including crew/craft rates, craft mix, etc.). Identify all items included in all-in rates (if used).
- Pricing source and methodology for construction indirects.
- Pricing source for all start-up costs.
- Pricing source and methodology for all home office costs (project management, engineering, design, etc.). Document the basis for any contractor fee costs.
- Pricing source and methodology for costs such as freight, taxes, duties, etc.
- Pricing source for any owner's costs included in the estimate.
- Currency exchange rates if applicable, as well as the stability and/or volatility of rates.
- Escalation indices used, and the method of calculation (including duration).
- Contingency development and basis.
- Location factors used and the basis for these factors.
- Influence of local market conditions.
- Capital costs vs. expense costs, or other categorization as necessary.
- Any other pricing factors or external influences that may have a significant impact on project cost should be identified.

Allowances

In this section, identify the level and types of allowances used in the estimate. Describe the basis for the common estimating allowances such as material take-off allowances, overbuy allowances, design allowances for engineered equipment, congestion allowances, working height allowances, etc.

This section should also describe any other costs that have not been detailed in the body of the estimate, such as lump-sum allowances for specific areas of scope or any other factored costs not described elsewhere in the estimate basis.

Assumptions

Any other assumptions made by the estimator but not documented elsewhere in the estimate basis should be included in this section. This may include such assumptions as an adequate labor supply being available, adequate funding available, site conditions, etc. Small assumptions can change into major assumptions throughout the life of the project. Therefore, it is better to document assumptions than not to document at all.

Exclusions

In this section, the estimator should document all potential items of cost which a reviewer might associate with the project, but for which no costs have been included in the estimate. Asbestos abatement, removal of hazardous wastes, acquisition of land, taxes, financing costs, licensing costs, etc. are examples of potential items that may need to be identified.

Exceptions

The estimator should identify any anomalies or variances to your organization's standard estimating practices. This section should document any significant deviations from the project and/or engineering deliverables normally required for the applicable class of estimate. A good practice is to provide a checklist as an attachment to the BOE that will document any exceptions that are identified. This checklist should correspond to the company's standard estimating practices.

Risks and Opportunities

Any areas of the estimate containing significant risk or opportunity should be identified. If a formal risk analysis study has been prepared then it should be described (e.g. methodology, technique, etc.). In particular, this section should identify those cost elements that have been identified with high or very high risk or opportunity values. The risk analysis report (or summary) should be provided as an attachment to the BOE.

Contingencies

Contingency is a cost element of the estimate used to cover the uncertainty and variability associated with a cost estimate, and unforeseeable elements of cost within the defined project scope. Contingency covers inadequacies in complete project scope definition, estimating methods, and estimating data. Contingency specifically excludes changes in project scope, and unforeseen major events such as earthquakes, prolonged labor strikes, etc. The amount of contingency included in the estimate should be identified, as well as the methods used to determine the contingency amount. If risk analysis techniques were utilized to develop the contingency amount, the associated confidence level should also be identified.

Management Reserve

Contingency is not intended to cover the costs associated with changes in project scope. If the project needs to provide an allowance for anticipated changes in scope, or to cover the costs for items that may be required but have not yet been specifically identified as being included in the current project scope, then that amount of cost, typically referred to as management reserve, should be identified here.

The intended purpose and use of management reserve should be clearly identified. The approval process, management and tracking of the management reserve should also be clearly identified.

Reconciliation

Provide an overview of the major differences between the current estimate and the last published estimate prepared for this project. Identify the cost impacts due to scope changes, pricing updates, labor productivity adjustments, estimate refinement, etc. A more detailed reconciliation or cost trending report can be provided as an additional attachment if necessary.

Benchmarking

This section should document any comparisons of overall estimate metrics, ratios, and factors with similar projects, historical data, and industry data. Projects used in the benchmark comparisons should be similar in process type and overall value. If significant variations of the estimated project costs versus the benchmarks exist, those inconsistencies should be identified and commented upon. A more detailed benchmark analysis report may be included as an attachment to the BOE.

Estimate Quality Assurance

Since estimate reviews are the means for testing the quality of the estimate, this section of the BOE should identify all estimate reviews that have taken place to date, and any additional reviews that are proposed to take place. All review comments or analysis should be included as an attachment to the BOE.

Estimating Team

In this final section, all members of the estimating team should be identified, including roles and responsibilities.

Attachments

Several supporting documents will generally be included with the basis of estimate.

Attachment A: Estimate Deliverables Checklist

Attach a completed estimate deliverables checklist indicating the project and engineering deliverables that should be provided to support preparation of the estimate for the associated estimate classification, and whether they were in fact available during preparation of the estimate.

Attachment B: Reference Documents

Document the drawings, manuals, texts, notes, specifications, and other references used in developing the estimate. Identify the revisions and date of issue for key documents.

Additional Attachments

Include any other attachments that may be necessary or required (reconciliation report, benchmarking report, risk analysis report, escalation calculations, etc.).

LEVEL OF DETAIL IN THE BASIS OF ESTIMATE

It is often not a simple matter to determine the amount of detail that should be provided in a BOE. Several factors may come into play during the preparation of the cost estimate that will help determine the level of detail. However, it is the estimator's best judgment that will ultimately determine the appropriate level of detail in the BOE.

Level of Project Definition

Estimates are prepared at various stages of a project. A more detailed estimate will generally require a more detailed BOE, however that is not always the case.

A conceptual estimate will most likely be based on a limited amount of scope but may require a more detailed basis of estimate. It's not uncommon for a BOE for a conceptual estimate to be more thorough than one prepared for a more detailed estimate because there are often more assumptions made at the conceptual stage of a project that require greater documentation.

Conversely, there may be times when the project definition is so complete or simplistic that a BOE does not require a great amount of detail. A three or four page document may be sufficient to convey the information provided in the BOE.

Cost Value of the Project

Typically, a more expensive project will require a more detailed BOE. However, projects of lesser cost can require an extensive BOE to fully communicate major assumptions that constrain or reduce the cost.

Type of Project

The type of project can also affect the BOE. For example, the BOE for a direct purchase (e.g., single piece of large equipment) may be less detailed than a BOE for a construction project

Other Factors

Other factors that affect the level of detail in a BOE are: work breakdown structure (WBS), consideration for new technologies, contracting strategy, etc.

The BOE should contain a concise level of detail to fully support the review of the estimate by those that have not been a part of the preparation of the estimate. The BOE provides a definition of the scope of the project as estimated, and should establish the basis for change management subsequent to publication of the estimate.

REFERENCES

1. Hollmann, John K., Editor. *Total Cost Management Framework: A Process for Applying the Skills and Knowledge of Cost Engineering*, Morgantown, WV: AACE International, 2006.

CONTRIBUTORS

Todd Pickett, CCC (Author)
Peter R. Bredehoeft, Jr.
Ted A. Downen
Larry R. Dysert, CCC
Bruce G. Elliott, CCC
John K. Hollmann, PE CCE
Stephen M. Jacobson CCC
Carlton W. Karlik, PE
Christopher L. Kinney
Donald F. McDonald, Jr. PE CCE PSP
Bernard A. Pietlock CCC
Richard A. Selg, CCE