

Construction Estimations Writing Principles and Procedures

Rosen &
Heineman

CONSTRUCTION SPECIFICATIONS WRITING

Principles and Procedures

THIRD EDITION

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M. D. MORRIS, P.E.
Series Editor

*Ithaca, New York
November 1989*

P R E F A C E

Tom Heineman joins me in this third edition in spelling out the advances occurring in construction specification writing.

The major changes in specification writing in the 1960s and 1970s have solidified as commonly accepted good practice throughout North America. All the same, as this edition is put together, intense development in several aspects of specifying is under way. Some chapters describe this ongoing change. The efforts to shorten text, to fine tune general conditions to the needs of the times, to provide comprehensive master texts, to use the computer to greater effect, and to link specifications to important databases and to other parts of the design process are among the important trends that the authors have touched upon.

The education of the specifier takes place almost entirely outside of the traditional four- or five-year college curriculum. It appears that the number of architects and engineers who are undergoing training on the board, in the field, at the word processor, and in continuing education is not equal to the need for skilled specifiers in new and existing practices. Several of the chapters of this edition touch upon the ways in which this slack is being taken up by simplifying the

specifying process: the establishment of clear guides by which to organize the documents, the consolidating of Federal government systems, the publishing of comprehensive, well researched master texts, further automating of specifications, the movement to shorter, pithier text, the use of fulltime independent specifications consultants, and the emergence of knowledge-based specifying systems.

With all that is underway to make specifying easier, the education of the specifier is still the crucial element in assuring good specifications. The knowledge of materials and methods; the experience of the building process, and the love of good design are the foundation of this architectural and engineering subdiscipline. We hope that the subjects presented in this book will set out the course of study for what else the specifier needs to build well.

HAROLD J. ROSEN

*Coconut Creek, Florida
October 1989*

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secured. Generally, there are four different types of specifications: descriptive, performance, proprietary, and reference.

6. *Specifications Writing Techniques.* These techniques involve the use of scope clauses, the work of other sections, the use of "or equal" or base bid specifications, the avoidance of duplication and repetition, and the use of the residual legatee technique.

PROCEDURES

In broad terms, the procedures to be followed are based on standards developed by the American Institute of Architects (AIA), the Construction Specifications Institute (CSI), and by systems developed by the authors and by others from whom they have borrowed heavily. These include the following:

1. *General Requirements.* These are nonlegal, non-technical portions of the specifications which are described in detail in Division 1 of the CSI 16-division *Masterformat*.

2. *Specifying Materials.* This procedure deals with the approach to writing open, closed, or base bid specifications for materials and products, citing the advantages and disadvantages of each system.

3. *Specification Language.* The use of clear technical language that can be understood by contractors, superin-

tendents, and foremen is imperative. Legal phraseology or highly stilted formal terms and sentences are to be avoided. Sentences should be clear and concise; they should be written in simple terms to avoid misunderstanding. Sentence structure, punctuation, and the phraseology used in specification writing are an art in themselves.

4. *Specification Reference Sources.* Knowing where to look for information to be used in specifications is quite important. Materials standards have been established by the federal government, the American Society for Testing and Materials, the American National Standards Institute, and others. Association standards have been developed by materials manufacturers and subcontractors for materials and workmanship. Many textbooks on specification writing are available for reference purposes. Guide specifications are available from CSI and AIA, and several specification studies are available from the CSI.

5. *Materials Evaluation.* A systematic approach to the evaluation of materials is outlined suggesting the parameters to review in evaluating and selecting materials.

6. *Specification Writing Procedures.* A guide is recommended for the procedure to be used in gathering information, research, and writing to dovetail the completion of the specifications with the finalization of the drawings.

This book is intended to be an elaboration of the principles and procedures above, and it is designed for the student as well as those currently engaged in writing specifications.

PART ONE

PRINCIPLES

The Role of the Specifications

Whenever an architect or an engineer is commissioned by an owner to design a building or a structure, he must develop three basic documents which a third party, the contractor, must use when he undertakes to build the structure. These three basic documents are the drawings, the conditions of the contract, and the specifications. Together with certain additional documents as hereinafter enumerated, they constitute the contract documents.

CONTRACT DOCUMENTS

Project Manual

The *contract documents* consist of the following instruments:

- ① *Agreement.* A written agreement between the owner and contractor setting forth the work to be performed, the time for completion, and the contract sum.
- ② *Conditions of the Contract.* These consist of the general conditions, supplementary conditions, and other conditions (see Chapter 11).
- ③ *Drawings.* The graphic presentation of work to be done.
- ④ *Specifications.* Written, verbal description of work to be performed. (*Technical*)
- ⑤ *Addenda.* Changes made before contract execution.
- ⑥ *Modifications.* Instructions, change orders, directives, and so on, written after execution of the contract.

Quite often the term *construction documents* is used as a synonym for contract documents.

BIDDING DOCUMENTS

Bidding documents is a term generally used to describe the documents furnished to bidders. They include not only the

contract documents, but also the bidding requirements (see Chapter 9).

SPECIFICATIONS

The AIA classifies specifications as one of the contract documents—one of the necessary constituent elements of the contract. As one of the major contract documents, it is imperative that practicing architects and engineers have a very good working knowledge of the role that specifications play.

Whether the specifications are written by a specifier in a large office or by the job captain or architect and engineer in a small office, they are used by a diverse group of participants. ~~To begin with, they are written for the contractor to tell him how to construct, manage, and direct the construction.~~ ^{NOT} They are also written for the estimator in the contractor's office, who prepares the estimate based on the specifications. They are written for the purchasing agent in the contractor's office, who procures the materials and equipment described in the specifications. They are written for the resident project representative or inspector, who must be given a document that can aid him in inspecting and controlling the work. They are written for the owner, who would like to know what he is buying and what he is entitled to receive. They are written for the subcontractors so that each can readily discern the scope of his subcontract. They are written for the manufacturers of building materials and equipment so that the grade and type are clearly defined with respect to the many variations they may manufacture.

Webster's Unabridged Dictionary gives the following definition of the term *specifications*: "Specifications (usually plural)—A written or printed description of work to be done, forming part of the contract and describing qualities

of material and mode of construction, and also giving dimensions and other information not shown in the drawings.” But the dictionary description does not suffice. As we explore the full meaning of the term, we discover many areas solely within the province of the specifications that extend far beyond a mere elaboration of the drawings.

For example, the specifications alone, as a contract document prepared by the architect, set forth legal requirements, insurance requirements, bidding procedures, alternates, options, subcontractor limits, contractor limits, and inspection and testing procedures. In many instances, design decisions cannot be shown on the drawings, and the specifications are the only vehicle through which these design considerations can be transmitted to the contractor. The following list illustrates the functions of the specifications:

1. *Legal Considerations*

a. The courts have generally held that in the event of conflict between drawings and specifications, the specifications, as a written document, govern. Judgments are most frequently resolved on the basis of the specification requirements.

b. General conditions, whether they consist of AIA standard preprinted forms, federal, state, or municipal forms, Engineers Joint Contract Documents Committee forms, or individually prepared general conditions, are usually bound with the specifications and, by reference, made a part of the specifications. The content and role of the general conditions are elaborated on separately. Essentially, however, they establish the legal rights, responsibilities, and relationships of the parties to the contract.

2. *Insurance Considerations.* Insurance requirements governing owner’s liability, contractor’s liability, and fire insurance are usually incorporated in the general conditions or in supplementary conditions and, again, made a part of the specifications by incorporation therein.

3. *Bidding Requirements.* The bidding requirements include the Invitation to Bid, the Instructions to Bidders, the Bid Form, and the Bid Bond. These bidding requirements are developed by the architect solely for the use of the bidder and are intended to provide the bidder with information required to submit a proposal. These are usually bound with the specifications.

4. *Alternates, Options*

a. The specifications provide a basis for the contractor’s estimate and the submission of a bid. Alternates are established by the architect and owner for the deletion of work, the addition of work, and for the substitution of materials. Alternates are listed in the Bid Form.

b. The technical specifications may permit the contractor, *at his option*, to use one of several materials or

manufacturers’ brands specified for use in the work. By selecting and specifying materials or products that are comparable and satisfactory to the specifier, the contractor is offered the option of using any one of those specified.

5. *Subcontractor’s Limits.* Drawings generally show all of the work to be done and the interrelationship of the various parts. No attempt is made on the drawings to segregate the work of the several subcontractors, except that separate drawings are generally prepared for plumbing, heating, ventilation and air conditioning, and electrical work. The specifications segregate the work shown on the drawings into many sections, or units of work, to aid the general contractor unobscuring the work to various subcontractors.

6. *Contractor Limits.* When several prime contracts are desired, as mandated by either state, federal, or municipal agencies or an owner’s requirements, the specifications, primarily in Division 1, General Requirements, will establish the limits of each prime contract.

7. *Inspection and Testing Procedures (Quality Control).* The specifications establish inspection and testing procedures to be followed during the construction operations. Standards for office and field inspection are described for numerous materials and building systems. Test procedures are given for evaluating the performance of completed mechanical installations.

8. *Design Criteria.* In some instances the drawings cannot be used to show or delineate design decisions. For example, the architect’s selection of finish hardware for doors can be described only in the specifications. Specifications for paint materials, the number of coats of paint, and the degree of luster or sheen are similarly given only in the specifications.

PROJECT MANUAL

Everyone associated with the design profession (architects, engineers, and specifiers), as well as those involved in construction (contractors, subcontractors, and materials manufacturers), use the term “specifications” when referring to the written document that accompanies drawings. The definition has prevailed for years, even though this particular book contains some documents that cannot be strictly classified as specifications.

Some specifiers say that specifications are only the technical sections. Others state that the specifications constitute everything between the two covers of a book. The material usually bound in a book includes an Invitation to Bid, Instructions to Bidders, a Bid Form (or Proposal Form), a standard preprinted form of general conditions, supplementary conditions, a form of agreement, and forms for Bid Bonds, Payment Bonds, and Labor and Materials Bonds.

The inability to define specifications properly lies both in the failure to define many of the documents used in

construction and in the absence of any authoritative source establishing precise definitions. The terms "construction documents" and "contract documents" are sometimes used interchangeably. Although contract documents are defined in the *AIA General Conditions*, a definition for construction documents is nonexistent. The term "bidding documents" has been used rather loosely in the past. Some have employed it to mean the drawings and specifications available to bidders in preparing a bid; others have used it to mean the bidding requirements.

The bidding requirements are now defined by both AIA and CSI as including the Invitation to Bid, the Instructions to Bidders, and the Bid Form, together with certain sample forms such as Bid Bond, Performance and Payment Bonds, and similar documents.

The agreement on the definition of bidding requirements resolved somewhat the proper terms to be used for the parts that constitute these documents. Advertisement to Bid, Notice to Bidders, and Notification to Contractors have been used in place of the recently adopted term "Invitation to Bid." Other terms used for Instructions to Bidders have included Information for Bidders and Conditions of Bid. The terms "Bid Form" and "Proposal Form" have also been used extensively in the past. CSI documents and AIA documents now call it Bid Form.

Confronted by this profusion of terms, the profession is making progress in redefining some documents. In an attempt to clarify the various documents prepared by architects for detailing, specifying, bidding, and constructing a project, the AIA, through a national Committee on Specifications in 1965, produced the "Project Manual" concept.

The *Project Manual* concept is, in its simplest terms, a reorganization and renaming of that familiar book of bidding forms and contract documents, usually referred to as the "Specifications" or "Specs," which, along with the drawings are the documentary basis for all construction projects.

The Project Manual contains a great deal more than specifications. It normally includes the Bidding Requirements, that is, invitation, instructions, sample bid; bond and agreement forms; general and supplementary conditions; and information on alternate and unit prices, in addition to the *technical specifications* describing the materials and performance expected in the construction of the project. The book also frequently contains a schedule of the drawings pertaining to the project. The book is indeed a *manual of project bidding* requirements and contract documents.

While the Bidding Requirements are not part of the contract documents, for convenience they are assembled and bound with the technical specifications into a Project Manual.

By designating all of the written material as a Project Manual, as opposed to the graphic material which is designated as the drawings, the volume still known and referred to by many as the specifications is better described as a Project Manual.

The materials included in the Project Manual fall into two general categories: (1) those describing the requirements for bidding and (2) those that become part of the contract documents upon the signing of the construction contract. Within each of these two categories, all of the familiar instructions, forms, and the like are organized.

The sequence recommended for the material to be bound in the Project Manual is as follows:

Title Page
Table of Contents
Addenda (if bound in Project Manual)
Bidding Requirements
Invitation to Bid
Instructions to Bidders
Information Available to Bidders
Sample Forms
Agreement
Bid Form
Bid Bond
Performance and Payment Bonds
→ Other Sample Forms
Conditions of the Contract
General Conditions
Supplementary Conditions
Schedule of Drawings
Technical Specifications
Divisions 1 through 16

The term "specifications" has been used for a long time to describe the bound volume, and many specifiers are loathe to change, or to use the new term. We should be realistic, however, and recognize that some of the documents bound in the old familiar volume are not specifications, and that we cannot continue to refer to this volume as such.

Relationship between Drawings and Specifications

WHAT GOES WHERE

The information that is necessary for the construction of any structure is usually developed by the architect by means of two basic documents: the drawings and the specifications. These two documents represent a means of communication of information between architect and contractor, but each document uses a special form of communication: one pictorial and the other verbal. Yet, in spite of these distinct methods of transmitting information, the documents should complement one another, and neither should overlap or duplicate the other. In this way, each document fulfills its own function. In broad terms, the drawings are a graphical portrayal, and the specifications are a written description of the legal and technical requirements forming the contract documents. Each should convey its own part of the story completely, and neither should repeat any part that properly belongs to the other, since duplication can very often result in differences of meaning.

Specifications are, by their very nature, a device for organizing the information depicted on the drawings. The drawings show the interrelationship of all the parts that go together to make the grand design. It has only been since about 1900 that mechanical, electrical, and structural information has been shown on separate drawings. All the general construction details are shown on drawings as they relate to one another, with no attempt to separate diverse materials. It is the specifications that break down the interrelated information shown on drawings into separate, organized, and orderly units of work, which we refer to as *technical sections* of the specifications.

To maintain the separate yet complementary character of these two documents and to ensure that they will be interlocking but not overlapping requires the development of definite systems for each. Hence what is better described in the specifications should not be shown on the drawings and,

similarly, what is better shown on the drawings should not be described in the specifications.

DRAWINGS

Drawings present a picture, or a series of pictures, of the structure or parts of a structure to be erected. They give the size, form, location, and arrangement of the various elements. This information cannot be described in the specifications since it is graphically shown by means of lines, dots, and symbols peculiar to drawings. In fact, a drawing is a special language or means of communication to convey ideas of construction from one person to another. These ideas cannot be conveyed by the use of words.

Drawings should generally show the following information:

1. Extent, size, shape, and location of component parts.
2. Location of materials, equipment, and fixtures.
3. Detail and overall dimensions.
4. Interrelation of materials, equipment, and space.
5. Schedules of finishes, windows, and doors.
6. Sizes of equipment.
7. Identification of class of material at its location.
8. Physical extent of alternates.

SPECIFICATIONS

Chapter 1 sets forth in detail some of the more pertinent functions of the specifications. With respect to their relationship to drawings, the specifications complement the drawings by describing qualities of materials, systems, and equipment; workmanship on-site and off-site fabrication; and installation and erection.