

EST.04

Owner Validation of Contractor-Prepared Estimates

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Without question, contractors have come to dominate the world of engineering and construction more than ever before. Gone are the days when owners have in-house resources to fully engineer and design new facilities. Typically, owners, at best, have small internal organizations that are responsible for managing engineering work outsourced to contractors. An essential, but sometimes undervalued, in-house resource is the cost engineer (CE). It is he/she who must validate all contractor-prepared, capital project (authorization) estimates.

The author was an owner's cost engineer for a multinational, Dow 30 company for over 15 years. The evaluate-reconcile-validate approach, presented here, was developed by him in the mid-1990s and successfully used to validate over a billion dollars of capital project estimates ranging in size from \$250,000 to \$100,000,000.

Owner validation of contractor-prepared estimates has become an industry best practice. The estimate is the primary engineering deliverable used to manage the financial aspects of capital investment projects. More importantly, the estimate sets the price the owner will ultimately pay. By his/her validation, the owner's cost engineer is certifying that, given the scope of work (SOW), the estimate's indicated total cost (ITC) is a fair value for the owner to pay.

Capital projects are major purchases. They are complicated. They include the purchase of engineering and design services; equipment (including specially designed and fabricated engineered equipment); and construction services, labor, materials, and other related expenses. There is no price catalog. Thus validation involves (in effect) significant negotiation, procurement, and contract execution responsibility. The validating CE must be well trained and experienced.

WHY VALIDATE?

Some owners/managers will question the need to validate estimates. They, understandably, do not want to pay for the same service twice. The contractor may be instructed that he/she is expected (even required) to provide both a high quality and a fairly priced estimate. Given this, it must be recognized that, even though owners and contractors may partner and strive to work toward a common goal, their respective bottom-line results create a very real conflict of interest. Though sometimes overlooked by

internal auditing organizations, this is a conflict of interest that cannot be ignored. Validation is an essential check and balance. As such, it is a fiduciary responsibility of management to stockholders.

Additionally, it is important to recognize the different perspectives of an owner and a contractor. Contractors are strongly motivated to recognize, and include within the estimate, all project scope requirements as well as sufficient funds to complete the job. They are less motivated to identify asset classes (via the work breakdown structure—WBS) to fully capture all financial incentives. Some important considerations must be the proper classification of noncapital vs. capital expenditures, identification of special purpose structures and pollution abatement facilities, using optimum depreciation categories, and applying the most effective sales tax assessments allowed under the applicable law. The owner must accept responsibility to maximize and protect his/her interests in these areas.

Another key product of the validation process must be protection against undervalued estimates. A contractor who is told an estimate is too high and must be reduced may do so without a commensurate reduction in scope. After all, he/she does not want to lose a major sale. Neither is he/she as concerned as the owner about project cost overruns. The owner's cost engineer's validation may kill a project. An honest, professional position must be taken based on the facts. Owners must be told what they need to hear. If the project, when properly estimated, is not economical, the owner must be so informed.

Following is a comprehensive process that, when properly executed, will ensure a quality validation.

OWNER SUPPORT

It is not enough to have a cost engineer on-staff or under exclusive contract. Owner management must recognize the value of validating contractor estimates and provide full support. An effective way to demonstrate this is to require the CE's validation before projects are submitted for authorization. Additionally, the CE should be a part of the project authorization process and participate in the formal project review with authorizing management.

The owner should also assign the CE an independent status that protects him/her from career path hazards by project team leaders. This status will allow the CE to be objective (sometimes

Table 1—Examples of Actual Validation Results

Project Description	Validation Impact	Comment
Add additional product manufacturing capacity.	Estimate reduced > \$4,000,000.	Contractor admitted to estimating errors (duplicated significant electrical and instrumentation scope).
Re-start of moth-balled manufacturing equipment.	Estimate reduced \$500,000.	Project was business/customer schedule driven. Validation was completed one week after project authorization. Contractor agreed to lower estimate.
Installation of significant new/modified process and environmental equipment.	Changed depreciation categories. Reduced sales tax liability > \$26,000.	Significant investment was reclassified as special purpose structure. Depreciation recovery periods were reduced, thereby improving project economics.
Manufacturing equipment modifications and additions.	Reduced project cost \$500,000 and avoided a pay-for-performance fee.	Contractor's estimate was > \$800,000 higher than validation amount. Owner/contractor negotiated estimate down \$150,000. Project was cost controlled to the validation amount. Contractor issued letter of apology and agreed to not submit a contract allowable pay-for-performance award.
Major product manufacturing expansion.	Project not authorized.	Contractor's estimate was \$100,000,000. Corporate management set \$90,000,000 as maximum. Business worked with contractor to reduce estimate. Validating CE took firm position that scope of work could not be done for \$90,000,000.

quite assertively). Independent status will also help eliminate the conflict of interest in allowing (or even driving) higher estimates to ensure project leaders are successful at bringing the project in, at, or below cost (prevents fat estimates).

An objective validation drives improved business success!

EVALUATE-RECONCILE-VALIDATE (E-R-V)

Webster's defines *evaluate*, *reconcile*, and *validate* thus:

Evaluate—to determine the significance or worth of usually by careful appraisal and study.

Reconcile—to settle, resolve (~ differences).

Validate—to support or corroborate on a sound and authoritative basis.

This is precisely the approach owners' cost engineers must use when reviewing contractor-prepared estimates.

Reconciling differences and/or issues raised during the review involves some degree of negotiation. An estimate is a prediction of the future. Thus, no one can know everything that will happen. Validating estimates will always require some compromise.

Once the owner's CE has resolved all differences, he/she then validates the estimate. This validation is usually formalized by the CE signing a hard copy of the final version or via an e-mail to all interested parties. An official report of the validation may also be submitted.

SELECT THE VALIDATION METHOD THAT FITS

Different circumstances will determine the method of validation. The owner's CE must guide the project team to select the appropriate level of effort needed. Consideration may be given to:

- a complete parallel estimate by a third party;
- a parallel estimate of selected components;
- an in-house budgetary estimate; and
- a high-spot ratio factoring.

Regardless of the detailed approach used, the owner's CE must review the estimate sufficiently to ensure it adequately meets all the owner's needs.

ENGINEERING AND DESIGN (E&D)

There are several techniques that may be used to validate engineering and design:

- analysis of engineering deliverables vs. total force requirements;
- percentage-of-project indicated total cost (ITC);
- comparison to similar projects; and
- engineering judgment.

Contractors must be informed, up-front, that they will be required to provide data used to estimate engineering and design. The validating CE should work closely with other owner project team

members (engineering, technical, manufacturing, maintenance, and construction) to evaluate engineering deliverables and the indicated workhours required to prepare them. Such deliverables will include scopes of services (engineering and design), scopes of work (construction), schedules, drawings, models, specifications, purchase orders, bid packages, priced equipment lists, etc.

The CE should fully understand all aspects of the contract with the engineering firm. He/she must verify billing rates, escalation impacts, volume factors, pass-throughs, per diem allowances, markups and fees, performance incentives, etc., and must ensure they are properly applied to the estimate.

The status (physical percent complete) of engineering and design used to prepare the estimate must be determined and used to evaluate the quality of the estimate. Authorization estimates are compiled with some amount of final design. If the owner has a requirement that a minimum amount of E&D must be completed, to assure a quality estimate, the CE must confirm this. Engineering deliverables that should be complete might include:

- final scopes of services;
- final scopes of work;
- final equipment arrangements;
- major equipment specifications; and
- process and instrumentation diagrams.

The owner's CE should also evaluate the amount of costs billed to the capital account. The monies capitalized to-date must reasonably value the capitalizable engineering deliverables in-hand. Transfers to or from the noncapital account should be made as needed.

Additionally, any contingencies and allowances must be understood and fully justified.

ENGINEERED EQUIPMENT (EE)

Determining the completeness of data used to obtain engineered equipment quotes is essential. The use of data sheets versus detail, final specifications can have a significant impact on the quality of prices. While use of final specifications is desired, business demands may require using less-firm data. The owner's CE needs to clearly understand and take into consideration the quality of the data and assess contingencies and allowances with this in mind.

Understanding the contractor's pricing strategy is also a must. For example, the contractor may obtain three competitive quotes and consistently use the high quote in the estimate. This is not necessarily improper, but the owner's CE should know how quotes are selected. He/she should also consult other owner team members to determine how best to react to the strategy. For example, it may be decided to use average bid prices, reduce the EE contingency, or leave the estimate as is.

Finally, the owner's CE should evaluate the procurement plan, percentage of firm pricings (orders placed, firm quotes, etc.), quality assurance allowances, sales tax determinations, freight and import fees, etc.

This is a very important and, oftentimes, one of the most difficult parts of a capital project to estimate and ultimately cost control. It consists of up to four subcategories: direct field labor, field materials, contracts, and other miscellaneous field costs.

Direct Field Labor (DFL)

This component may be present in estimates where there is a resident contractor, onsite, serving as the general contractor. It is used to track and manage his/her labor. DFL is, perhaps, the highest-risk component of a capital project estimate. It typically consists of (1) bare direct labor (BDL), and (2) direct labor burdens (payroll taxes, insurance, benefits, etc.). This latter component may be referred to as field directs (FD). When BDL and FD are combined, they become direct field labor (DFL). There are three primary variables to note: labor rates (\$/Hr.), quantities, and productivity.

The owner's CE can evaluate labor rates by understanding contracts and the local labor market. Attention must be directed at escalation, premium time, stipends, per diems, and special incentives.

Accurate determination of quantities of work to be performed is a primary responsibility of the estimating contractor. The owner's CE may consult other owner team members and discuss the quality of items and quantities included in the estimate. This may be a part of the process for deciding the method of validation to be used (e.g., parallel estimate, high-spot ratio factoring, etc.) The ultimate responsibility for selecting the appropriate validation method rests with the owner's CE.

Productivity is the most difficult variable to predict. The owner's CE should evaluate working condition factors, staffing schedules, training needs, rework provisions, and contingencies. These should be compared to historical experience, if available.

When reliable data are available, analytical comparisons should be made of DFL hours to perform selected tasks, against historical experience. Collecting and maintaining a historical database is an important responsibility of the owner CE.

Field Materials (FM)

An analysis can be made of field material values versus quantities, using local experience, applying engineering judgment, and quizzing the contractor. The objective is to assess the quality of data and estimating techniques used.

Care must also be given to marketplace conditions, especially if there are pricing issues with selected items such as stainless steel or other exotic metals.

Last, the owner's CE must evaluate allowances, escalation, freight, sales taxes, and contingencies.

Contracts

The owner's CE should play a role in selecting the contracting strategy that will be used to execute the project. The most common strategies are cost-plus (time and material), lump-sum/unit price (LS/UP), and cost plus incentives. Any one of these may best serve the needs of the owner. Evaluating these

strategies and testing their strengths and weaknesses against the specific circumstances surrounding the project is a must.

There are some universally accepted contracting best practices. Not all owner project team members are knowledgeable in this area. The owner's CE should be prepared to bring these best practices to the team and/or challenge strategic contract management weaknesses. For example, allowing a contractor to perform LS/UP and T&M (cost-plus) work, on the same site, at the same time, is discouraged and should be avoided if practical. If required (or allowed), the potential risks must be well understood, and appropriate managerial safeguards must be taken. Contingencies and extra work allowances might be impacted by the effectiveness of applying contracting best practices.

It is important to evaluate the schedule versus the strategy. For example, one must ascertain if there is sufficient time to properly execute a quality bid process. When appropriate, the CE may evaluate the status of scopes/definition of bid packages to assess the quality of bid quotes included in the estimate.

Other Miscellaneous Field Costs

As defined here, these are all remaining field costs after bare direct labor, field materials, and contracts. Costs typically included include field directs (FD). As explained earlier, these are payroll taxes, benefits, insurance, etc., directly added to BDL to obtain DFL. Indirect field costs (IFC) may be grouped into categories such as:

- contractor's administration and overheads;
- temporary construction facilities;
- small tools and equipment; and
- special services/equipment/allowances.

To most effectively evaluate this component of the estimate, the owner's CE must understand and identify the bare direct labor (BDL) dollars included in the estimate. BDL, simply defined, is the direct labor hours multiplied by the weighted average W-2 rate for all crafts.

It is customary for estimates to reflect direct field labor (DFL) costs, not bare direct labor. The problem with this is that there is no universally accepted standard for what is included in DFL. It starts with BDL but always includes other costs. With no standard for FD, the owner's cost engineer cannot meaningfully compare IFC to DFL. A high ratio may simply be lowered by moving IFC items into FD.

If BDL dollars are not clearly identifiable, they can be easily determined. The CE must obtain from the estimate, or the contractor, the total direct labor hours and the weighted average W-2 rate. Given these data, one can back-calculate BDL:

- Given: direct field labor dollars of \$721,450.00
- DFL rate/hour: \$20.65
- DFL hours are $(\$721,450/\$20.65)$ or 34,937 hrs.
- Times the local wt. ave W-2 rate, say \$17.80
- Yields BDL of \$621,879.00
- Then: DFL minus BDL yields field directs \$99,571.00
- $(\$721,450 \text{ minus } \$621,879)$

Field directs should be added to all other miscellaneous field costs (also known as field indirects or indirect field costs (IFC)). The resulting total can then be used for a most revealing ratio analysis: $FD + IFC/BDL$. The ratio, with BDL as the common base, is meaningful in making comparisons contractor-to-contractor, location-to-location, and project-to-project. These ratios may range from .75 to 1.50, plus or minus. The owner's CE can use this ratio to make sense of all miscellaneous field costs (FD + IFC) included in an estimate. The correct ratio is the one that makes sense for the specific project at-hand. Clearly, engineering judgment is required.

CONTINGENCIES

Contingencies are usually estimated at the total project level. The E-R-V process looks at contingencies by major estimate category: engineering and design, engineered equipment, and field costs. This is a logical way to test the appropriateness of the project total contingency amount. For example, if engineered equipment values are based on firm quotes made with final specifications, applying a flat percent to the project ITC may not be justified. Likewise, if E&D is 60 percent complete, the E&D contingency should be based on the remaining 40 percent only.

WORKING WITH CONTRACTORS

As large corporate owners cost reduced their in-house engineering organization, it became fashionable to develop partnering relationships with contract engineering and construction firms. These relationships have served both very well. While partnering has obvious advantages, it is imperative that the conflict of interest discussed earlier be kept in mind. Partnering does not make the conflict go away. The owner's CE should help guide the owner's team to ensure owner interests are not compromised. It is helpful if the owner team members meet periodically, without contractors present, to discuss proprietary items. Care should be taken to not communicate estimate expectations that might bias the contractor. For example, telling the contractor the project is budgeted at \$25,000,000 serves no useful purpose. Budgetary estimates are much less precise than definitive, authorization estimates. If the contractor knows the owner is prepared to pay up to \$25,000,000 and the initial estimate is in the \$20,000,000 range, the contractor will understandably be biased to add monies, justifiable or not.

Estimate ranges may be shared, but the contractor must understand it is his/her responsibility to determine the final estimate value. Owner team members must continuously challenge the contractor to ensure the final estimate is cost competitive. The owner's CE's validation is the final effort to this end.

The evaluate-reconcile-validate approach as presented here is very comprehensive. Yet, it is not intended that every estimate validation be so exhaustively performed. It is important to remember Pareto's law—80 percent of a project's ultimate outcome is a result of 20 percent of its higher impact components.

The owner's CE must use his/her experience and engineering judgment to evaluate risks and decide how detailed the validation must be.

It is expected that validation costs will typically range from .1% (.001) to .25% (.0025) of the project's indicated total cost, plus or minus. The higher end of the range may be called for where a parallel estimate and travel expenses are required. While validation is an expense owners like to avoid, doing so is, without a doubt, a foolish and high-risk option, which will often be even more expensive. As a consequence, failing to validate contractor-prepared, capital project estimates is simply not an acceptable option.

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