Detailed Cost Estimating

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Detailed cost estimating is the process of predicting the cost of a facility through quantitative analysis of the work required by the design documents. Although not always required by clients, detailed cost estimates can be an important part of overall cost management and budget adherence.

Summary

Why a Client May Need These Services

- To validate project construction budgets
- To validate a portion of project construction budgets
- To establish a benchmark for a construction bid or negotiation
- To establish a basis for financing

Knowledge and Skills Required

- Knowledge of basic economic principles and methods
- Ability to interpret construction drawings and specifications
- Understanding of construction materials, processes, and methods
- Ability to relate details and specifications to costs
- Facility with spreadsheets and interrelated mathematical formulas
- Communication skills for interacting with multiple disciplines
- Attention to detail

Representative Process Tasks

- Define scope of service
- Define parameters to be used
- Prepare the estimate
- Validate contents and assumptions
- Reconcile estimate with others (if required)
- Document and present results

A detailed cost estimate is defined in the 13th edition of the *Architect's Handbook of Professional Practice* as "a forecast of construction cost prepared on the basis of a detailed analysis of materials and labor for all items of work." It is different from a preliminary estimate of construction cost, which is usually based on current area, volume, or similar conceptual estimating techniques. Generally, detailed cost estimating is appropriate when documentation is sufficient to properly measure and price individual items, usually during design development or construction documentation.

It is common for architects to prepare preliminary cost estimates, but historically architects have not often prepared detailed cost estimates. For these, they have relied on contractors, specialists in their firms, or professional estimating organizations. As new delivery methods have evolved, other parties—in particular construction managers—have been involved in the preparation of estimates, particularly detailed estimates.

In the AIA contract documents detailed cost estimating is identified as an additional service, although many owners require a detailed estimate as a standard deliverable. Architects may develop the capacity to prepare detailed cost estimates themselves. However, this discussion is based on architects procuring these services.

Detailed estimating is important because it verifies whether the cost of a project as predicted in a conceptually developed estimate is indeed the actual cost. It is not uncommon for detailed estimates to be prepared by different parties, in which case their estimates should be reconciled and assessed. Such reconciliation requires a consistent approach, especially from one project phase to the next.

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CLIENT NEEDS

Today's owners expect their design and construction team to manage project costs in an accurate and responsive manner. They expect that an accurately defined budget will be prepared early in a project and that the project will be completed to required scope, meeting expectations of quality and performance, all within the budget. Clients are demanding that designers manage project costs and meet budgets without compromising excellence in design.

For many clients a detailed estimate is a required deliverable of the procurement process, and therefore it is made a deliverable of the design team. If the results of this estimate do not indicate that the project is within budget, the procurement process will often come to a halt or the design team may be required to redesign at no cost to meet the budget. A design team could again face a project stoppage or redesign if the responses are above budget when the project is bid or offered for a guaranteed maximum price (GMP).

In 2000, 65% of AIA member firms offered cost estimating services. Of these, 19% offered cost estimating as a stand-alone service.
AIA Firm Survey 2000–2002

A client may require a detailed cost estimate to confirm the cost status of a project or to explain comprehensively where and why costs have changed. Even if not required by the client, preparation of a detailed estimate demonstrates a design team's commitment to cost management.

SKILLS

Regardless of who actually prepares a detailed cost estimate, the design team should be actively involved in the process. Architects will benefit from gaining an understanding of the basic principles and major issues associated with cost estimating. This conceptual knowledge can help architects select and work with consultants who provide these services, and it can be useful in developing in-house cost-estimating capabilities.

Abilities Needed

Detailed cost estimating by its very nature requires attention to detail and consistency in methods of preparation. Those who prepare estimates benefit if they are able to focus on detail while at the same time keeping an eye on the larger picture of how construction items interface. The ability to relate construction details and specifications to actual construction processes is useful, especially for processes and sequences not typically drawn and detailed in construction documents, such as excavation, form work, sheeting and shoring, false work, and a variety of general conditions. An understanding of where construction disciplines interface, particularly in compressed areas such as plenum spaces and trenches, is also helpful.

Effective estimating in any form, detailed or not, will benefit from an individual's ability to think and work with the hierarchical format structures typically associated with construction. Roll-ups and breakdowns are typical steps associated with estimating.

Almost all estimating today is performed using computers, spreadsheets, and specialized software. Comfort with the use of spreadsheets and interrelated mathematical formulas is a practical necessity for estimating and cost management. A great deal of information is also available on construction cost, in both printed and digital form. Familiarity with these sources, an ability to use reference material on specifications and cost, and understanding of the limitations of such references are necessary.

Market factors and risk issues can be complicated and confusing. Estimators and those using estimates for cost management will benefit greatly from an understanding of basic economic principles, as well as a more detailed knowledge of the economics of the methods and materials of construction.

Good verbal and written communication skills are a boon in any technical activity, and estimating is no different. In particular, the ability to interact as part of a group of professionals from multiple disciplines is beneficial.

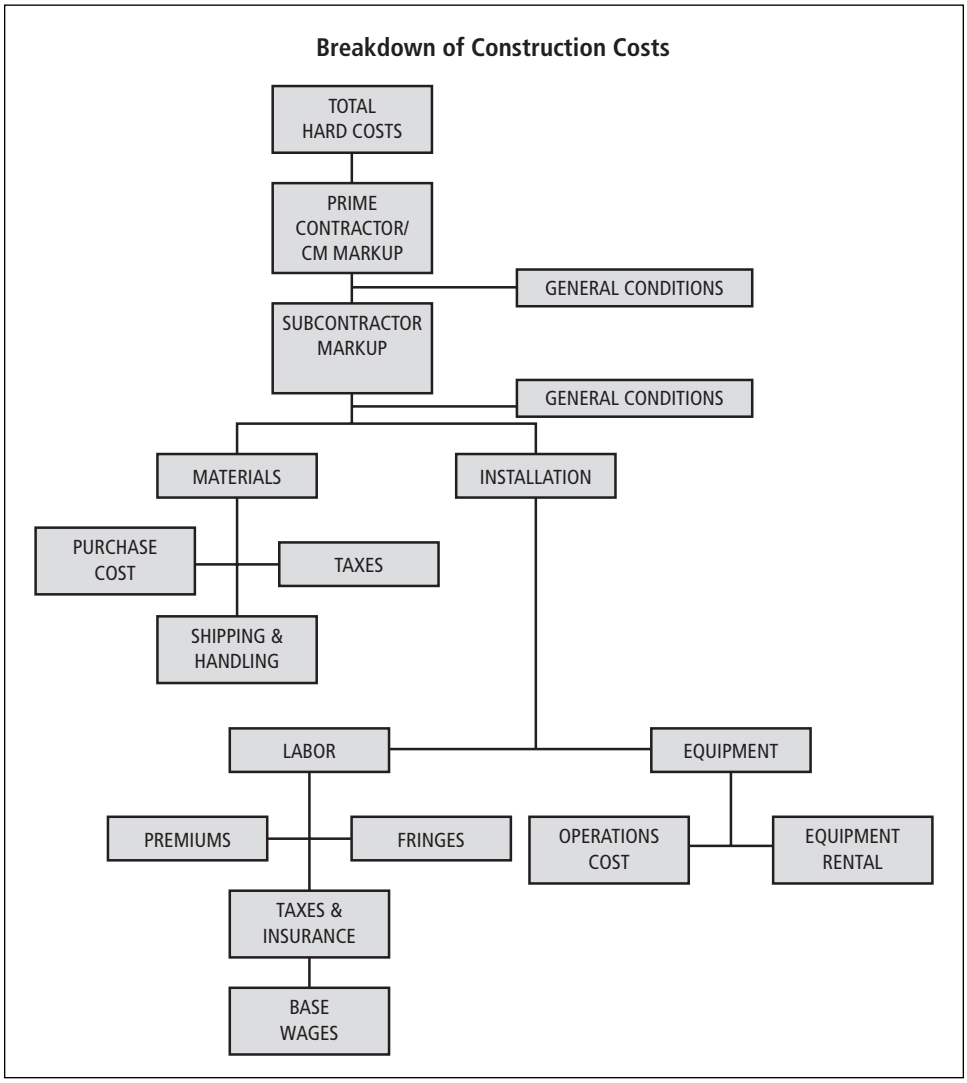
Understanding Cost Estimating Issues

An understanding of cost estimating issues and considerations will make estimating an effective component of overall cost and project management. Also, it is essential that

those using an estimate and those producing it completely understand why the estimate is being produced and how it will be used.

Breakdown of Construction Costs

Construction costs include the cost of materials, labor, and equipment. Overhead costs related to the job site contribute to management of the project, while additional markups are applied relative to the "home office" cost of doing business. The accompanying diagram presents a breakdown of these costs in a hierarchy of elements.



Direct costs include materials and installation. Special burdens for shipping and handling or premiums associated with managing labor such as travel and subsistence may be added to direct costs or may be carried separately as an extended general conditions cost.

Costs associated with managing building construction are usually aligned with provisions in the general conditions of the construction contract. These costs relate to on-site supervisory staff; additional professional services staff (possibly part time) for scheduling, engineering, and quality oversight; and the cost of temporary facilities, small tools, temporary utilities, and a variety of safety and security equipment. Bonds, permits, and insurance costs allocated to the project are also included in this category. Additional costs such as temporary lodging, travel, and other labor-related costs might also be allocated under the general conditions.

All contractors and subcontractors working on-site incur costs associated with general conditions management. Such costs for subcontractors may be rolled into their subcontract cost, but on larger projects these costs may be included in the cost for general

conditions items for the general contractor or construction manager. Invariably, some facilities and services, such as temporary power, will be shared among all contractors.

Markups for overhead associated with the main office of each contractor include salaries of home office staff, certain insurance costs, various home office overhead costs (job procurement, marketing, advertising, etc.), and profit. Depending on the degree of risk associated with a project, a contingency may be carried as part of the general conditions and/or markup.

Reasons Costs Vary

The availability and relative supply and demand of materials will affect their direct purchase price. Over the years, shortages have occurred in structural steel, portland cement, precast concrete, gypsum products, and glass and glazing. Some trades may be in short supply as well. The issue is to be careful and aware of potential material and labor shortages. Availability may also affect the lead time required for delivery and shipping and handling costs, especially in remote areas, and can affect the cost of materials. Special project requirements such as the Buy America Act and other procurement-related factors can drive up the cost by limiting competition. A variety of sales taxes, import/export duties, and other special fees indirectly affect the cost of material.

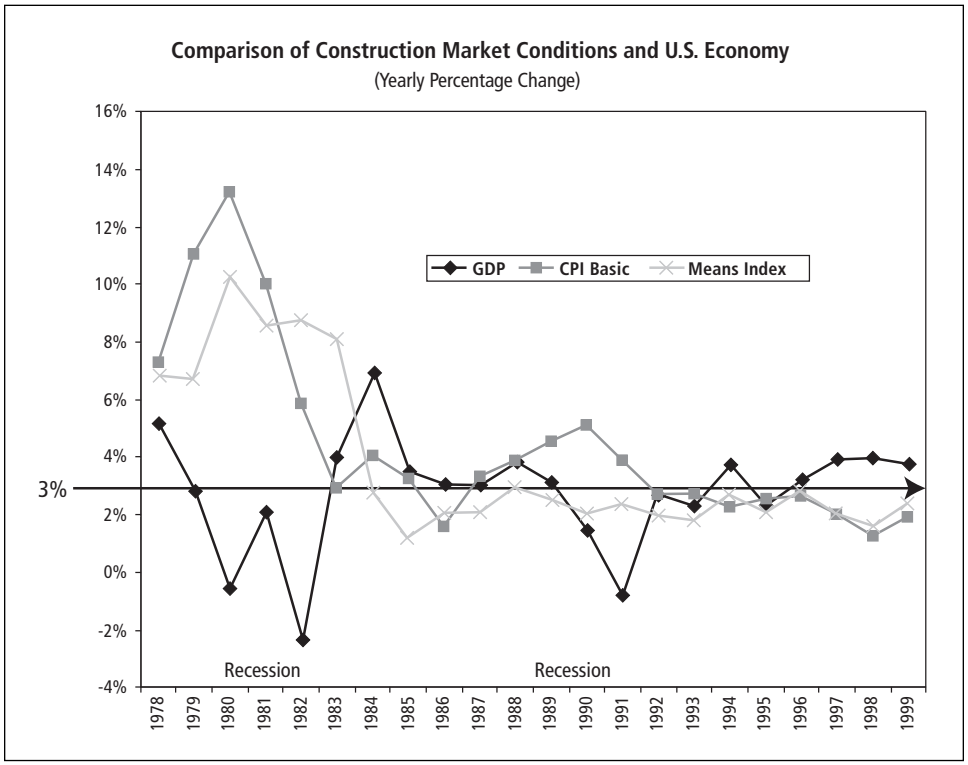
Installation costs vary according to an even more complex series of relationships. Direct labor wages can vary from location to location by 10 to 15 percent, and sometimes as much as 50 percent. Once wages are considered, labor productivity drives the cost of installation. High productivity results in lower installation cost, while low productivity increases installation cost. However, it is not uncommon for productivity to be very low when direct labor rates are very low, resulting in a relatively high in-place cost per unit despite low wages. Taxes and insurance affect labor costs. Certain trades, such as demolition, carry very high insurance premiums because of the risks associated with the work and the relative safety record of the contractor. Conditions of the work, particularly with renovation, affect productivity relative to access and egress, lay-down/staging areas, and dust, dirt, and general job cleanup requirements, as well as the space available to conduct business. Scheduling and work hour requirements may restrict access to the work or may force multiple work activities to be scheduled at the same place or at the same time. How efficiently shared equipment and services are managed will also affect productivity.

Estimating Renovation Projects

Costs for renovations and alterations are always difficult to predict. However, documenting and accounting for basic potential problems can help:

- *Existing drawings.* Are they available? If so, are they accurate and dependable?
- *Codes.* Have codes changed over time in ways that will affect the work?
- *Continued occupancy.* Will the facility be occupied during construction? Do special cleaning requirements or environmental limitations apply to the project?
- *Hidden work.* What is the likelihood that hidden work has not been anticipated? What are the ramifications of unexpected additional work?
- *Changes in function.* Is the new use of the building different from the original use? If so, do any code issues result from this change? Are environmental issues likely to arise?
- *Structural changes.* Structural changes are often associated with changes in function. Do codes or building deterioration require further structural change?
- *Adjoining buildings.* Is the renovation or addition likely to require underpinning or environmental work for adjoining buildings? How are these buildings used? Must vibration or environmental conditions be addressed?
- *Salvage.* Salvage can occasionally be a significant factor. Who will own the salvage rights?
- *Access to space and staging areas.* This factor is often not properly considered in an estimate. Is there sufficient access to the site, including turning radii and bearing capacity? Is there enough space on-site to stage materials and avoid double handling?

Market competition and project risk factors affect cost. In times of high competition, firms may have to reduce overhead and profit markups to be competitive. When competition is poor, these costs tend to increase. Designers, owners, and project or construction managers may invest considerable time and effort to control construction costs, but in the end, market and economic conditions may overwhelm other issues. Construction market conditions tend to follow the overall economy, as demonstrated in the accompanying chart, which compares the gross domestic product (GDP) with two common indexes, the consumer price index (CPI) and R. S. Means's Construction Cost Index (CCI).



The chart shows that inflation affects construction costs, but it shows other factors at work as well. In times of recession or slow economy, prices tend to drop because demand is down. Conversely, in times of economic boom, prices tend to rise because demand is up. The late 1980s were an economic boom period, and demand outstripped supply to the point where bid prices rose 10 to 15 percent above fair market value. In the early '90s there was an abrupt drop in the economy and a parallel abrupt drop in construction demand. In a very short time, construction prices dropped 10 to 15 percent below fair market value. It took a number of years for the industry to compensate for this change, and it wasn't until the late 1990s that bid prices once again began to exceed fair market value.

Risk is always a significant factor in determining a project's cost. . Any transfer of risk to a contractor will likely result in a higher price for the work. Stringent work requirements, liquidated damages, excessive retention, and extreme bonding requirements indirectly affect risk and cost and, furthermore, may cascade from subcontractor to subcontractor. Some owners feel that transferring risk will protect them, but they may be unaware that the transfer of risk will be reflected in the contractor's bid price.

The Difference Between Bidding and Estimating

Bidding and estimating are related but different concepts and processes. Bidding is a *procurement* process, whereas estimating is a *predictive* process. General contractors prepare an initial estimate as part of the bidding process, but with the exception of the direct work actually conducted by the general contractor, they rely on quotes from subcontractors and suppliers to finalize their bid.

The estimating process of an installation contractor differs somewhat from that of a

general contractor or a consulting estimator. An installation contractor's estimate represents a quote or agreement for actually completing the work. The expectation from the general contractor is that the work will be conducted in accordance with the subcontractor's quote and that changes will be accepted only if conditions vary from those in the contract. Thus, installation contractors incur more direct risk in their estimating process. In order to minimize this risk, the subcontractor's estimating approach is very detailed and is based on specific procurement actions, a defined schedule, and known labor productivity. Assuming that each subcontractor prepares an estimate, the general contractor assembles the quotes and prepares a bid. This process may consume months or may take as little as a week.

In addition to the project bid, the differences between bidding and estimating are important to changes during construction. For example, resolving a question when several trades are involved in an element of work may require the involvement of several subcontractors. Even a relatively simple change may affect costs in several trades, and ensuring that changes are properly reflected is a challenge.

PROCESS

The process of preparing detailed cost estimates starts with establishing clear definitions of the scope of the estimating tasks and the physical nature of the project being estimated. The next step is to follow an organized and consistent work plan for preparing and reviewing the estimate. The final step is to present the estimate and, if necessary, reconcile it with estimates prepared by others.

Defining the Scope of Services

Before preparing an estimate or calling for an estimate to be prepared, it is critical to set expectations for the estimate. Equally important is ensuring that everyone involved in preparing and analyzing the estimate has agreed to the decisions made. Certain steps are recommended to define detailed cost estimating services for a project:

- *Define the scope of the estimate, identifying both inclusions and exclusions.* Items to be excluded from an estimate are important. If not specifically excluded, all items included in the contract documents will be part of the estimate.
- *Define the basis to be used for pricing, including a clear definition of what is included in unit pricing.* For example, should prices quoted in the body of the estimate represent costs to the general contractor or costs to the installing contractor, or are they the raw costs of the installing contractor? In each case, the cost will be substantially different and subject to a series of different markups. There are no standard guidelines for deciding what costs to apply to unit pricing, so consistency is vital. For example, it is important to associate markups of a particular item of work with that item everywhere it is mentioned.
- *Establish the procurement and construction schedule for preparing the estimate.* Include the expected construction start time, any planned phasing of construction, the expected construction completion date, the anticipated commissioning process, and the actual move-in schedule.
- *Establish a schedule for preparing and reviewing the estimate.* First, all parties need to agree when documents will be provided and when estimates must be completed. Scheduling submittal of the estimate and the final documents for the same time can cause problems. Either the documents must be completed in advance or the estimate will have to be based on incomplete plans. Overlapping the estimating process with a quality review of the documents can be a reasonable alternative.
- *Choose a format for the estimate* (see sidebar). It is difficult and time-consuming to reformat and reprice estimates as an afterthought. Specify the level of detail, amount of description required of work items, and pricing philosophy. If standardized databases are to be used, define procedures acceptable for overriding such pricing.

- *Decide whether estimates based on progressive submittals should be prepared from scratch or as updates of earlier estimates.* Plus/minus updates are feasible but are recommended only when changes are minor and the scope is consistent.

Preparing the Estimate

The steps involved in preparing an estimate include preparing a quantity survey for the project, pricing the individual line items of work, assessing general conditions costs, accounting for markups for overhead and profit, factoring market conditions, and assessing escalation rates for material and labor costs and project contingencies and risks.

Preparing a Quantity Survey

A quantity survey defines the actual items to be constructed in sufficient detail to allow for accurate unit pricing. The U.S. construction industry has few standards for measurement of estimate components, and these apply only to major building measurements such as gross area and net area. This lack of standardization can lead to disagreements among those preparing different portions of an estimate. Therefore, it is important to define methods of measurement to be used in a particular estimate and to ensure they are applied consistently.

►In the United Kingdom, the quantity surveying profession, led by the Royal Institute of Chartered Surveyors, has promoted methods of measurement that meticulously define building components and subcomponents.

When a detailed estimate is required during design development, complete design documentation and specifications often are not available. Although not all aspects of the design have been detailed enough for full quantity survey, it may still be possible to produce detailed estimates for analysis purposes. One way to accomplish this is to use systems and assemblies as a means of defining quantities. This approach provides a bridge between conceptual estimating and a full detailed quantity survey. Systems or assemblies can be used to "model" components not completely designed. This exercise is useful because it can establish a quantitative base for future comparison.

When limited design information is available, the estimator can work with the designers to develop a set of assumptions on which to base an estimate. It is possible to use historical information from similar facilities or similar building components and elements as a basis for these estimates. It also may be necessary to develop what are referred to as "assemblies," which essentially are mini-estimates for individual components.

Published sources can be used to prepare estimates and to cross-check estimates prepared using other methods. The R. S. Means Company publishes a guide that contains a variety of predefined assemblies for architectural, structural, mechanical, electrical, and sitework elements.

Pricing Individual Line Items of Work

Once labor rates are determined, productivity is the prime determinant of unit labor costs. Obviously, low productivity increases cost while high productivity reduces it. Taxes and insurance on labor also have to be accounted for. Any special conditions of the work, particularly in a renovation, have to be assessed, as well as costs for material handling, storage, and taxes.

Many pricing sources are available, including publications, standardized databases, industry journals, historical records, and quotes from contractors and suppliers. Soliciting and documenting quotes, especially for major items, is a good idea. However, the veracity of quotes obtained outside a competitive environment should be checked. Experience has shown that quotes provided to designers, estimators, and consultants often differ from quotes provided to contractors. In fact, depending on a contractor's relative buying power, quotes may even vary between contractors.

Assessing General Conditions and Overhead and Profit

General conditions can be estimated as a percentage of overall construction cost or calculated on a line item basis as per specifications and front-end requirements. Incorrectly reflecting the impact of scheduling requirements on general conditions is a source of error on estimates. If scheduling issues are significant, either through acceleration or restriction, a detailed assessment would be more appropriate than applying a percentage.

Unit pricing methodology for work items should be reviewed to determine if any

general conditions have been included in the unit prices. Check to be sure there is no duplication in general conditions and unit pricing.

To some degree, market conditions and issues of risk will have a bearing on overhead and profit. Nonetheless, estimating the amount of overhead and profit for a project requires a judgment call. In any case, it is important to document all assumptions and avoid any overlaps between general conditions and overhead and profit.

Factoring in Market Conditions

How can market conditions be tracked over time in relation to project cost? If a market change takes place, how should it be documented and accounted for? Overall supply and demand factors may affect a geographic area and require tracking, but certain types of construction are subject to other supply and demand factors. For example, K-12 school construction is booming in many metropolitan and suburban areas, creating regional competition for the same resources. Because general contractors, construction managers, and trade contractors tend to specialize in K-12 construction, the field for labor and construction trades is limited. Even when the overall economy is relatively flat, if much school construction is occurring in a locale, the prices for school construction there will likewise be high, perhaps even prohibitive.

Positive market conditions (high competition) can reduce bid prices by 3 to 5 percent. In extreme conditions a "discount" of as much as 10 to 15 percent has been experienced. On the other hand, reduced competition is often reflected in a reduced number of bidders with higher expectations of profit. If a project has only one or two bidders, an increase of 3 to 5 percent can be anticipated. Single bidders may increase costs by more than 10 percent.

Do not automatically assume that because a reasonable number of general contractors bid on the work the situation is competitive. It is not uncommon for general contractors to share key trades in common. Trade-based shortages and lack of competition can add 10 percent or more to individual trade bids. Another simple yet beneficial activity is to evaluate what other projects are going on at the same time as the project to be estimated and to try to avoid competing directly with those other projects. Even in times of good competition, restrictive specifications or bidding practices can constrain competition and increase bid prices.

Assessing Escalation, Contingencies, and Risks

Escalation and contingencies are real costs that have not been specifically identified at the time an estimate is prepared. All estimates should include consideration of these factors, as it is unlikely nothing will change in a project once the estimate has been prepared. The terms *escalation* and *contingency* can be defined as follows.

Escalation is the inflationary cost growth anticipated between the time an estimate is prepared and the project is bid or finally costed. Pricing included in the estimate represents only costs known when it was prepared, so escalation is added to these figures in the estimate to anticipate future escalation in cost. These increases in cost are usually predicted in two stages:

1. *During construction of the project.* For simplicity, half the work is assumed to take place before the midpoint of construction and half after. Therefore, an estimate escalated to the midpoint reflects the difference between the potential increased cost and the cost a bid would represent at the time of estimate preparation (a current bid estimate). Note that when a subcontractor submits a firm quote for work, that quote is a bid and, as a result, includes any anticipated cost growth.
2. *From the estimate preparation date to the projected bid date.* For an estimate to reflect a future bid date, a bid estimate would be escalated from the date of the bid estimate to the actual bid date.

A contingency is an allowance for work that is not completely defined at the time an estimate is prepared but anticipated to be part of the project scope. Contingencies are generally added by a single factor (e.g., a percentage of the cost estimate) but actually may

represent several components. For example, design contingency costs tend to reflect the degree of completeness of the design. Design contingency covers what is not explicitly defined but what will eventually be included.

An *estimating contingency* reflects the estimator's confidence in the estimate but may also depend on the development of the design and other factors affecting cost, such as ease of access/egress and conditions of the work. The design and estimating contingencies are usually combined and generally approach zero as the documents are completed.

A *construction contingency* is intended to cover the amount of cost increase that could occur after the construction contract has been awarded. Included are the effects of unknown site conditions, weather, and uncontrollable delays, as well as change orders due to inconsistencies or incompleteness in the construction documents. Construction contingencies are not generally carried as part of a bid estimate, since the costs included will not be incurred until after award of the contract.

An *owner's contingency* may include the construction contingency but, more important, includes an allowance for scope increases and owner-elected changes. This contingency is usually carried exclusively by the owner/client.

What are reasonable allowances for contingencies? Contingencies of 15 percent or more are common at conceptual or schematic design, but detailed estimating from design development onward does not usually contain more than a 10 percent contingency. This should vary to zero when final construction documents have been completed.

Risk factors on a project can cover any number of project elements. It may be beneficial to actually prepare risk-based estimates focusing on major cost components for which risk is a significant issue. Formalized risk-estimating methods are available and may be appropriate for certain circumstances. Range estimating can be done in a rather simple fashion by selecting the 20 percent of line items in an estimate that represent 80 percent of the cost, developing a range for each of these items, and then simply adding the low and high ranges. A more advanced approach involves taking the same 20 percent of items, establishing the range, and then using any one of several available software packages to produce a risk profile. This approach would give a more accurate projection of the logical highs and lows involved with 20 percent factors. A sensitivity analysis can also be prepared to vary the key risk parameters.

In fact, it may be beneficial to use a complete risk analysis package that permits full range estimating to prepare a comprehensive risk profile that establishes confidence ranges and contingency amounts.

Validating, Cross-checking, and Reconciling Estimates

Validating and cross-checking estimates is an important step that is sometimes overlooked. An estimate can be cross-checked in a number of ways. Critical components can be verified by independent estimates, or critical measures of an estimate can be checked in a relatively simple fashion. For example, adding up all the floor finishes in an estimate and comparing the floor finishes to the total gross area of the building can provide a quick check of overlapping or underlapping finishes. If the total finishes exceed the floor area, there is an error. If the total is less than the overall gross area, a quick check of unfinished spaces and construction areas contained inside walls or voids can validate the numbers.

Another way to check an estimate is to rely on standard measures of components or systems. For example, the total cost for air-conditioning can be calculated based on total in-place cooling capacity expressed in tonnage or BTUs. If the cost per ton varies from accepted standards, either there is an error or the basis of the estimate differs from the accepted standard. Other examples include calculating total pounds of structural steel per square foot of the building to assess steel framing cost, or figuring the cubic yards of concrete needed to determine the in-place concrete framing cost. Such statistics can be extracted from past projects for comparison.

When comparing two or more estimates that have been prepared for the same project, it is important to reconcile them in an orderly and comprehensive manner. How-

ever, take care to avoid expending unnecessary time and energy to no real purpose. Some suggestions for a reconciliation process follow.

- *Determine the construction classification system to be used.* This should be decided before the estimate is prepared. If possible, parties involved in preparing the estimate should discuss and agree on the classification system to be used.
- *Define the method of pricing.* One or more of the parties involved in estimate preparation may have to alter either their method of pricing or the way they present their estimates. It is not a good idea for parties to price work or materials using a method with which they are unfamiliar, but the estimate must be summarized in a way others can understand. Any markups included in the pricing or in the body of the estimate should be clearly identified.
- *Document the project schedule and time frame.* In some cases, a schedule listing individual activities or phases is attached to each estimate.
- *Document and define escalation and contingency factors, if included.* Make clear whether bid date escalation or midpoint escalation was used.

The actual reconciliation process can follow either a top-down or a bottom-up strategy. It generally is not feasible to reconcile two estimates on a line-by-line basis. The top-down strategy calls for an examination of the overall cost of an estimate followed by comparison of major components. Disagreements should focus on significant components of the estimate, such as the structural shell or HVAC costs. It is strongly recommended that major quantities of critical items be separately identified and any calculations associated with them documented. In addition, significant risks affecting the project should be assessed, and time should be spent determining how these risks have been addressed in each estimate. These risks need to be scrutinized because major differences in interpretation of them can result in consequential differences in the estimates. It is neither feasible nor beneficial to focus a great deal of time and effort on details of the estimates when significant disagreements may exist over the drivers. The top-down approach forces discussion and reconciliation of the major risks.

The bottom-up approach is useful for examining scope inclusions and exclusions and overall consistency. A review of selected line items is useful when examining overall trends and patterns of pricing in a particular area. Two or more estimates, even when competently prepared, may vary dramatically from component to component and certainly from item to item. An initial reconciliation should include scope, inclusions, and exclusions; major pricing assumptions concerning markups, profit, and overhead; and any significant restrictions of the work. Subsequently, attention can be focused on a review of the major drivers as they are identified. The bottom-up reconciliation, which proceeds line item by line item, should be used as a means of adjustment only after the top-down review has addressed major differences in estimates.

Documenting and Presenting Results

Detailed estimates often consist of hundreds, if not thousands, of line items of work. Certainly, the contents need to be clear, readable, and consistent. A summary of findings can facilitate review of the cost estimate by others and allow it to be used as a reference for cost management activities. Written summaries can be used to explain aspects of the estimate that do not lend themselves to typical spreadsheets and tables.

When estimates are prepared incrementally, comparisons with each increment and explanations of variances are beneficial. Also, it may be desirable to present an estimate in multiple formats to assist reviewers and decision makers.

Detailed estimating is a methodology that can accurately predict the cost of construction and thus is an important component of overall cost management. The effort committed to performing detailed estimating promotes communication among members of the design and construction team and provides valuable feedback for the design process.

Classification Systems for Structuring an Estimate

An essential component of any cost estimating approach is the use of a standard framework for classifying and managing construction information. The framework chosen should accommodate cost data needs throughout the project life cycle and respond to the viewpoint and needs of the various users. If a firm does not use a standard construction information framework for estimating its projects, inconsistencies will occur in estimates between projects and between stages of each project. Confusion and ultimately loss of control will result.

Employment of a standard framework for construction information addresses the following basic needs:

- Consistency of work products over time and from project to project
- A frame of reference for collecting and managing information and eventually for evaluating the experience gained
- A checklist to aid both management and technical decision making
- Clear communication between all disciplines
- A basis for ongoing training of personnel
- An efficient basis for automation

The most common data standard in use in the construction industry today is MasterFormat, a system of numbers and titles for organizing construction information into a standard sequence. This sequence is subdivided into 16 divisions organized by major products and trades associated with construction and then into four levels of detail. Level one comprises major groupings such as bidding requirements, contracting requirements, and the 16 division trades. Levels two, three, and four provide progressively more detailed subgroupings.

MasterFormat is used extensively throughout the industry as a format for project manuals, specifications, and project data. It is now the standard for various references accepted by sources such as R. S. Means Co., which uses it for unit cost publications, and Sweets, which uses it for product literature. Since the format resembles the basic form by which projects are procured (subtrades and contract packages), it is often used as a cost control, scheduling, and estimating framework, especially for detailed estimating.

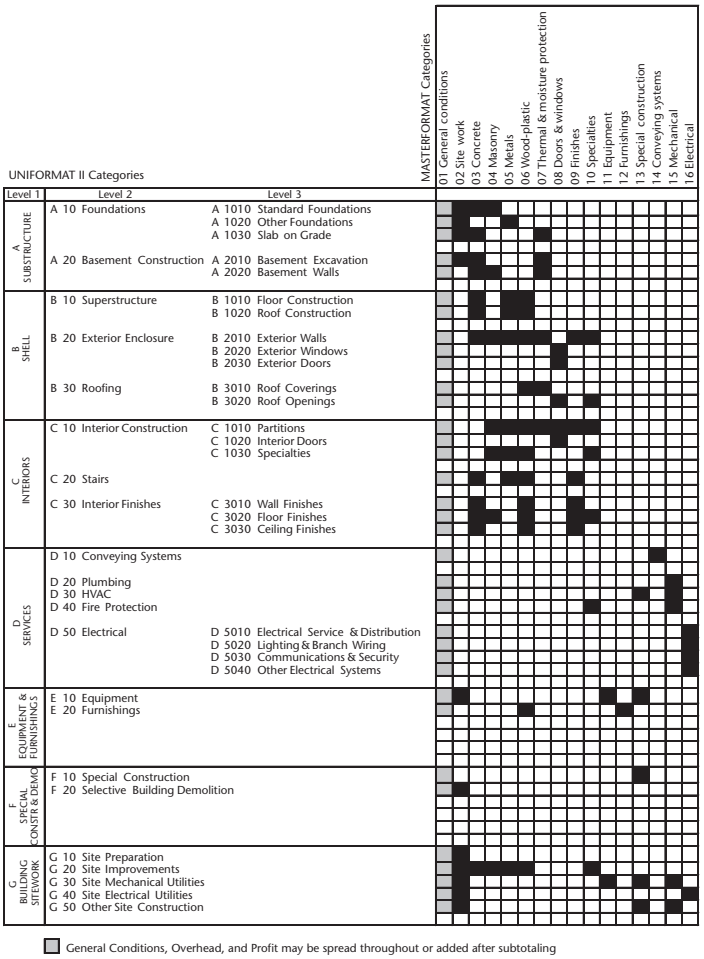
MasterFormat provides an effective way to define building systems within single trades, but its use can be problematic for tracking the cost of building systems that span multiple trades. For example, an exterior wall system standard detail consisting of masonry block backup, insulation, and precast concrete panel would reference three sections from three separate divisions. This relates well to the means of specifying and constructing the wall, but the needs of the designer are somewhat different. The designer views the wall as a complete functional entity or system and can work more readily with a data format that uses a system or elemental approach to defining building components.

An information format that relates better to the language of design is UniFormat II. It is particularly well suited to use during early design phases, when cost, budget, and performance aspects of building components are still conceptual. Using UniFormat allows estimates of building components to be gathered under one heading, regardless of the type of material being specified. Listing each element as a discrete functional building part facilitates cost and performance comparisons, regardless of the actual materials chosen. In addition, UniFormat II is hierarchical, which allows information (in particular, cost information) to be developed at different levels appropriate to the degree of information available. This flexibility is useful when specific material and system choices have not been made.

UniFormat is subdivided into 22 major building elements. The accompanying diagram shows a list of UniFormat II at levels one, two, and three. It demonstrates the hierarchical nature of the format and shows the relationship between UniFormat II and MasterFormat.

Although UniFormat is commonly used, many owners require MasterFormat for detailed estimates. As a general rule, UniFormat can be used as a basic structure for preparing estimates during design development and construction documentation. Most of today's computer systems and advanced spreadsheets allow for conversion from one format to the other.

Relationship Between UniFormat II and MasterFormat



The Estimate Report

Regardless of how an estimate is prepared, it should be presented in a clear, concise manner. The following elements are typically included in an estimate report:

1. Project title, location, list of individuals who worked on the estimate, and the date
2. Written overview of findings
3. Summary chart of estimate findings, preferably on one sheet of paper, with appropriate backup material appended or referenced
4. List of any estimate values or quotes provided by others and included in the estimate
5. Reconciliation of estimate to budget and/or previous estimates, with identification of variances and explanations for same
6. Recommendations for corrective actions if costs vary from budget
7. Method used to prepare the estimate
8. Documents on which the estimate is based
9. Assumed schedule (bid date, construction start, completion)
10. Type of contract and procurement method assumed
11. Outline of items included and specific lists of items excluded from estimate
12. Time basis of currency included in estimate and basis of escalation included
13. Design and construction contingencies included
14. Market conditions at the time of the estimate and projected to the bid date
15. Outline specifications, performance, and quality levels assumed in estimate
16. A list of alternatives examined
17. General comments on any special conditions that might affect future prices

"Detailed Cost Estimating" was originally published in *The Architect's Handbook of Professional Practice, Update 2003*, ©2003 by the American Institute of Architects, published by John Wiley & Sons, Inc.

The AIA provides a contract document designed especially for alternative architectural services.

B102–2007, Standard Form of Agreement Between Owner and Architect without a Predefined Scope of Architect's Services.

AIA Document B102–2007 is a standard form of agreement between owner and architect that contains terms and conditions and compensation details. B102–2007 does not include a scope of architect's services, which must be inserted in Article 1 or attached as an exhibit. Special terms and conditions that modify the agreement may be included in Article 8.

The separation of the scope of services from the owner/architect agreement allows users the freedom to append alternative scopes of services.

AIA Document B102–2007 replaces and serves the same purpose as AIA Document B141–1997 Part 1.

For more information about AIA Contract Documents, visit www.aia.org/contractdocs/about

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