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ELECTRICAL ESTIMATING METHODS

FOURTH EDITION

Wayne J. Del Pico

WILEY

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Fourth Edition

WAYNE J. DEL PICO, CPE

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Dedicated to the memory of

Sid Numerof

1929–2013

Good friend, valued coworker, and dedicated family man

Contents

About the Author

Wayne J. Del Pico is president of W. J. Del Pico, Inc., where he provides construction management and litigation support services for construction related matters. He has more than 35 years of experience in construction project management and estimating and has been involved in projects throughout most of the United States. His professional experience includes private commercial construction, public construction, retail construction, and residential land development and construction.

Mr. Del Pico holds a degree in civil engineering from Northeastern University in Boston, where he taught construction-related curriculum in Cost Estimating, Project Management, and Project Scheduling from 1992 until 2006. He is also a member of the adjunct faculty at Wentworth Institute of Technology in Boston, where he presently teaches programs in Construction Cost Analysis, Estimating, Project Control, and Construction Scheduling.

Mr. Del Pico is a seminar presenter for the RSMeans Company, where he provides instruction on topics from estimating to scheduling. He is the author of *Plan Reading and Material Takeoff* (1994), *Estimating Building Costs (2004)* and its second edition in 2012, and is a co-author of *The Practice of Cost Segregation Analysis (2005)*. His most recent book, *Project Control: Integrating Cost and Schedule in Construction,* was published by Wiley in September 2013.

His construction experience and knowledge of the industry has qualified him to be the past president of the Builders Association of Greater Boston (2010). He is also a practicing Neutral for the American Arbitration Association, where he hears construction-related arbitration cases.

To learn more about the author, visit www.wjdelpico.com.

1 THE ESTIMATING PROCESS

1 Components of an Estimate

One of the most difficult tasks in estimating any project is to capture all of the costs involved in the project. Construction has many variables, and it is these variables that can have an impact of the way the estimator "sees" the work and ultimately its costs. The means and methods selected, or the plan to execute the work, will impact price significantly. Another important variable is the bid documents; comprehensive, fully developed designs offer a better chance for the estimator to reach an accurate price. It is the goal of the estimator to arrive at the most accurate price for the cost of the work under a specific set of circumstances and conditions.

While different estimators may see a project differently and thereby arrive at a different price for the work, all estimates share some basic components. Every cost estimate requires three basic components. The first is the establishment of standard *units of measure.* The second component of an estimate is the determination of the *quantity* of units for each component, which is an actual measurement process: how many linear feet of wire, how many device boxes, and so on. The third component, and perhaps the most difficult to obtain, is the determination of a reasonable *cost* for each unit.

The first element, the designation of measurement units, is the step that determines and defines the level of detail, and thus the degree of accuracy, of a cost estimate. In electrical construction, such units could be as all-encompassing as the number of watts per square foot of floor area or as detailed as a linear foot of wire. Depending on the estimator's intended use, the designation of the unit of measure may describe a complete system, or it may be a single task within the entire scope of the project. The selection of the unit of measure also determines the time required to do the estimate.

The second component of every estimate, the determination of quantity, is more than simply counting units. In construction, this process is called the *quantity takeoff* or *quantity survey.* It is an integral part of the estimating process that requires an intimate understanding of the work being estimated and a commitment to

accuracy. To perform this function successfully, the estimator should have a working knowledge of the materials, methods, and codes used in electrical construction. An understanding of the technical specifications that were the basis of the design is also particularly important. This knowledge helps to ensure that each quantity is correctly tabulated and that essential items are not forgotten or omitted. The estimator with a thorough knowledge of construction is also more likely to account for all requirements in the estimate.

A clear understanding of the *scope*, or limits of the work, what is included and what is not, is also critical for a defining the estimate.

Not all of the tasks in an estimate involve materials; some are labor-only tasks. Testing is an example of a labor-only item. Some can be just material items, for example, a work box and conduit that is set in a masonry wall by the bricklayer. Experience is, therefore, invaluable to ensure a complete estimate.

The third component is the determination of a reasonable cost for each unit referred to as *pricing.* This aspect of the estimate is significantly responsible for variations in estimating. Rarely do two estimators arrive at exactly the same material cost for a project. Even if material costs for an installation are the same for competing contractors, the labor costs for installing that material can vary considerably, as a result of varying productivity and pay scales in different areas. The use of specialized equipment can decrease installation time and, therefore, cost. Finally, material prices fluctuate within the market. These cost differences occur from city to city and even from supplier to supplier in the same town. It is the experienced and well-prepared estimator who can keep track of these variations and fluctuations and use them to his or her best advantage when preparing accurate estimates.

This third phase of estimating, the determination of costs, can be defined in three different ways by the estimator. With one approach, the estimator uses a unit cost that includes all the elements (i.e., material, installation, overhead, and profit) in one number expressed in dollars per unit of work. A variation of this approach is to use a unit cost that includes total material and installation as a single amount, adding a percent markup for overhead and profit in the estimate summary.

A second method is to use individual unit costs for material and for installation. Costs are calculated separately for each category without markups. These are called *bare costs*. Different profit and overhead markups are applied to each item before the material and installation prices are totaled. The result is called the *billing* rate or price.

A third method of pricing uses unit costs for materials, with labor-hours as the measure of labor. Again, these figures are totaled separately; one represents the value of materials expressed in dollars, and the other shows the total labor-hours for installation. The average cost per hour of trade labor is determined by allowing for the expected ratios of foremen, journeymen, and apprentices. This is sometimes called a *composite labor rate.* This rate is multiplied by the total labor-hours to get the total bare cost of installation. Different overhead and profit markups can then be applied to each, material and labor, and the results added to get the total billing rate.

Whichever methodology is selected, it is important to remember that it should remain consistent through the entire estimate to avoid errors, omissions, or duplications. The estimator must, therefore, exercise care to utilize these methods correctly and consistently for the format of each particular estimate.

As a point of clarification, the word *unit* is used in many ways, as can be seen in the preceding definitions. Keeping the concepts of units clearly defined is vital to achieving an accurate, professional estimate. For the purposes of this book, the following references to different types of units are used:

- **Unit of measure.** The standard by which the quantities are counted, such as *linear feet* of conduit, or *number* of boxes. There are industry-accepted standards of units for almost all work.
- **Cost units.** The total dollar price per each installed unit of measure, including the costs of material and installation. This figure may be a bare cost or may include overhead and profit.
- **Material unit cost.** The cost to purchase each unit of measure. This cost represents material dollars only—with no overhead and profit.
- **Installation unit cost.** The cost for installing each unit of measure. This cost includes labor dollars only—with no overhead and profit.
- **Labor unit.** The labor-hours required to install a unit of measure. (*Note:* Labor units multiplied by the labor rate per hour equals the installation unit cost in dollars.)

A final thought on cost: It is important to note that the word *cost* is defined by its frame of reference. For the general contractor; the electrical contractor's entire price is a cost. When the work is complete, the general contractor will pay the entire contract amount to the electrical contractor and record it as a cost to the project. For the electrical contractor, cost is defined as all amounts in the estimate, with the *exception* of the profit. The electrical contractor will records costs as material, labor, and equipment paid to others, while the profit made is the only item not classified as a cost.

2 Types of Estimates

Estimators use four basic types of estimates. These types may be referred to by different names and may not be recognized by all as definitive. Most estimators, however, will agree that each type has its place in the construction estimating process. The four types of estimates are as follows:

- **Order of magnitude estimate.** The order of magnitude estimate could be loosely described as an educated guess. It can be completed quickly. Accuracy will vary between 20% and 25%.
- **Square foot estimate.** This type is most often useful when only the proposed size and use of a planned building is known. This method can be completed within an hour or two. Accuracy can be plus or minus 15%.
- **Assemblies estimate.** A systems estimate is best used as a budgetary tool in the planning stages of a project when some parameters have been decided. This type of estimate could require as much as one day to complete. Accuracy is expected to be plus or minus 10%.
- **Unit price estimate.** Working drawings and full specifications are required to complete a unit price estimate. It is the most accurate of the four types but is also the most time consuming. Used primarily for bidding purposes, the accuracy of a unit price estimate can be plus or minus 5%.

As an estimator *and* his or her company gain repetitive experience on similar or identical projects, the accuracy of all four types of estimates will improve dramatically. In fact, given enough experience and the historical data backup, *square foot* estimates can be extremely accurate for certain types of work. However, most prudent contractors would never sign a contract based on a square foot price for the electrical scope of the work without some wiggle room. Unit price estimates are still the method of choice for competitive bidding leading to contract.

ORDER OF MAGNITUDE ESTIMATES

The order of magnitude estimate, also called a *rough order of magnitude (ROM) estimate,* can be completed with a minimum amount of information and a small expenditure of time. The units of measure, described in Chapter 1, "Components of an Estimate," can be very general for this type of estimate and require little definition. The units of measure are frequently units not typical to the construction industry and are used for cost-benefit analysis and very early decision making. For example, the cost of electrical work for a residential apartment building can be provided in a cost per apartment.

This type of ROM estimate can be made after a few minutes of analysis, drawing on experience and historical data from similar past projects. While this ROM might be appropriate for initial decision making, it does not take into account the uniqueness of individual projects. Experienced electrical contractors with historical data from similar projects can distill the total project cost into units of measure that are at their most basic. For example, the total electrical cost for an apartment complex could be provided in terms of the number of apartments in the complex. For parties with no historical cost data from which to draw, there are sources of published cost data that can provide data that can be the basis of a ROM estimate.

Table 2.1 and 2.2, from *Means Electrical Cost Data*, is a source of data that can be used in generating early ROM estimates. As previously stated, this cost data is in a unit of measure that is representative of the type and use of the project. As an

Table 2.1 Order of Magnitude Data (Lines 9000 and 9500)

50 17 | Square Foot Costs

	50 17 00 | SF Costs		UNIT	UNIT COSTS 1/4	UNIT COSTS MEDIAN	UNIT COSTS 3/4	% OF TOTAL 1/4	% OF TOTAL MEDIAN	% OF TOTAL 3/4	
01	0010	**APARTMENTS Low-Rise (1 to 3 story)**	SF	73	92.50	123				01
	0020	Total project cost	CF	6.55	8.70	10.75				
	0100	Site work	SF	5.35	8.55	15	6.05%	10.55%	13.95%	
	0500	Masonry		1.44	3.55	5.80	1.54%	3.92%	6.50%	
	1500	Finishes		7.75	10.65	13.15	9.05%	10.75%	12.85%	
	1800	Equipment		2.40	3.63	5.40	2.71%	3.99%	5.95%	
	2720	Plumbing		5.70	7.30	9.30	6.65%	8.95%	10.05%	
	2770	Heating, ventilating, air conditioning		3.63	4.47	6.55	4.20%	5.60%	7.60%	
	2900	Electrical		4.25	5.65	7.65	5.20%	6.65%	8.35%	
	3100	Total: Mechanical & Electrical		15.10	19.60	24	16.05%	18.20%	23%	
	9000	Per apartment unit, total cost	Apt.	68,000	104,000	153,500				
	9500	Total: Mechanical & Electrical	"	12,900	20,300	26,500				

Source: Reprinted with permission from Reed Construction Data from *RSMeans Electrical Cost Data 2014.*

example, refer to the bottom of the category titled *APARTMENTS Low-Rise (1 to 3 Story)*. The proposed use and magnitude of the planned structure—such as the desired number of apartments in an apartment complex—may be the only parameters known at the time the ROM Estimate is done. The data given in Table 2.2 does not require that details of the proposed project be known to determine rough costs; the only required information is the intended use and capacity of the building. The lack of accuracy can be subsidized with the addition of a contingency of 20% to 25%.

SQUARE FOOT ESTIMATES

Another type of estimate requires more definition to the project. In addition to the building's use or type, the definition is provided in the form of its size in gross square area of the building. This type of estimate is called the *square foot estimate.* The use of square foot estimates is most appropriate after the conceptual design has been started and maybe only a floor plan and elevation exist, although these types of estimates can be applied in the absence of any plans. This allows early cost estimates to be generated and budgetary parameters to be set.

For the electrical contractor with the historical data and experience, he or she can translate total project costs into dollars per gross square foot of building. The best source of square foot costs is the estimator's own cost records for similar projects, adjusted to the parameters of the project at hand. Once again, this is a preliminary estimate and not meant to be the cost basis of a contract.

Table 2.2 Square Foot Cost Data

50 17 | Square Foot Costs

	50 17 00 | SF Costs		UNIT	UNIT COSTS 1/4	UNIT COSTS MEDIAN	UNIT COSTS 3/4	% OF TOTAL 1/4	% OF TOTAL MEDIAN	% OF TOTAL 3/4	
01	0010	**APARTMENTS Low-Rise (1 to 3 story)**	SF	73	92.50	123				01
	0020	Total project cost	CF	6.55	8.70	10.75				
	0100	Site work	SF	5.35	8.55	15	6.05%	10.55%	13.95%	
	0500	Masonry		1.44	3.55	5.80	1.54%	3.92%	6.50%	
	1500	Finishes		7.75	10.65	13.15	9.05%	10.75%	12.85%	
	1800	Equipment		2.40	3.63	5.40	2.71%	3.99%	5.95%	
	2720	Plumbing		5.70	7.30	9.30	6.65%	8.95%	10.05%	
	2770	Heating, ventilating, air conditioning		3.63	4.47	6.55	4.20%	5.60%	7.60%	
	2900	Electrical		4.25	5.65	7.65	5.20%	6.65%	8.35%	
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