

THE ELEMENTS OF SPECIFICATION WRITING

A TEXT-BOOK FOR STUDENTS IN
CIVIL ENGINEERING

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PREFACE TO THE FOURTH EDITION

In rewriting this work the author has retained substantially its original form, but has incorporated considerable new material into almost every chapter. The chapter, "Torts and Independent Contractor," is entirely new and serves to emphasize the legal background of a number of the general clauses. The chapter on contracts has been materially expanded. Rearrangement of subject matter in other chapters has secured added clearness and certainty of emphasis. Obsolete references have been eliminated and more recent ones added. Typical clauses in use at the moment have been substituted for older and less satisfactory ones. The number of footnotes has been decidedly reduced. Some new problem material has been included.

The author records with gratitude the fact that Professor Fleming James, Jr., of the Yale School of Law, has read and criticized constructively several chapters, especially Chapter V, also that Professor Lauren E. Seeley, of the Yale School of Engineering, has furnished helpful comment.

RICHARD SHELTON KIRBY

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EXTRACTS FROM PREFACE TO THE FIRST EDITION (1913)

This book is a textbook on the art of specification writing, not a collection of specifications. While intended primarily for the classroom, it should prove of value to the young engineer in practice. . . .

The fundamentals of a contract, particularly of a construction contract with its attendant plans and specifications . . . are concisely brought out. . . .

The general clauses are given thorough exposition from an engineer's viewpoint. Many interesting cases illustrating their application to actual construction work are cited and discussed. . . . Model clauses are quoted. . . .

To secure the maximum of efficiency in the use of the book as a text it is suggested that the instructor gather . . . a carefully selected assortment of specifications for collateral use by the class.

The most important changes in the second and third editions were the inclusion of problem material, the increase in the number of concrete illustrations, the expansion of Chapters I and IV and the addition of "Questions for Discussion" at the end of each chapter.

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THE ELEMENTS OF SPECIFICATION WRITING

CHAPTER I

INTRODUCTION

Necessary to the writer of specifications is an understanding of certain business relations which may have a bearing on both their subject matter and their phraseology. In this preliminary chapter the various cost-plus arrangements are compared with one another and with the older and more common type of contract

1. Construction Work Classified. Engineering construction projects may be, and are, carried out under several well-recognized varieties or types of business arrangements between those who plan the work, those who supervise the actual construction and those who pay for it. For the sake of brevity we shall make frequent use of the term "Owner" as referring to the person, firm, private corporation or public corporation for whom construction work is done. Although important work not infrequently necessitates, in these days, the coöperation of engineers in many capacities, we shall use the word "Engineer" in speaking of the Engineer employed by the Owner.

(a) The Engineer may, as agent of the Owner, direct all operations, even to purchasing the materials and paying the workmen. The Panama Canal and the Los Angeles Aqueduct were constructed under such an arrangement. The Corps of Engineers of the United States Army, various railroad corporations and some municipalities carry on a portion of their construction work under this or a slightly different plan. Fed-

eral relief projects begun in 1933 and 1934 were carried on under such a plan. Of the 92 miles of tunnels on the Colorado River Aqueduct nearly 34 miles are being bored in this way. The term "*force account*" is generally applied to this arrangement, which is a very flexible one, but one to which slight reference will hereafter be made in this book.

(b) A modification of the above plan consists in the employment by the "Owner" of a third person, called a "Contractor,"* who agrees to furnish whatever material and labor is from time to time needed and to direct the work (under the Engineer's supervision), in return for which he agrees to accept as payment an amount slightly greater than the cost to him. This is commonly called having a piece of construction done by "*cost plus*," although the term "*day's work*" has been applied to it. According to the terms of the agreement, the price paid the "Contractor" may be related to the cost to him in one of three ways, namely:

(i) *Cost-plus-a-percentage*. With this arrangement the price paid by the Owner is computed by summing up the cost, to the Contractor, of materials and labor (with sometimes a further allowance for incidental expenses such as depreciation, office rent and other overhead charges) and adding to this sum an agreed percentage of profit. A number of miles of extra trackage was once added to the elevated railway system of New York City at a cost of some \$8,000,000. It was constructed by three contractors at cost plus 15 per cent.

(ii) *Cost-plus-a-fixed-sum*. This varies from (i) simply in that the amount added is a prearranged sum, not a prearranged fraction of the cost.

(iii) *Cost-plus-with-a-"sliding-scale-of-profits,"* or a "division of savings," or a "variable premium." These are various plans which differ slightly in details. All, however, guarantee the Contractor a minimum profit which increases as he reduces

*The ancient term "undertaker" was much more expressive; it is related to the French *entrepreneur*.

the cost to the Owner; this obviously makes it to the interest of the Contractor as well as of the Owner to keep the costs down. Among recent large projects carried on under an arrangement of this type were portions of the River des Peres drainage works at St. Louis, Missouri.

The following illustrates one plan. Suppose that, in the Engineer's opinion, a reasonable figure for a piece of construction work would be \$10,000. The Contractor agrees, however, to undertake it, furnishing all materials, tools, labor, etc., for actual cost to him, plus 15 per cent of such cost, plus or minus a variable amount which is to be computed as follows. If this cost plus 15 per cent proves to be less than \$10,000, the saving is to be shared equally between Owner and Contractor. But if the cost plus 15 per cent exceeds \$10,000, half of this excess is to be borne by the Contractor, i.e., deducted from his 15 per cent, and half is to be borne by the Owner. The Contractor's profits, moreover, are not to be less than 10 per cent, nor greater than 20 per cent. A table of prices will illustrate this arrangement.

Actual Cost to Contractor	Contractor's Profit	Owner Pays Contractor
\$7,500.00	\$1,500.00 = 20%	\$9,000.00
8,000.00	1,600.00 = 20%	9,600.00
8,500.00	1,387.50 = 16.3%	9,887.50
8,695.65	1,304.35 = 15%	10,000.00
9,000.00	1,175.00 = 13.1%	10,175.00
9,523.75	952.38 = 10%	10,476.16
10,000.00	1,000.00 = 10%	11,000.00

Another Cost-Plus Arrangement

The following was used on a contract for the construction of a dam. A "base (net) price" of \$700,000 was fixed, with the Contractor's fee of 10 per cent (more or less). In addition, a fixed amount of \$20,000 was allowed to cover plant charges. The actual price paid the Contractor was to be adjusted as follows. If the net cost exceeded the base price, the Contractor's fee was to be 10 per cent minus 20 per cent of this excess. However, this deduction was never to be more than half of the 10 per cent. If the actual net cost proved to be less than the base price, the fee was to be 10 per cent plus 20 per cent of the difference. Apparently a maximum price of \$975,000 was also fixed. The student may prepare a table similar to that above, illustrating this arrangement, and diagrams based on the table.

(c) *Comparison of cost-plus plans.* Opinions concerning

the merits of cost-plus contracts differ.* The principal advantages claimed for them are fairness, flexibility and centralization of power. It may be said of the plan in general, but particularly of cost-plus-a-percentage, that if no necessity exists for fixing in advance a maximum allowance either of time or of money, and if unlimited confidence can be placed in the ability, energy and reliability of the Contractor, it is ideal. It is especially applicable to emergencies such as confront governments in time of war or water companies during prolonged droughts; to projects the extent and nature of which cannot well be foreseen, such as some forms of subaqueous construction; to work of a hazardous or experimental nature; and to work which is to extend over a long period of time and which must be undertaken while wages and prices of materials are advancing steadily and the supply of either or both is uncertain.

The objection to (i) is that at its worst it leads to extravagance, padded pay-rolls and other forms of dishonesty on the part of the Contractor, and sometimes doubtless to inefficiency on the part of labor, while at its best it offers no definite premium for economy and careful management. The advantage of (ii) over (i) is a negative one, in that, since his profit no longer varies with the cost, no temptation is offered the Contractor to increase the cost. A considerable number of buildings have been built in the United States on a cost-plus-a-fixed-sum basis during recent years, but it has not been to any extent applied to other construction work.

The plan of (iii) has been devised and used comparatively recently; though it is becoming increasingly common it may yet be considered as somewhat experimental. Its advantage

* The late Brig.-Gen. R. C. Marshall, Jr., when chief of the construction division of the War Department, in urging the advantages of cost-plus, once said, "The next great lesson [of the war] is that bearing upon the relationship between the Contractor and the Owner. No contractor should be called upon or allowed to undertake the performance of any contract such that within the four corners of the paper upon which it appears is, or may be, written the financial bankruptcy of the Contractor. It is unjust, it is inequitable, it is uneconomic."

over (ii) is that it furnishes the Contractor a positive incentive for economy and efficiency.

Under any cost-plus plan it is necessary to examine and check the Contractor's accounts; this may prove to be a troublesome and expensive procedure. It is sometimes argued that the so-called "cost-plus-with-a-guaranteed-maximum" arrangement is to be condemned as either misleading or inequitable.

In case the Owner is a public corporation, that is, a local, state or national government, any cost-plus arrangement is, in most localities and under ordinary circumstances, unlawful.

(d) Much the larger proportion of construction can be classed as "*contract work*." This is a convenient term for that which is carried on under an agreement by which the Owner pays the Contractor a definite sum for his work (or for each separate part), regardless of the Contractor's profits. In contract work, although the Owner's interests are still looked after by the Engineer, much of the responsibility for the execution of the work is shifted to the Contractor's shoulders.

2. Arguments For and Against Cost-Plus. From an Owner's standpoint the arguments commonly advanced may be classified briefly under the following four heads. A few of the arguments apply with somewhat more force to the first two forms of cost-plus than to the last.

(a) *Economy.*

For. The preliminary outlay for advertising is usually unnecessary in cost-plus. The usual cost-plus profit (10-20 per cent) is reasonable, while the profits on some "contract" work, notably in cases where there was no *bona fide* competition, have been exorbitant.* The Owner is not obliged

* The student should realize that a reasonable percentage is legitimate profit. Further than this, a Contractor is perfectly justified, as his contract progresses, in endeavoring to increase his net profits by wise planning, careful supervision and economy—not by slighting his work or by attempting to substitute inferior workmanship or materials. The best work is not necessarily that which has proved most costly to the Contractor.

to pay for insurance against contingencies which may never arise. He may find opportunity to economize by taking advantage of favorable market conditions.

Against. Competitive bidding on a cost-plus basis is difficult to secure. More account keeping is necessary. The project is apt to be less clean-cut and definite, hence certain economies cannot always be effected. The Owner pays for the Contractor's mistakes as well as his own. The total cost of cost-plus work cannot well be predicted.

(b) Speed.

For. The time spent in preliminary investigations and in getting in bids may be saved. By increasing the working force, a project may be rushed to completion almost at the Owner's pleasure.

Against. The average laborer does not work as hard under cost-plus. The Contractor suffers no particular loss if he is dilatory. Even if cost-plus work is accelerated, haste often means waste, and may result in poor construction.* If no certain time is set for completion, any construction work is likely to drag.

(c) Flexibility.

For. Any portion of the design may be altered as often and as radically as the Owner wishes. Experiments may be tried at will, perhaps with resulting betterments or economies. "Extra work" evils are avoided.

Against. Frequent changes, when due to lack of intelligent planning, may involve waste of effort and consequent loss to the Owner.

(d) Fairness.

For. A fair profit is assured the Contractor, even in an unstable labor and materials market.

Against. There is at least a temptation to padded payrolls. Inferior work must be replaced at the expense of the Owner.

* Not necessarily, however, for it is true that most kinds of construction can be done either rapidly and poorly or rapidly and well.

3. Contract Documents. In connection with a single piece of construction work done under contract it is frequently necessary to prepare, in addition to the plans, six documents, *viz.:*

- (a) Advertisement (or Notice to Contractors).
- (b) Information for Bidders.
- (c) Form of Proposal.
- (d) Contract.
- (e) Bond (or Bonds).
- (f) Specifications.

The responsibility for the preparation of (b), (c) and (f) should, and usually does, rest entirely with the Engineer, and he is generally expected either to prepare portions of the others, or at least to be familiar with their contents. On work of any magnitude the contract proper should be framed entirely by the Owner's legal adviser, or be subject to his approval, while the bond is essentially a legal matter.

If the magnitude and importance of the work warrant the extra expense involved, all these documents, generally excepting the advertisement, are printed and bound together in pamphlet form. The best practice is tending away from the ancient and cumbersome legal cap form, bound at the top, toward a much more convenient form six or eight inches wide and nine or ten high, bound at the left-hand edge like an ordinary book.

Marginal headings, numbered sections or paragraphs (using perhaps a decimal classification), an index and the intelligent selection of type, when used in connection with this improved form, should make it possible for one to refer to any portion of the composite document with the minimum expenditure of time and effort.

Another recent innovation is the loose-leaf form, which affords flexibility, adaptability to various projects, and economy, but is not universally favored. Reducing the page to pocket size (about five by eight inches or even smaller) has some further advantages.

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CHAPTER II

ADVERTISEMENT (OR NOTICE TO CONTRACTORS) AND INFORMATION FOR BIDDERS

This chapter treats of advertising, more particularly as applied to public work. The essential features of the Advertisement and its sequel, the Information for Bidders, are discussed.

4. **Necessity for Advertising.** Unless circumstances are exceptional, contracts for engineering construction work are let only after a more or less extensive competition among contractors, which is secured by inviting a number of them each to submit a formal offer to do the work.

(a) If the work is unimportant, not likely to attract a large number of prospective bidders and is to be done for private individuals or corporations, contractors may be communicated with somewhat informally.* For example, the Engineer or the Owner may speak or write to those who they think will be interested. Where the work is of some magnitude, however, this method may be neither strictly fair to all contractors nor most advantageous to the Owner, and the plan outlined in (b) may be more or less completely followed.

(b) In connection with work where the Owner is a public corporation (as a borough, village, town, city, county, state or nation) it is by law or ordinance generally provided that a wide and formal invitation be given through the public prints to all interested. This formal invitation is called an Advertisement, or Notice to Contractors. It is common to except work of a trivial nature (involving the expenditure of only a

* Public service and other corporations, as well as private persons, do, of course, advertise when it appears to them advisable.

few hundred dollars) and sometimes emergency work—although the word emergency may be subject to varying interpretations. Some ordinances provide also that copies of the Advertisement be posted in certain public places. Further than this it is frequently desirable, and some local ordinances so provide, that the Advertisement be published in one or more of the technical papers which have a circulation among contractors likely to be interested. The Advertisement should first appear a sufficiently long time in advance to give prospective bidders a reasonable period in which to make their necessary business arrangements. Less than two or three weeks is seldom sufficient. On extensive and complicated contracts, if longer periods are allowed, lower bids will often result. The Advertisement should appear at stated intervals during the period.*

A typical city ordinance relating to the advertisement of public work follows:

All contracts to be made or let for work to be done or for supplies to be furnished to said City, except . . . , shall be made by the departments, boards, or by the officers having the subject matter in charge. Whenever any work is necessary to be done to execute or perfect a particular undertaking, or any supply is needed for any particular purpose, and the several parts of the said work or supplies shall together involve the expenditure of more than two hundred and fifty dollars, a written contract for such work shall be made . . . , which contract shall be founded on sealed bids or proposals, . . . , made in compliance with public notice, duly advertised by publication, at least ten days before the time fixed for opening said bids or proposals, . . . provided, however, that all street cleaning, general repairs and general maintenance of the highways in said city may be performed at the expense of said city under the supervision of the proper department thereof without calling for any bids or making any contract.

* Major Gillette (*Eng. News*, 1907, v. 57, p. 587) cites an instance in which public work aggregating \$4,000,000 was advertised 18 days in obscure papers. He says that \$9 out of every \$10 which the city paid out as a result of this practice was wasted. Fortunately for the taxpayers the contract was broken before more than a fraction of the work had been performed.