محاضرات الدكتور /عادل السمادونى

١- مراحل تخطيط المشروعات.

٢- المواصفات فى صناعة التشييد.

٣- استخدام طريقة خط الاتزان فى تخطيط ومتابعة المشورعات.

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Contract Planning and Contractual Procedures

مراحل تخطيط المشروعات

1 THE PLANNING PROCESS

Planning procedures in the construction industry appear to vary widely between companies. They tend to be governed by the following factors

(1) The size and management structure of the business organisation. The size of the firm may be determined for statistical purposes by reference to its annual turnover or to the number of employees. It is only a guide and a convenience as the two may not correspond and a firm with a large turnover may have very little direct labour. Other factors include the magnitude and location of the work itself, its complexity in both technical and managerial terms, and the level of capability to which the firm aspires; these all influence organisation and control.

The construction team for a complex building project may represent a large manufacturing and marketing concern while on the other hand a labour intensive activity may call on little by way of plant and finance to support it.

In terms of planning and control the plan establishes production objectives, while control systems are designed to review performance in relation to them, and to report deviations which might call for action. Any communication gap between site activity and responsibility may call for action. A site which is visited frequently by the proprietor of the firm may result in planning and control being undertaken mainly verbally and informally, action being in response to a visit. Where decisions on finance, plant and staffing have to be made for distant sites a more detailed and complex control system is needed. In the latter case the objectives of the firm and its plans must be stated formally and in more detail.

Planning policy is thus a response to the firm's perception of its control needs and the objective standards it sets in order to achieve them.

(2) The type, nature and varying range of work undertaken. Many organisations limit the type of work undertaken or specialise in certain types of construction, e.g. a medium-sized company may specialise in housing work on a speculative or contract basis while others limit their work range to industrial projects.

(3) The planning policy within the organisation. This stems from the policy laid down by the principal or board of directors. This may arise from the awareness of senior managers towards planning objectives and may be related to the background or experience of individual members of the management team.

(4) The technical and managerial expertise represented by the company.

1.1 THE PLANNING STAGES INVOLVED IN THE CONSTRUCTION PROCESS

Stage 1: Pre-tender Planning

This is the planning carried out during the preparation of an estimate as a contribution to a tender or bid.

Recommended procedures of pre-tender planning are set out in the Institute of Building Code of Estimating Practice.[1]

The time period for carrying out pre-tender planning activities may vary from one week to three months, depending upon the nature of the enquiry.

The RIBA Code of Practice[2] recommends that a minimum period of four weeks should be allowed for the preparation of a realistic bid.

Stage 2: Pre-contract Planning

This is the planning which takes place after the award of a contract, immediately prior to the commencement of construction work on the project.

Again the time period for pre-contract planning activities varies widely. The date of possession of the site is normally stated in the contract documents. Time periods of up to six weeks are, however, common practice.

It is frequently a requirement of the contract that the client and architect should be furnished with a programme. This may be a presentation based on the contractor's own detailed programme. The purpose of this requirement is that the client should have some guide as to the intentions of the contractor. On the other hand, the contractor frequently enters key dates for the provision of information. The document later becomes reference material whenever claims arise from delays.

Stage 3: Contract Planning

This is the planning which takes place during the building process. It is the responsibility of the contractor to complete the contract within the specified time period. Contract planning activities establish standards against which progress can be reviewed at regular intervals during construction. To complete the project within the contract period demands action to correct for any shortfalls in such progress and contract planning is thus part of control. Control entails additional expense and thus the resources to be applied in its pursuit are judged in relation to the business risks involved. Figure 1.1 indicates the planning process encompassing the three stages involved.

THE PLANNING PROCESS

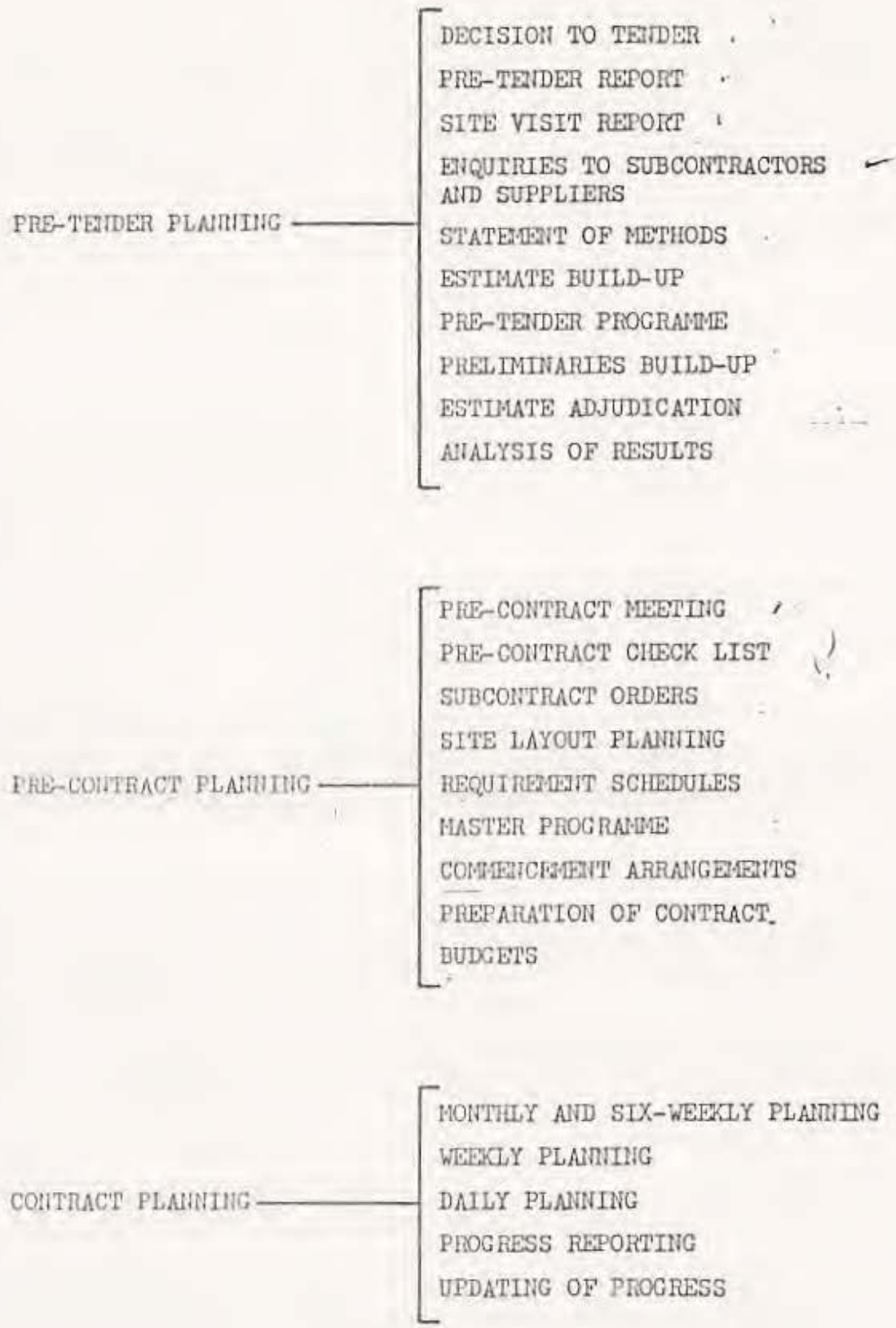

Figure 1.1

1.2 PRE-TENDER PLANNING STAGE

The preparation of an estimate and its ultimate adjudication to formulate a tender follows a similar process in most organisations.

The procedures used within a smaller organisation may, however, be less formal than in the more complex and larger one.

Larger organisations adopt a more formal approach to estimating as the responsibility is shared among a construction, estimating and buying team, with senior management adjudicating, e.g. deciding how to convert the estimated net cost into the price they wish to bid.

The stages involved during the preparation of an estimate are as follows

(1) The decision to tender
(2) The pre-tender report
(3) The site visit report
(4) Enquiries to subcontractors and suppliers
(5) The statement of construction methods
(6) The build-up of the estimate rates
(7) The pre-tender programme
(8) The preliminaries build-up
(9) The estimate adjudication
(10) Analysis of results

The above sequence of events takes place during the estimating process within the structure of the medium to large firm. The Institute of Building, within the Code of Estimating Practice,[1] illustrates various estimating forms which may be of assistance in standardising estimating procedures.

1.3 PRE-CONTRACT PLANNING STAGE

A contract is a commitment. When the contractor has accepted this, he must review the information available to him and establish his plan. Decisions must be made relating to the financing of the contract, the appointment of subcontractors and suppliers and the availability of information requirements and resources. Budgets, plans of action and programmes must be prepared. A cash flow assessment will indicate the funds which may be required to finance the contract, and the necessary loans can be raised.

The stages involved during pre-contract planning are

(1) The pre-contract report and meeting
(2) Pre-contract check list
(3) Placing of subcontracts - suppliers and subcontractors
(4) Site layout planning

(5) Schedules of requirements
(6) Preparation of master programme
(7) Arrangements for commencing work
(8) Preparation of contract budgets

Standard proformas can again be used for the various stages involved. The prospective site manager should become involved in the planning activities as these are, in effect, an attempt to formulate the method he will adopt. In particular the drawings and bills of quantities must be reviewed in order to assess essential requirements for the early stages of the contract, so that the immediate resources can be earmarked.

Budgets will be prepared in order to forecast cumulative value and cost. A cash flow assessment may be developed from budgetary control procedures and a valuation forecast prepared. Preliminaries and plant budgets can be prepared against which actual costs may be matched during the contract.

Without a plan against which to monitor performance, there can be no control. The terms in which the plan is stated are conditioned by the form of control which the firm proposes to exercise.

1.4 CONTRACT PLANNING

The stages involved in contract planning during a project may be summarised as follows

(1) Six-weekly and monthly planning review
(2) Weekly or short term planning
(3) Daily planning
(4) Monthly and weekly reports of progress
(5) Updating of progress and comparison of budget with performance

The contract planning stages of a contract enable requirements and progress to be reviewed monthly and weekly. Site meetings at monthly intervals with the architect, consultant and subcontractors form an integral part of the planning process. Weekly meetings at site foreman level aim at keeping the monthly programme under review by detailed planning of labour and plant resources for the next five-day period.

Figure 1.2 indicates the relationship between programmes prepared at the pre-tender, pre-contract and contract planning stages.

PROGRAMME RELATIONSHIPS

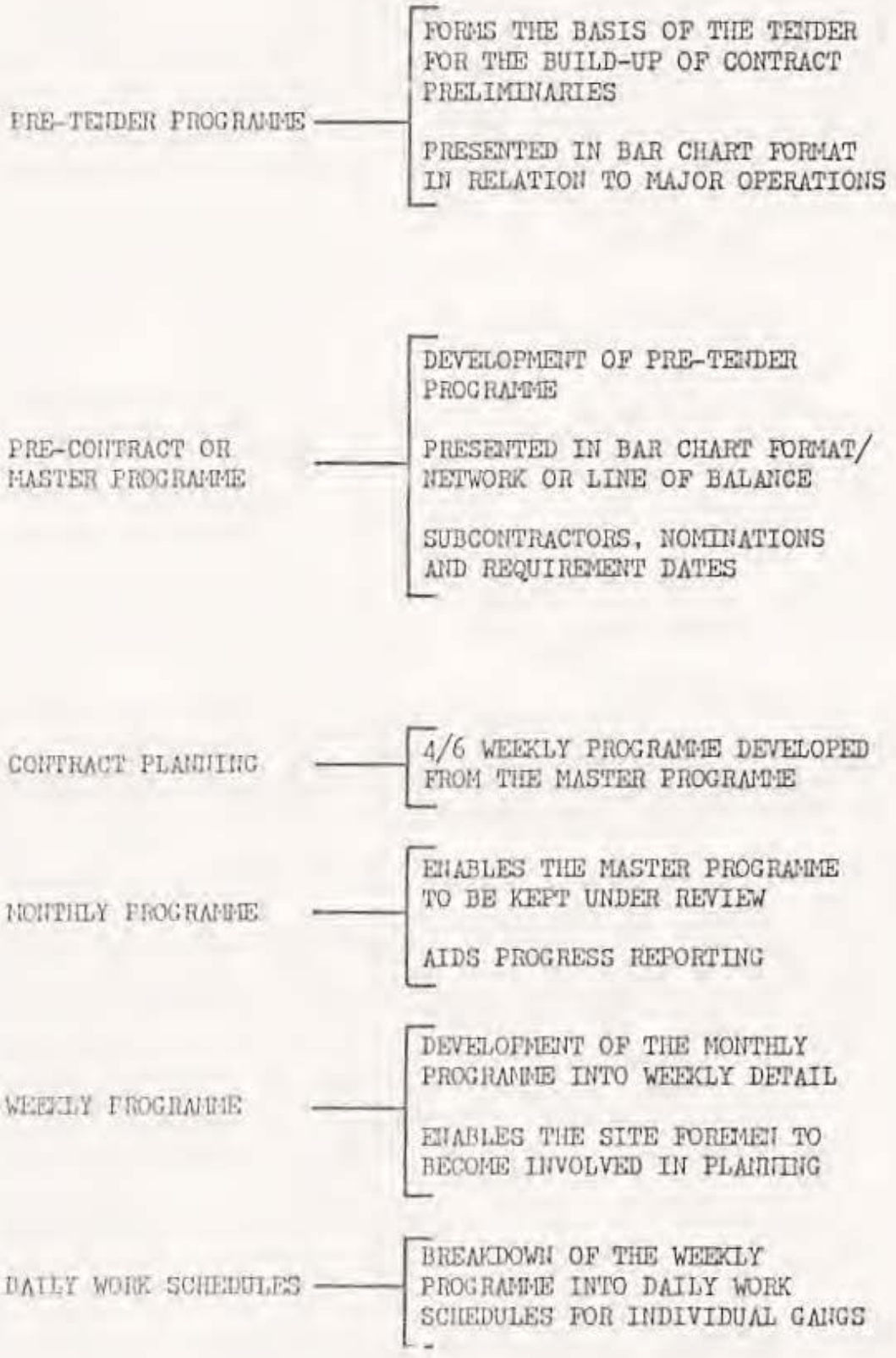

Figure 1.2

1. The Institute of Building Code of Estimating Practice Fourth Edition, 1979

2. National Joint Consultative Committee - Code of Procedure for Single Stage Selective Tendering, R.I.B.A. 1977

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المواصفات فى صناعة التشييد

Introduction to Principles and Procedures of Specifications Writing

A knowledge of specification writing principles and procedures is essential to the specifier in the architect's and engineeer's office in the preparation of sound, enforceable specifications. Unless these skills are properly developed, an expert knowledge of materials, contracts, and construction procedures cannot be communicated successfully to the ultimate users of the finished specifications. The users, namely, contractors and materials suppliers, will also have a better understanding of the nature of specifications, if they understand these principles.

What, then, constitute the principles of specification writing? Basically, the principles of specification writing should encompass those factors that permit architects or engineers to understand more clearly the relationship between drawings and specifications, between the graphic and the verbal, and to enable them to communicate more effectively by setting forth in a logical, orderly sequence the material to be incorporated within a specification.

PRINCIPLES

In broad terms, the principles of specification writing can be set forth as follows:

1. *The Role of the Specifications.* Specifications constitute one of the contract documents, together with the drawings and the agreement. Since they are written instructions, they are frequently adjudged by the courts as having greater importance than drawings when these documents are in conflict, and judgments are frequently resolved on the basis of the specifications. Also, the drawings, except for structural, mechanical, and electrical drawings, make no attempt at segregating the work of the various trades, and all of the architectural work is shown on them as an integrated whole. The specifications, on the other hand, segregate the information depicted on the drawings into the various specification sections so that a contractor can generally let subcontracts on the basis of the specification breakdown of sections.

2. *The Relationship between Drawings and Specifications.* Drawings are a graphic portrayal of the various elements. Specifications should describe the quality of materials, processes, and workmanship. There should not be duplication between these two documents; instead, they should be complementary. To improve coordination between drawings and specifications, there should be standardization of the information appearing in them.

3. *The Organization of Specifications.* For many years specifications were arranged in a series of sections based on the order or chronology in which the various trades appeared on the construction scene. However, it was found that our increasingly complex building structures did not necessarily follow these simple rules, nor was there a uniform, nationwide system of specifications.The *CSI Masterformat* has established a uniform arrangement of division–section organization.

4. *The Technical Section and Its Arrangement.* The technical section, which generally forms a subcontract, must be defined in terms of its scope and content. Until CSI promulgated the *3–Part Section Format*, there was no universal arrangement of information in an orderly, coherent series of paragraphs dealing with the content of the technical section.

5. *Types of Specifications.* Specifications can be prepared on the basis of either methods or results. The specifier can elect to specify in detail the method by which a contractor does certain operations in order to achieve a certain result. Conversely, the specifier can prepare a specification placing on the contractor the responsibility for securing the desired result, leaving to the contractor the method by which it is

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, nontechnical 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, superintendents, 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.

CHAPTER 1

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

The *contract documents* consist of the following instruments:

Agreement. A written agreement between the owner and contractor setting forth the work to be performed, the time for completion, and the contract sum.

Conditions of the Contract. These consist of the general conditions, supplementary conditions, and other conditions (see Chapter 11).

Drawings. The graphic presentation of work to be done.

Specifications. Written, verbal description of work to be performed.

Addenda. Changes made before contract execution.

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. 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 unsubletting 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.

CHAPTER 2

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.

Specifications should generally describe the following items:

1. Type and quality of materials, equipment, and fixtures.
2. Quality of workmanship.
3. Methods of fabrication, installation, and erection.
4. Test and code requirements.
5. Gages of manufacturers' equipment.
6. Allowances and unit prices.
7. Alternates and options.

Specifications should not overlap or duplicate information contained on the drawings. Duplication, unless it is repeated exactly word for word, is harmful because it can lead to contradiction, confusion, misunderstanding, and difference of opinion. Duplication, word for word, is redundant.

COORDINATING THE DESIGN PROCESS

To achieve proper separation of information between drawings and specifications, it is essential that the development of the specifications go hand in hand with the preparation of the drawings. At the outset, someone in the office should be made responsible for establishing and keeping the all-important checklist for a specific project. This checklist should establish a schedule of what is to appear on the drawings, what is to be described in the specifications, and what is to be itemized and listed in schedules on the drawings. The checklist should include preliminary or outline specifications, lists of all decisions made in the drafting room, and notes of all changes made on the drawings since the last set was printed for the specifier, including questions to be settled.

The broad guidelines previously noted for the separation of material that appears on the drawings and in the specifications do not go far enough in establishing a line of demarcation between these documents, inasmuch as there are areas of disagreement among authorities on specifications writing as to the specific information that should be shown or specified or both. For example, one authority suggests that the drawings should indicate a material such as concrete and the specifications should determine whether it is to be precast or cast-in-place concrete. Preferably the drawings should delineate the location of these two different materials. Another authority argues against the customary hatching and other indication of materials on plans and elevations. If the experts disagree, how can the draftsman and the neophyte specifier settle the issue? Duplication will exist between drawings and specifications when there is a lack of a clear-cut and well-defined policy.

Generally, each office establishes a policy to be followed in its own practice. However, systems can be formulated between the specifier and the draftsman, and as a general rule it will follow that common sense will dictate which medium serves as the better means of communication.

To ensure complete understanding on the part of the contractor, it is essential that standard terminology be employed and used consistently on both drawings and specifications. Too often draftsmen use certain terms to identify materials on the drawings, which may differ from the terms employed by the specifier. For example, a draftsman may use the term "caulking" to describe all caulking and sealant work, whereas the specifier will be selective and discriminate between the choice of materials and terms, resulting in ambiguity and misunderstanding on the part of the contractor.

Quite often it is essential to identify classes of materials at specific locations so that the contractor can readily differentiate among the variety of classes of materials. For example, there may be several types of flashings illustrated on the drawings or several varieties of sealants shown. By ascribing numerical or alphabetical characters to these flashings or sealants, both on the drawing and in the specifications, the contractor has no problems identifying what material goes where. This system precludes the necessity for describing in the specifications the location of classes of similar materials.

To illustrate, let us consider the use of various types of sealants and joint fillers for both interior and exterior applications. At various joint details, the draftsman can indicate "Sealant No. 1," or "Sealant No. 2," and so on. He can likewise show "Filler No. 1," "Filler No. 2," and so forth. The specifier will describe in the specifications the required sealant and filler by using the same identifying numbers. With systems such as this, any contractor will have no difficulty in determining what type of sealant and filler is required in a specific joint. Similar systems can be developed for other materials so that like terminology is used for drawings and specifications.

RESOLVING CONFLICTS

We have a Supreme Court to resolve differences that occur in interpreting our Constitution. We also require a mechanism to resolve conflicting duplications that may occur within drawings, within specifications, and between drawings and specifications.

No matter how carefully construction documents are prepared, there are bound to be discrepancies. To resolve these conflicts, it is essential to set guidelines. Paragraph 1.2.3 of the *AIA General Conditions*, Document A201 (see Chapter 11), requires amendment in order to resolve discrepancies. A recommended supplement to Par. 1.2.3 is set forth in Chapter 11.

DEVIATIONS FROM THE GENERAL RULES

The specifier must recognize that specifying is not an exact science. While rules and standards are devised to simplify and guide the specifier, it is sometimes more expedient and beneficial to bend the rules. As an example, in alteration work, it would be prudent to place notes or specification language on a drawing next to certain details rather than within a specification, to highlight a peculiar condition. Essentially, rules and standards are devices for simplification, but when they become burdensome in their execution, they should be modified.

CHAPTER 3

Organization of Specifications

HISTORICAL DEVELOPMENT OF SPECIFICATION ORGANIZATION

When the term "organization of specifications" is used, it refers to the separation of the specifications into a series or a schedule of separate units of work termed "technical sections." (See Chapter 4 for a definition of the technical section.) The history of specification writing and the growth in complexity of buildings illustrate how this system of a series of technical sections has evolved.

Specifications in the eighteenth and nineteenth centuries consisted of a single document containing a description of all the work and materials to be included in a building. This was especially true of small, simple structures that were constructed by a general contractor who engaged all the crafts and did not sublet or subcontract any parts of the work. An early textbook by T. L. Donaldson entitled *Handbook of Specifications* (London, 1860) provided for the arrangement of specifications on a craft basis. The specifications were divided into two main general divisions, with subdivisions as follows:

Carcase	Finishing
Excavator	Joiner
Bricklayer	Plasterer
Mason	Plumber
Slater	Painter
Founder and smith	Glazier
Carpenter	Paperhanger
	Ironmonger
	Smith and bellhanger
	Gasfitter

As materials and methods of construction gained a degree of sophistication, the specification sections began to change with the times and took on additional crafts within one section of the specifications. In lieu of the general contractor hiring specific crafts under his own supervision, he began to sublet portions of the work to subcontractors, who, in turn, hired the several crafts to perform certain parts of the work.

Specifications written for buildings toward the end of the nineteenth century consisted generally of three main sections—masonry, carpentry, and mechanical work—with various allied or related subjects under each section. The masonry section included excavation, concrete, brickwork, stonework, steel columns and lintels, and waterproofing. The carpentry section included roofing, glazing, and painting, as well as carpentry. The mechanical or pipe trades consisted of plumbing, gas, and heating work. When electricity came into use, it was included in the mechanical work.

The foregoing arrangement of the specifications was adequate for the nature of the buildings constructed at that time, and for the materials and methods of construction then prevalent. Buildings were simpler structures, with a minimum of mechanical and electrical systems, communication systems, and conveying systems. Man-made building products too were limited in number. However, with the advent of more complex structures a need for a standardized organization of the specifications became apparent.

NEED FOR ORGANIZING SPECIFICATIONS

As buildings grew more complex, and materials and construction techniques became more involved it became necessary to increase the number of technical sections as more portions of the work came under subcontract. Today, the specification sections are designed essentially to permit general contractors, estimators, subcontractors, manufacturers, and

materials dealers to "take off" the items of their specific work for estimate during the bidding period.

Accuracy in estimating is in the best interests of building owners and architects alike. To assure accuracy, the specifications should be divided into sections to permit the contractor's estimator and the subcontractors to prepare estimates quickly and precisely. The preparation of drawings and specifications takes considerable time, whereas bidding periods are generally of short duration. It is therefore quite evident that the estimator must have a specification separated by sections or units of work so that he can list the materials and quantities, note the methods of their use and installation, separate those parts on which he will take subestimates, secure prices and tabulate results, all within a 3- or 4-week bidding period, and often within only 2 weeks. Such a system also permits the specification writer to organize his own material. It provides him with a method for organizing the information on the drawings in a systematic, orderly, and prearranged manner.

For convenience in writing, speed in estimating, and ease of reference, it has been found that the most suitable organization of the specifications is a series of sections dealing successively with the different subcontractors, and in each section grouping all of the work of the particular trade to which the section is devoted.

Until April 1963, when the *CSI Format for Construction Specifications* was promulgated by the Construction Specifications Institute, each specifier organized his specifications in a series of sections which more or less followed a time relationship, or chronological order, related to the order of appearance on the site of the various subcontractors. For example, excavation and backfill usually was the first section since the excavator was on the site at the beginning, followed by the concrete section, the masonry section, and so on. However, from office to office, and even within the same office, this order was not uniform. In addition, complex structures required that certain mechanical trades be involved at an early stage in the construction process so that a true trades chronology was not possible in the organization of the specifications. It became apparent that a major overhaul was required in the organization of specification sections, and that a uniform system would provide certain corollary benefits.

CSI/CSC MASTERFORMAT

The *CSI Format for Construction Specifications*, which has been updated several times since its inception in 1963, provides a uniform system for the location of technical sections within a bound volume of the project manual together with a five-digit permanent number for each section. The most recent edition of *CSI Format for Construction Specifications* is the *Masterformat* published by CSI and CSC (Construction Specifications Canada) (see Exhibit 3-1).

BIDDING REQUIREMENTS, CONTRACT FORMS, AND CONDITIONS OF THE CONTRACT

00010 PRE-BID INFORMATION
00100 INSTRUCTIONS TO BIDDERS
00200 INFORMATION AVAILABLE TO BIDDERS
00300 BID FORMS
00400 SUPPLEMENTS TO BID FORMS
00500 AGREEMENT FORMS
00600 BONDS AND CERTIFICATES
00700 GENERAL CONDITIONS
00800 SUPPLEMENTARY CONDITIONS
00900 ADDENDA

Note: The items listed above are not specification sections and are referred to as "Documents" rather than "Sections" in the Master List of Section Titles, Numbers, and Broadscope Section Explanations.

SPECIFICATIONS

DIVISION 1—GENERAL REQUIREMENTS

01010 SUMMARY OF WORK
01020 ALLOWANCES
01025 MEASUREMENT AND PAYMENT
01030 ALTERNATES/ALTERNATIVES
01035 MODIFICATION PROCEDURES
01040 COORDINATION
01050 FIELD ENGINEERING
01060 REGULATORY REQUIREMENTS
01070 IDENTIFICATION SYSTEMS
01090 REFERENCES
01100 SPECIAL PROJECT PROCEDURES
01200 PROJECT MEETINGS
01300 SUBMITTALS
01400 QUALITY CONTROL
01500 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS
01600 MATERIAL AND EQUIPMENT
01650 FACILITY STARTUP/COMMISSIONING
01700 CONTRACT CLOSEOUT
01800 MAINTENANCE

DIVISION 2—SITEWORK

02010 SUBSURFACE INVESTIGATION
02050 DEMOLITION
02100 SITE PREPARATION
02140 DEWATERING
02150 SHORING AND UNDERPINNING
02160 EXCAVATION SUPPORT SYSTEMS

EXHIBIT 3-1. **Masterformat. Reproduced by permission of the copyright owner, The Construction Specifications Institute, Alexandria, VA.**

02170 COFFERDAMS
02200 EARTHWORK
02300 TUNNELING
02350 PILES AND CAISSONS
02450 RAILROAD WORK
02480 MARINE WORK
02500 PAVING AND SURFACING
02600 UTILITY PIPING MATERIALS
02660 WATER DISTRIBUTION
02680 FUEL AND STEAM DISTRIBUTION
02700 SEWERAGE AND DRAINAGE
02760 RESTORATION AND UNDERGROUND PIPE
02770 PONDS AND RESERVOIRS
02780 POWER AND COMMUNICATIONS
02800 SITE IMPROVEMENTS
02900 LANDSCAPING

DIVISION 3—CONCRETE

03100 CONCRETE FORMWORK
03200 CONCRETE REINFORCEMENT
03250 CONCRETE ACCESSORIES
03300 CAST-IN-PLACE CONCRETE
03370 CONCRETE CURING
03400 PRECAST CONCRETE
03500 CEMENTITIOUS DECKS AND TOPPINGS
03600 GROUT
03700 CONCRETE RESTORATION AND CLEANING
03800 MASS CONCRETE

DIVISION 4—MASONRY

04100 MORTAR AND MASONRY GROUT
04150 MASONRY ACCESSORIES
04200 UNIT MASONRY
04400 STONE
04500 MASONRY RESTORATION AND CLEANING
04550 REFRACTORIES
04600 CORROSION RESISTANT MASONRY
04700 SIMULATED MASONRY

DIVISION 5—METALS

05010 METAL MATERIALS
05030 METAL COATINGS
05050 METAL FASTENING
05100 STRUCTURAL METAL FRAMING
05200 METAL JOISTS
05300 METAL DECKING
05400 COLD FORMED METAL FRAMING
05500 METAL FABRICATIONS
05580 SHEET METAL FABRICATIONS
05700 ORNAMENTAL METAL
05800 EXPANSION CONTROL
05900 HYDRAULIC STRUCTURES

DIVISION 6—WOOD AND PLASTICS

06050 FASTENERS AND ADHESIVES
06100 ROUGH CARPENTRY
06130 HEAVY TIMBER CONSTRUCTION
06150 WOOD AND METAL SYSTEMS
06170 PREFABRICATED STRUCTURAL WOOD
06200 FINISH CARPENTRY
06300 WOOD TREATMENT
06400 ARCHITECTURAL WOODWORK
06650 SOLID POLYMER FABRICATIONS
06500 STRUCTURAL PLASTICS
06600 PLASTIC FABRICATIONS

DIVISION 7—THERMAL AND MOISTURE PROTECTION

07100 WATERPROOFING
07150 DAMPPROOFING
07180 WATER REPELLENTS
07190 VAPOR RETARDERS
07195 AIR BARRIERS
07200 INSULATION
07240 EXTERIOR INSULATION AND FINISH SYSTEMS
07250 FIREPROOFING
07270 FIRESTOPPING
07300 SHINGLES AND ROOFING TILES
07400 MANUFACTURED ROOFING AND SIDING
07480 EXTERIOR WALL ASSEMBLIES
07500 MEMBRANE ROOFING
07570 TRAFFIC COATINGS
07600 FLASHING AND SHEET METAL
07700 ROOF SPECIALTIES AND ACCESSORIES
07800 SKYLIGHTS
07900 JOINT SEALERS

DIVISION 8—DOORS AND WINDOWS

08100 METAL DOORS AND FRAMES
08200 WOOD AND PLASTIC DOORS
08250 DOOR OPENING ASSEMBLIES
08300 SPECIAL DOORS
08400 ENTRANCES AND STOREFRONTS
08500 METAL WINDOWS
08600 WOOD AND PLASTIC WINDOWS
08650 SPECIAL WINDOWS
08700 HARDWARE
08800 GLAZING
08900 GLAZED CURTAIN WALLS

DIVISION 9—FINISHES

09100 METAL SUPPORT SYSTEMS
09200 LATH AND PLASTER
09250 GYPSUM BOARD
09300 TILE
09400 TERRAZZO
09450 STONE FACING
09500 ACOUSTICAL TREATMENT
09540 SPECIAL WALL SURFACES
09545 SPECIAL CEILING SURFACES
09550 WOOD FLOORING
09600 STONE FLOORING
09630 UNIT MASONRY FLOORING
09650 RESILIENT FLOORING
09680 CARPET
09700 SPECIAL FLOORING
09780 FLOOR TREATMENT
09800 SPECIAL COATINGS
09900 PAINTING
09950 WALL COVERINGS

EXHIBIT 3-1. (Continued)

DIVISION 10—SPECIALTIES

10100 VISUAL DISPLAY BOARDS
10150 COMPARTMENTS AND CUBICLES
10200 LOUVERS AND VENTS
10240 GRILLES AND SCREENS
10250 SERVICE WALL SYSTEMS
10260 WALL AND CORNER GUARDS
10270 ACCESS FLOORING
10290 PEST CONTROL
10300 FIREPLACES AND STOVES
10340 MANUFACTURED EXTERIOR SPECIALTIES
10350 FLAGPOLES
10400 IDENTIFYING DEVICES
10450 PEDESTRIAN CONTROL DEVICES
10500 LOCKERS
10520 FIRE PROTECTION SPECIALTIES
10530 PROTECTIVE COVERS
10550 POSTAL SPECIALTIES
10600 PARTITIONS
10650 OPERABLE PARTITIONS
10670 STORAGE SHELVING
10700 EXTERIOR PROTECTION DEVICES FOR OPENINGS
10750 TELEPHONE SPECIALTIES
10800 TOILET AND BATH ACCESSORIES
10880 SCALES
10900 WARDROBE AND CLOSET SPECIALTIES

DIVISION 11—EQUIPMENT

11010 MAINTENANCE EQUIPMENT
11020 SECURITY AND VAULT EQUIPMENT
11030 TELLER AND SERVICE EQUIPMENT
11040 ECCLESIASTICAL EQUIPMENT
11050 LIBRARY EQUIPMENT
11060 THEATER AND STAGE EQUIPMENT
11070 INSTRUMENTAL EQUIPMENT
11080 REGISTRATION EQUIPMENT
11100 MERCANTILE EQUIPMENT
11090 CHECKROOM EQUIPMENT
11110 COMMERCIAL LAUNDRY AND DRY CLEANING EQUIPMENT
11120 VENDING EQUIPMENT
11130 AUDIO-VISUAL EQUIPMENT
11140 VEHICLE SERVICE EQUIPMENT
11150 PARKING CONTROL EQUIPMENT
11160 LOADING DOCK EQUIPMENT
11170 SOLID WASTE HANDLING EQUIPMENT
11190 DETENTION EQUIPMENT
11200 WATER SUPPLY AND TREATMENT EQUIPMENT
11280 HYDRAULIC GATES AND VALVES
11300 FLUID WASTE TREATMENT AND DISPOSAL EQUIPMENT
11400 FOOD SERVICE EQUIPMENT
11450 RESIDENTIAL EQUIPMENT
11460 UNIT KITCHENS
11470 DARKROOM EQUIPMENT
11480 ATHLETIC, RECREATIONAL, AND THERAPEUTIC EQUIPMENT
11500 INDUSTRIAL AND PROCESS EQUIPMENT
11600 LABORATORY EQUIPMENT
11650 PLANETARIUM EQUIPMENT
11660 OBSERVATORY EQUIPMENT
11680 OFFICE EQUIPMENT
11700 MEDICAL EQUIPMENT
11780 MORTUARY EQUIPMENT
11850 NAVIGATION EQUIPMENT
11870 AGRICULTURAL EQUIPMENT

DIVISION 12—FURNISHINGS

12050 FABRICS
12100 ARTWORK
12300 MANUFACTURED CASEWORK
12500 WINDOW TREATMENT
12600 FURNITURE AND ACCESSORIES
12670 RUGS AND MATS
12700 MULTIPLE SEATING
12800 INTERIOR PLANTS AND PLANTERS

DIVISION 13—SPECIAL CONSTRUCTION

13010 AIR SUPPORTED STRUCTURES
13020 INTEGRATED ASSEMBLIES
13030 SPECIAL PURPOSE ROOMS
13080 SOUND, VIBRATION, AND SEISMIC CONTROL
13090 RADIATION PROTECTION
13100 NUCLEAR REACTORS
13120 PRE-ENGINEERED STRUCTURES
13150 AQUATIC FACILITIES
13175 ICE RINKS
13180 SITE CONSTRUCTED INCINERATORS
13185 KENNELS AND ANIMAL SHELTERS
13200 LIQUID AND GAS STORAGE TANKS
13220 FILTER UNDERDRAINS AND MEDIA
13230 DIGESTER COVERS AND APPURTENANCES
13240 OXYGENATION SYSTEMS
13260 SLUDGE CONDITIONING SYSTEMS
13300 UTILITY CONTROL SYSTEMS
13400 INDUSTRIAL AND PROCESS CONTROL SYSTEMS
13500 RECORDING INSTRUMENTATION
13550 TRANSPORTATION CONTROL INSTRUMENTATION
13600 SOLAR ENERGY SYSTEMS
13700 WIND ENERGY SYSTEMS
13750 COGENERATION SYSTEMS
13800 BUILDING AUTOMATION SYSTEMS
13900 FIRE SUPPRESSION AND SUPERVISORY SYSTEMS
13950 SPECIAL SECURITY CONSTRUCTION

DIVISION 14—CONVEYING SYSTEMS

14100 DUMBWAITERS
14200 ELEVATORS
14300 ESCALATORS AND MOVING WALKS
14400 LIFTS
14500 MATERIAL HANDLING SYSTEMS
14600 HOISTS AND CRANES
14700 TURNTABLES
14800 SCAFFOLDING
14900 TRANSPORTATION SYSTEMS

DIVISION 15—MECHANICAL

15050 BASIC MECHANICAL MATERIALS AND METHODS
15250 MECHANICAL INSULATION
15300 FIRE PROTECTION
15400 PLUMBING
15500 HEATING, VENTILATING, AND AIR CONDITIONING
15550 HEAT GENERATION
15650 REFRIGERATION
15750 HEAT TRANSFER

EXHIBIT 3-1. (Continued)

15850 AIR HANDLING
15950 AIR DISTRIBUTION
15990 TESTING, ADJUSTING, AND BALANCING

DIVISION 16—ELECTRICAL

16050 BASIC ELECTRICAL MATERIALS AND METHODS
16200 POWER GENERATION—BUILT-UP SYSTEMS
16300 MEDIUM VOLTAGE DISTRIBUTION
16400 SERVICE AND DISTRIBUTION
16500 LIGHTING
16600 SPECIAL SYSTEMS
16700 COMMUNICATIONS
16850 ELECTRIC RESISTANCE HEATING
16900 CONTROLS
16950 TESTING

EXHIBIT 3-1. (Continued)

USING THE MASTERFORMAT

How does one use this system? For each specific project the specifier prepares his technical sections as he did previously, except that he now places them under the fixed division, with a fixed five-digit Section number. Some specifiers use an alphanumeric Section number such as 2A and 2B or 5A and 5B in lieu of the fixed five-digit number. Where local trade practices or conditions of the specific project dictate, the specification writer has the prerogative to alter the location of the information and the section.

The *Masterformat* published jointly by the CSI and CSC, is somewhat analogous to the organization of specifications referred to earlier in the *Handbook of Specifications*. The Division headings under the *Masterformat* are based on four major categories: materials, trades, functions of work, and place relationships. For example, Division 4, Masonry, is an instance of a materials relationship. The sections listed under Division 4 have materials as their common denominator. These include sections on unit masonry, stone, and mortar and masonry restoration, all dealing with materials common to one another. Division 5, Metals, is an example of a trades relationship. Sections on structural metal, open-web joists, metal decking, miscellaneous metal, and ornamental metal are located here, and the metal fabricators, erectors, and ironworkers usually perform this type of work. Division 7, Thermal and Moisture Protection, illustrates a relationship based on functions of work. The sections dealing with the environmental protection of the building are located here: roofing, waterproofing, dampproofing, thermal insulation, and caulking and sealing. Division 2, Site Work, is an example of a place relationship, and it includes such sections as demolition, clearing and grubbing, earthwork, piling, roads and walks, and lawns and planting.

What are the advantages of this particular system for organizing the specifications? In preparing his specification section, the specifier no longer needs to be concerned with whether the architect or the engineer adds or deletes certain materials or trades as he develops his drawings. Previously, such a change in design meant the deletion of a specification section or the inclusion at the last moment of a specification section, placed entirely out of sequence. Under the *Masterformat* such revisions do not impose hardships since a section can be added to or deleted from a specific division without radically upsetting the sequence and numbering system. The specifier can write or prepare sections long before the drawings are completed and assign numbers to them immediately. In addition, the specifier can now file material, shop drawings, correspondence, technical data, literature, samples, estimates, and a host of office memoranda under a similar numbering system. The contractor, manufacturer, estimator, and inspector can more readily find those items in the specifications with which he or she is concerned.

In an earlier version of this book the author predicted that in time, with widespread use, the AIA would conform its specification work sheets and its standard filing system to this system; the Associated General Contractors could number its estimating work sheets on the same basis; Sweet's Catalog Service could renumber its architectural file; and building materials manufacturers would number their literature accordingly. This prediction has been fulfilled. Federal, state, and local governmental bodies are following suit and utilizing the *Masterformat*.

CHAPTER 4

Concept of the Technical Section

WHAT IS A TECHNICAL SECTION?

You could visualize a complete specification as a series of chapters in a novel, with each section of a specification comparable to a chapter in the novel. Chapters are established in a novel basically to make it easier to write and to read and to provide an episode complete in itself. The specification section is also a subdivision of the complete specification, providing information on one subject as the content of each technical section.

A technical section in its simplest form is a word description of a basic trade or material installation, outlining the quality of material to be used and the quality of workmanship to be employed in its installation. A technical section can best be described as a unit of work consisting of a carefully worded description of materials and an explanation of methods of construction in the form of instructions to a contractor. The term "trade section" has been used frequently heretofore to describe this unit; however, under today's connotations and definitions, "trade section" is misleading, and much misunderstanding has arisen from the use of the term as it relates to the technical sections of specifications.

It has been previously been pointed out that the drawings generally show all the work that is to be constructed. The only attempt made in the drawings to segregate the work of different trades is in the preparation of separate drawings for plumbing, heating, electrical work, and structural work. When a specification is written, the specifier endeavors to segregate under the various technical or "trade" sections of the specifications a unit of work that a contractor may let to a subcontractor; a unit of work that a materials man may supply for another to install; a unit of work that combines the responsibilities of several subcontractors into a single authority; or a unit of work that is performed by a single recognized trade.

The misunderstanding concerning the use of the word "trade" arises both from the dictionary definition and from the failure to recognize that the so-called "trade" section of the specifications can be as restrictive or all-inclusive as previously described. The dictionary defines *trade* as "(1) The business one practices or the work in which one engages regularly; occupation; means of livelihood. (2) A pursuit requiring manual or mechanical training and dexterity; a craft. (3) Those engaged in a business or industry." Trade can therefore mean a craft, such as carpentry, bricklaying, or plumbing; or it can mean a business, such as a concrete subcontractor or a plumbing and heating subcontractor.

A unit of work that a contractor may let to a subcontractor can encompass a section entitled "Concrete Work." The concrete subcontractor employs carpenters for erecting formwork; lathers or ironworkers for installing the steel reinforcement; concrete laborers for placing concrete; and cement masons for finishing the concrete.

A unit of work that a materials man may supply for another to install is exemplified by the section entitled "Finish Hardware." The general contractor purchases the hardware from a materials supplier, who simply delivers the material to the site for the carpentry subcontractor to install, or for the general contractor to install with his own forces.

A unit of work combining several subcontractors so that a single responsibility is established for that portion of the work is illustrated by the section entitled "Curtain Walls." The general contractor may award this work to one subcontractor, who in turn will sublet such items of work as fabrication and installation of metal framing and metal panels, furnishing and installation of glass, caulking and sealing of the curtain wall, flashing of the curtain wall, and insulation of the curtain wall.

A unit of work that is performed by a single recognized trade can best be illustrated by the section entitled "Painting."

While the work can be done by a subcontractor who employs only painters, the general contractor may elect to hire his own painting crew to perform this portion of the work.

CHANGING AND EVOLVING SECTIONS

It is not a simple matter to determine the proper subdivision of the technical sections, and once made it is not necessarily permanent. Changes occur as new materials are introduced by building materials manufacturers, and recognized trades change as a result of these new materials. Changes also occur as new concepts in design appear, such as the curtain wall and the integrated ceiling. Changes are also dictated by the introduction of new construction techniques, such as lift slabs and slip forming. Concrete work was formerly a general mason's work; now it is specified under the concrete division and performed by a concrete subcontractor. Wood forms for concrete work were once specified under carpentry, but are now specified under concrete work. Doors that were traditionally wood were installed by carpenters and specified under the carpentry section. When tempered glass doors, metal doors, and bronze doors were introduced, the carpenters claimed this work as being under their jurisdiction. As new methods of work develop, they are first performed by an existing craft, but eventually come under the jurisdiction of specialty subcontractors, where new skills must be developed.

BROAD-SCOPE AND NARROW-SCOPE SECTIONS

The technical section can vary in size or scope according to the specific project. It can be broad in scope, meaning that it can include everything, that is, stonework, including granite, marble, limestone, and travertine; or it can be narrow in scope and limit the content of each section to four distinct titles: Granite, Marble, Limestone, and Travertine.

The concrete section for a nonfireproof dwelling will be small in scope and the descriptive material brief; however, it will still be necessary to write this section as a unit of work to be let as a subcontract. For a high-rise fireproof structure, the concrete section will encompass many aspects of concrete finishes, and form removal—and this technical section will be relatively long and involved. There is, however, another criterion to be considered in determining whether a long, involved concrete section should be written as a single unit of work. Is the amount of work so large in scope and its dollar value so high that it becomes too unmanageable and out of the reach of a subcontractor? In this case, consideration should be given to establishing several narrow-scope technical sections involving certain units of work that may be subcontracted. The concrete reinforcement in a very large project can be established as a separate technical section. In addition, concrete form work, concrete testing, and the purchase of ready-mix concrete can be established as separate units of work within their respective technical sections. As a result, for a very large project involving a large dollar volume, the concrete work may be written in several narrow-scope sections, each involving work associated with concrete yet separating it into component parts that can be bid separately by specialty subcontractors.

FLEXIBILITY IN DETERMINING SECTION SCOPE

To establish the technical sections for a project, the specifier should assume that the general contractor may desire to sublet all the work, doing nothing himself except to organize and manage the project. If the specification sections are planned on this basis, it will be possible for the general contractor to reserve for himself whatever parts of the work he may be equipped to do, and sublet all the other parts. It would be quite simple for him to sublet two or more sections to one subcontractor if the work is broken down into small units of work, but it would be difficult for him to divide certain parts of the work between two subcontractors if these parts were not properly separated in the specifications.

It is generally true that a large number of smaller units of work simplifies the work of the estimator, makes it easier for the superintendent to refer to the specifications for any particular part of the work, and aids the specifier in his note taking for writing the section. But note that there are certain instances where the work is so closely united in execution that it should be combined in one technical section to simplify handling and to place a combination of two or more subcontracts on the shoulders of one subcontractor, who may then sublet part of the work. The curtain wall, the integrated ceiling, and roofing and sheet metal work are examples of composite construction that dictate broader technical sections.

However, the specifier should not lose sight of the fact that although he may establish the technical sections with the scope of each as limited or as broad as he may elect, it is still the privilege of the general contractor to combine or distribute the various technical sections in any manner he wishes, or to use them and let them as written. The general conditions of the contract should be supplemented with the following admonition:

> The following technical sections are generally divided into units of work for the purpose of ready reference. The division of the work among his subcontractors is the Contractor's responsibility and the architect assumes no responsibility to act as arbiter to establish subcontract limits between any sections of the work.

It should be apparent by now that the scope, content, and nature of the technical section must be flexible. Sections within the same project can be long and involved, yet others

may be short and still represent a large percentage of the work. Conversely, their length and content can vary from project to project, and fixed rules for size and content cannot be established. The specifier must thus assess each project on the merits of his own peculiarities and requirements before establishing the scope and content of the individual technical sections.

MASTERFORMAT

In order to arrive at more uniform practices nationwide, the CSI and CSC (Construction Specifications Canada) have published a list of preferred section titles to be used under the respective division headings of the *Masterformat*. These section titles have been established on the basis of broad section titles and restrictive section titles, following the concept that a technical section can be written to be all-inclusive or restricted in scope, depending on the particular project. This arrangement provides the flexibility needed by the specifier to retain the prerogative of organizing his specifications, while at the same time establishing a uniform system of preferred section titles throughout the profession.

RELATIONSHIP OF A SECTION TO THE PROJECT MANUAL

While each technical section or unit of work for a specific project is written so that it forms an entity of its own, it is related to the rest of the work described elsewhere in the specifications and to the drawings, the general conditions, and the agreement. These other documents spell out conditions and requirements pertaining to the technical section that are incumbent on the subcontractor who performs the work specified within a technical section. To assure that a subcontractor is aware of these other conditions and obligations, it is good practice to have an opening statement at the beginning of each technical section to alert the subcontractor to them. A statement that is all-inclusive even though the types of documents may vary is as follows: "Provide work under this section as shown or specified and in accordance with the requirements of the Contract Documents."

A cogent reason for making this statement stems from the fact that general contractors often furnish prospective subcontractors only with a copy of the technical section and neglect to give them copies of the General Conditions, Supplementary General Conditions, Division 1 General Requirements, or other pertinent documents. Adding the above statement makes the subcontractor aware of his additional obligations contained in these other documents. Since the term "Contract Documents" is defined in the AIA General Conditions and in most other general conditions as including certain documents (see the definition in Chapter 1), it becomes a catchall phrase that includes most documents used for construction.

Certain court cases have held that a subcontractor was not bound by the general conditions because it was proved that the general contractor had not furnished the subcontractor with a copy nor specifically alerted him to its existence and its effect on his work. Using the opening statement above may preclude litigation between the contractor and subcontractor or liens filed against the owner.

CHAPTER 5

Arrangement of the Technical Section

NEED FOR A SECTION FORMAT

The arrangement of the subject matter in an orderly, comprehensive format within a technical section is important for several reasons. The specifier when following a definitive procedure is less likely to overlook any item. Similarly, the contractor, estimator, materials manufacturer, and inspector will then find the information much more easily in the individual section.

A technical section in a book of specifications can be considered as analogous to a chapter in a book; the chapter, in turn, consists of paragraphs. The material that comprises the section consists essentially of paragraphs and subparagraphs. Other names to describe the breakdown of the material within the technical section, such as articles, clauses, headings, categories, or units, can lead to confusion.

The technical section contains two categories of paragraphs, namely, the technical and nontechnical, as follows:

Technical	Nontechnical
Materials	Scope of work
Fabrication	Delivery of materials
Workmanship	Samples and shop drawings
Installation	Permits
Tests	Guarantees
Schedules	Cleaning
Preparation	Job conditions

In prior years before the advent of a nationally promulgated section format, the technical section was written to include the technical and nontechnical paragraphs in the order in which they occurred chronologically, that is, in a sequence in which the contractor would ordinarily do his work, and each paragraph heading would be simple and self-explanatory. When the specifier followed this course, he was less likely to omit something, and his reliance on a checklist at his side diminished accordingly.

STANDARDIZED SECTION FORMAT

In 1969 CSI developed and promulgated the CSI Section Format. This has since been refined and updated several times and is now jointly produced by CSI and CSC. This nationally approved format provides guidelines for the arrangement of information within a technical section of the specifications, and it offers a concise and orderly method for specifiers to follow (see Exhibit 5-1).

Prior to the publication of this document, specifiers arranged the information within their technical sections in accordance with their own formulas, and in many instances without any specific method. In many cases, the lack or organization resulted in duplication and omission of information.

The standard Section Format is another important step toward providing a more unified approach. It permits easier access to information by manufacturers, contractors, and inspectors. It provides a checklist for the specifier so that omission of information is minimized. It provides standardization of input that permits its use in connection with computerized specifications and information retrieval.

The Section Format provides for the arrangement and presentation of information under three separate parts as follows:

Part 1, General, is concerned with the ground rules under which the work is to be performed, and it also establishes the scope of work to be performed within the section.

Part 2, Products, is intended for descriptions of materials, equipment, and fixtures, and for the manufacturing process used in the development and production of products. The latter requirement includes mixing and fabrication which

PART 1 GENERAL

SUMMARY
- Section Includes:
  - Products Furnished but Not Installed under This Section
  - Products Installed but Not Furnished under This Section
- Related Sections
- Allowances
- Unit Prices
- Alternates/Alternatives

REFERENCES
DEFINITIONS
SYSTEM DESCRIPTION
- Design Requirements
- Performance Requirements

SUBMITTALS
- Product Data
- Shop Drawings
- Samples
- Quality Control Submittals
  - Design Data
  - Test Reports
  - Certificates
  - Manufacturer's Instructions
  - Manufacturer's Field Reports
- Contract Closeout Submittals
  - Project Record Documents
  - Operation and Maintenance
  - Data Warranty

QUALITY ASSURANCE
- Qualifications
- Regulatory Requirements
- Certifications
- Field Samples
- Mock-Ups
- Preinstallation Conference

DELIVERY, STORAGE, AND HANDLING
- Packing and Shipping
- Acceptance at Site
- Storage and Protection

PROJECT/SITE CONDITIONS
- Environmental Requirements
- Existing Conditions
- Field Measurements

SEQUENCING AND SCHEDULING
WARRANTY
- Special Warranty

MAINTENANCE
- Maintenance Service
- Extra Materials

PART 2 PRODUCTS

MANUFACTURERS
MATERIALS
MANUFACTURED UNITS
EQUIPMENT
COMPONENTS
ACCESSORIES
MIXES
FABRICATION
- Shop Assembly
- Shop/Factory/Finishing
- Tolerances

SOURCE QUALITY CONTROL
- Tests
- Inspection
- Verification of Performance

PART 3 EXECUTION

EXAMINATION
- Verification of Conditions

PREPARATION
- Protection
- Surface Preparation

ERECTION
INSTALLATION
APPLICATION
- Special Techniques
- Interface with Other Products
- Tolerances

FIELD QUALITY CONTROL
- Tests
- Inspection
- Manufacturer's Field Service

ADJUSTING
CLEANING
DEMONSTRATION
PROTECTION
SCHEDULES

EXHIBIT 5-1. **CSI section format outline. Reproduced by permission of the copyright owner, The Construction Specifications Institute, Alexandria, VA.**

are inherent in the manufacturing process, whether performed on or off the site. An example of mixing that produces a product off-site is bituminous mixtures for road work. An example of mixing that produces a product on-site is terrazzo. In either case, the development of a product involving mixing is described under Part 2. An example of fabrication is hollow metal doors. The component materials comprising the door and fabrication process are both specified under Part 2 in the description of the development of the basic product.

Part 3, Execution, is used to describe in detail the workmanship, erection, installation, and application procedures

Under each part the Section Format provides for several standard paragraph headings following a more or less regular sequence or order. Obviously, each paragraph heading may not be pertinent for every technical section, and will not be used where not applicable. In addition, where paragraph heading titles would be forced, they should be retitled to be consonant with the work intended under a specific heading. For example, under Part 3, Execution, there is a paragraph entitled "Installation/Application/Erection." Under a section for "Earthwork," this title could be changed to "Excavation."

The paragraph headings also can take into account certain requirements normally used in civil engineering or heavy construction specifications and in mechanical and electrical specifications. For civil engineers and in heavy construction involved in contracts based on unit prices, a paragraph entitled "Measurement and Payment" can be added to Part 1 which will allow for description of these units. For mechanical and electrical engineers there are paragraphs entitled "System Description" that permit the engineer to fully describe an involved system prior to specifying its accomplishment. Specifications for balancing the heating and ventilating system or other mechanical and electrical items can be described under "Adjusting."

DETAILED DESCRIPTION OF FORMAT

The major paragraph headings lend themselves in turn to subordinate subparagraphs, which may include the following requirements:

PART 1—GENERAL

1.1 SUMMARY

A. See Chapter 8 for a discussion of the pitfalls of a "Work Included" or "Scope of Work" paragraph.

B. Related Sections: Describe those items that are normally part of this section which the specifier has for one reason or another specified elsewhere. Do not list items that are not normally the work of this section (see Chapter 8).

C. Allowances: Avoid duplication with Section 01020, or with Parts 2 and 3 of this section.

D. Unit Prices: Avoid duplication with Bid Form.

E. Measurement and Payment: Useful paragraph for civil engineering projects.

F. Alternates: Descriptions of alternates, which often involve more than one section, are specified under Division 1, General Requirements (see Chapter 12). Detailed specifying here can be redundant and dangerous. Make only the following statement here: "Alternates affecting the work of this Section are specified in Section 01030, Alternates."

1.2 REFERENCES

A. Titles of standards referred to in Parts 2 and 3. An unnecessary heading since it promotes duplication.

1.3 DEFINITIONS

A. Rather than defining terms, include a reference source in Section 01090 such as the *Dictionary of Architecture and Construction*, Cyril M. Harris, McGraw-Hill, 1975.

1.4 SYSTEM DESCRIPTION

A. Description of System: Describe systems such as heating system, elevator system, integrated ceiling system, state performance requirements.

1.5 SUBMITTALS

A. Enumerate the various types of data to be submitted for the architect's review. Assemble the information under various subparagraph headings, such as samples, shop drawings, product data, certificates, warranties, bonds, and so on.

1.6 QUALITY ASSURANCE

A. Standards: Specify standards, procedures, criteria, and limitations which establish an overall level of quality.

B. Qualifications: Establish standards and criteria for determining the qualifications of tradesmen, suppliers, subcontractors, and products.

C. Regulatory Requirements: Cite specific regulations and codes, which apply to contractor's detailed design of trusses, connections, precast items, etc.

D. Mock-up: A mock-up is defined in *Webster's Dictionary* as a "full-sized structural model built accurately to scale chiefly for study, testing, or display." Include sample panels, curtain wall assemblies, precast concrete panels, integrated ceiling systems, and so on.

E. Pre-Installation Meeting: Specify when, who is to come, agenda.

1.7 DELIVERY, STORAGE, AND HANDLING

A. General provisions governing the transportation, handling, storage, and protection of material and equipment are included in Division 1, General Requirements (see Chapter 12). Establish various subparagraphs here that will deal with the specific requirements for handling, storage, and delivery of materials, equipment, fixtures, and components

that by their nature will require more detailed technical refinements and conditions.

1.8 PROJECT/SITE CONDITIONS

A. Specification subparagraphs dealing with the physical and environmental conditions under which the work is to be performed should be specified here. These include existing conditions, weather, temperature, humidity, and so on.

1.9 SEQUENCING AND SCHEDULING

A. Be careful not to intrude on contractor's responsibility stated in AIA Document A201, Article 3.3.1.

1.10 SPECIAL WARRANTY

A. Use this paragraph to set forth the requirements for correcting defects that extend beyond the 1 year correction-of-work period in the general conditions. In addition, establish a special warranty form (see Exhibit 5-2) to ensure proper terminology and conditions rather than permitting the contractor to submit innocuous and self-serving warranties.

1.11 MAINTENANCE

A. Separate maintenance requirements which are part of the general construction and built into the contract sum from maintenance contracts to be executed separately.

B. Extra Materials: Specify hard-to-obtain sites and colors of materials for attic storage.

SECTION 07150 DAMPPROOFING SPECIAL WARRANTY

OWNER: _____
PROJECT: _____
ARCHITECT: _____
REFERENCE: Specification Section 07150, Dampproofing
TIME: Period of Warranty: 3 Years
WARRANTY: Starting Date: _____
In accordance with Article ____ of the GENERAL CONDITIONS, the undersigned hereby warrant the dampproofing against leaks resulting from defects of materials or workmanship; and further the undersigned agree, upon notification of such leaks within the warranty period, to make the necessary repairs and replacements at the convenience of the Owner.

CONTRACTOR: _____ Date ____
by: _____ _____
(signed) (printed)

SUBCONTRACTOR: _____ Date: ____
by: _____ _____
(signed) (printed)

EXHIBIT 5-2. **Sample warranty form.**

PART 2—PRODUCTS

2.1 MANUFACTURERS

A. This is a superfluous addition to the specifications, invites duplication, and may be unnecessary inasmuch as the information can best be provided in subsequent paragraphs.

2.2 MATERIALS/EQUIPMENT

A. Segregate these elements into a number of subparagraphs dealing with materials, equipment, components, accessories, and so on.

B. Specify by means of performance, descriptive, reference standards, proprietary methods, any or all.

2.3 MIXES

A. Whether prepared on-site or off-site, specify the proportions of the materials listed above required to produce concrete, plaster, terrazzo, macadam, and so on.

2.4 FABRICATION

A. The component materials are specified in paragraph 2.2 above. The fabrication and manufacturing process is specified herein. For example, sheet metal, sound deadening, zinc coatings, and paint primers for metal doors would be specified in paragraph 2.2. The fabrication and assembly of the components to form a metal door would be specified here.

PART 3—EXECUTION

3.1 EXAMINATION

A. Examination requires subparagraphs that formulate the criteria by which the subcontractor determines that the substrates to receive his work are sound, proper, and free of defects. These subparagraphs include condition of surfaces and inspection of structure.

3.2 PREPARATION

A. Preparation includes such subparagraph headings as field measurements, priming, and so on. For waterproofing or dampproofing it would include patching or grinding of surfaces to obtain a satisfactory base to receive these treatments.

3.3 ERECTION/INSTALLATION/APPLICATION

A. This paragraph would include various subparagraphs detailing the requirements for installation details, construction and erection methods, and quality of workmanship.

3.4 FIELD QUALITY CONTROL

A. Tests and inspection procedures to determine the adequacy of the work completed and installed are specified herein. This would include tests for soil compaction, pile loading, concrete cylinder tests, erection tolerance inspections, and so on.

3.5 ADJUSTING/CLEANING

A. Subparagraphs dealing with patching, adjustment, and cleaning would be used here to describe these requirements.

B. Patching would include the correction of honeycomb in concrete, defects in plaster or terrazzo, and so on.

C. Adjustment would include putting builders hardware into operating condition, balancing of a mechanical ventilation system, and so on.

D. Cleaning up in general terms is specified in Division 1, General Requirements (see Chapter 12). Cleaning of specific surfaces such as masonry, terrazzo, glass, and so on, is specified in this subparagraph.

USING THE SECTION FORMAT

It is important to note that the paragraphs above and subparagraph headings are appropriate when the work of technical sections can be adequately and appropriately specified thereunder. Do not use these headings when they do not apply. Introduce new headings when applicable. Deviations are proper when awkwardness would result from too close an adherence to this rule.

Another feature that is recommended for the section format is an organized system for the internal numbering of the paragraphs and subparagraphs. Since computers can handle most formats, the specifier can elect any alphanumeric system he chooses. The CSI pargraph format is as follows:

1.1 ARTICLE TITLE

A. Paragraph Heading

1. Subparagraph

a. Subparagraph

1) Subparagraph

CHAPTER 6

Types of Specifications

In general there are two basic approaches to writing specifications: the *method system* and the *results system*. When the method system is employed,the specifier describes in detail the materials, workmanship, installation, and erection procedures to be used by the contractor in the conduct of his work operations in order to achieve the results expected. When the specifier instead elects to specify results, he places on the contractor the responsibility for securing the desired results by whatever methods the contractor chooses to use.

The method system can best be described as a descriptive specification; the results system is best described as a performance specification. An appropriate analogy can be made by comparing these approaches with building code standards. The specifications code sets forth specific materials and methods that are permitted under the law in the construction of a building. Under the performance code, materials and methods are left to the architect and engineer, provided that performance criteria for fire protection, structural adequacy, and sanitation are met. As a matter of fact, both the descriptive specification and the performance specification can be used together in the same project specification, each in its proper place, in order to achieve the prime objective.

PERFORMANCE SPECIFICATIONS

Until the advent of systems building, the performance specification was used to a very limited extent. Buildings were designed using unit materials that could be defined and specified by means of descriptive, proprietary, or reference specifications. Performance specifications were used primarily when the specifier required the contractor to match or obtain a result consistent with an existing situation. Specifying in this manner constituted a performance specification.

Other examples of performance specifications are involved with relatively simple requirements. Since end results are paramount, a *performance specification* can be defined as specifying an end result by formulating the criteria for its accomplishment. The criteria for materials are established on the basis of physical properties of the end product. The criteria for equipment of a mechanical nature are established by operating characteristics. As an example, in a performance specification for a paint material, the end result is obtained by specifying or formulating the following criteria.

1. The painted surface shall withstand 10 washings with a mild detergent.
2. The painted surface shall show no sign of alligatoring or crazing.
3. The painted surface shall be resistant to abrasion when using the Taber abrasive method.
4. The painted surface shall have an eggshell finish.

Another example of a performance specification is one for a complete installation of a heating system. The specification spells out the following performance requirements:

1. The heating plant shall be capable of providing an interior temperature of 70°F when the outside temperature is 0°F.
2. The heating system shall use No. 6 oil and shall be a hot-water system.
3. The heating elements shall be fin-type baseboard radiation.
4. Controls such as thermostats, aquastats, and other safety devices shall be provided to regulate heat and prevent explosion.

Since the advent of systems building using major assemblies and subassemblies, there developed a need for more sophisticated procedures to specify end results. Performance

specifications encompassing these parameters are more fully explained in Chapter 7.

DESCRIPTIVE SPECIFICATIONS

A *descriptive specification* can be defined as one that describes in detail the materials to be used and the workmanship required to fabricate, erect, and install the materials. Described in cookbook fashion are the materials, workmanship, installation, and erection procedures to be employed by the contractor. This approach is based on the wealth of information and experience that has been gained by the specifier from use of known materials and methods.

The specifier is aware that if he specifies known bricks and mortar and proper workmanship techniques which have previously been used and put together in a specific fashion, the contractor can erect a quality masonry wall. As an example, a descriptive specification for a masonry wall would describe the materials to be used: the brick and mortar ingredients, composition of the mortar, tests of individual components, weather conditions during erection, workmanship involved in laying up the brick, type of brick bond, jointing, and, finally, the cleaning procedures. This allows all those concerned with specifications an opportunity to check each of the items specified. The supplier furnishes the brick and mortar as specified; the laboratory tests the components in accordance with specified test requirements; and the inspector checks the workmanship requirements so carefully specified. If the specifications have been accurately prepared, the masonry wall is erected accordingly, and the result the architect envisioned is achieved through his minute description.

REFERENCE SPECIFICATIONS

The *reference specification* is one that refers to a standard established for either a material, a test method, or an installation procedure. These standards similarly are predicated on either descriptive or performance criteria.

Before the advent of materials standards such as American Society for Testing and Materials (ASTM) specifications, American National Standards Institute (ANSI) standards, or federal specifications, materials were minutely described in the specifications so that the contractor was completely aware of what the specifier wanted. In many instances, these descriptive specifications for materials have been supplanted by the aforementioned standards. For example, in lieu of describing portland cement in detail, as to quality, fineness module, and other characteristics, the specifier now simply states that portland cement must "meet the requirements of ASTM C-150, Type—." This method of specifying has resulted in a type of specification that can best be described as a reference specification. By making reference to a standard, the standard becomes a part of the specification in the same way as descriptive or performance specification language is used.

The term "reference specifications" also can be applied to workmanship standards. Various trade associations, such as the Tile Council of America, the Gypsum Association, the Painting and Decorating Contractors of America, and others, have prepared standard workmanship specifications—for ceramic tile; furring, lathing, and plastering; painting; and so on—that can be incorporated by reference in project specifications. By so doing, the detailed descriptive workmanship clauses for these sections no longer need to be copied, but can simply be incorporated into the project specifications by means of the reference method.

It is essential that the architect and specifier be thoroughly familiar with the standards incorporated in the specifications. Some standards cover several types and grades, and unless the type or grade is specifically stated, the choice then becomes the contractor's option and not the architect's. In addition, a particular type or grade may be more suited for a particular project so that it should be selected and specified by the architect in preference to another type or grade. Sometimes the types or grades apply to a specific climate or geographical area, and they are used automatically unless another quality is specified.

Most standard specifications have been developed by committees representing materials manufacturers, government authorities, testing agencies, consumers, and those having a general interest in the particular standard. In many cases, these standards are compromises; in some cases, only minimum property standards are established. In some instances, it may be necessary to augment or strengthen certain provisions of these standards. This can be done quite readily by modifying the standard. However, one must be certain when modifying a standard that the material can be manufactured or furnished under these modified standards.

All reference specifications used by an architect should be on file in the architect's office. These standards are needed to make certain that the material or the installation procedure the architect specifies by means of these standards are satisfactory to the architect and are pertinent to the project. The architect needs them to check materials and test procedures submitted for approval. If the architect elects to use a reference specification for workmanship or for a construction procedure taking place at the site, it will also be necessary for the resident project representative to have a copy of that reference specification since the detailed requirements are specified in the standard rather than in the basic specification. For example, the architect may refer to an American Concrete Institute Standard for cold weather concreting, which describes procedures for placing concrete in freezing temperatures; or to an ASTM specification for masonry mortar, which describes various materials and mixing proportions of mortar; or to an ANSI specification for setting ceramic tile, which describe

installation procedures. A simple procedure to ensure that the inspector at the site has the specification reference is to include in the base specifications a provision requiring the contractor to furnish these standards at the same time he makes all his other submittals for review.

PROPRIETARY SPECIFICATIONS

A *proprietary specification* is one in which the specifier states outright the actual make, model, catalog number, and so on, of a product or the installation instructions of a manufacturer. Where certain options are available, the specifier should include those pertinent to the project.

REFERENCE STANDARDS

Benefits of Standards

Inasmuch as the subject of reference specifications has been discussed above, it is relevant to discuss in more detail here reference standards and the organizations that produce them.

Architects and specifiers constantly make use of reference standards in specifications, but many professionals are completely unfamiliar with the processes by which these standards are developed and promulgated. Furthermore, many are not aware of the contribution they can make in participating in the development and improvement of these standards.

Standards provide several important benefits. They reduce the number of types, sizes, and qualities of materials. They standardize methods of testing, and several provide standards on the quality of workmanship.

One major benefit is the reduction in size of construction specifications. By incorporating a reference standard in a specification, the volume of words required to specify a material and the method of testing it is reduced a hundredfold. This assures the specifier some degree of quality since the reference standard reflects the combined knowledge and experience of the people engaged in its development.

Nevertheless, it is imperative that if the quality of reference standards is to be improved, there must be greater participation by users. This means affiliation of individuals and companies as members of associations producing standards. Practicing architects, engineers, and specifiers are particularly encouraged to participate, since their interests are more objective and less colored than individuals representing manufacturers and industry.

Generally, most committees producing standards are a balanced working group representing all the interests concerned with the particular standard. Typically, they are composed of manufacturers of the basic ingredients of the material, the manufacturers of the end product, suppliers, independent testing agencies, consumer groups, contractors' associations, representatives of public authorities, and others who have special interests in a particular standard.

ASTM Standards

The product and test standards most widely used in both the private and public sectors of construction are ASTM standards. The American Society for Testing and Materials is an international, private, technical, scientific, and educational society devoted, in its words, to "the promotion of knowledge of the materials of engineering and the standardization of specifications and the methods of testing."

Since 1898, this organization has conducted research into the properties of materials and has developed numerous standards concerned with the specifications for materials, methods of testing, and definitions. An index to ASTM standards and information on membership may be obtained from the society headquarters at 1916 Race Street, Philadelphia, PA 19103.

Federal Specification Standards

Among federal agencies the reference standards that were mandatory until recently were Federal Specifications. ASTM committees are taking over the task of setting standards for products formerly in the FS series. Remaining federal specifications are in the custody of the General Services Administration. Copies of the Federal Specification Index may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

ANSI Standards

Another widely used reference standard is the ANSI standard, promulgated by the American National Standards Institute. In addition to developing standards on materials and testing procedures, many standards used in construction include workmanship and installation procedures. This standards body works closely with other technical societies engaged in developing standards, and many ANSI standards bear corresponding ASTM, AASHTO, NFPA, and CS standards numbers. An index of standards may be obtained from the association at 1430 Broadway, New York, NY 10018.

ACI Standards

The American Concrete Institute (ACI) is a nonpartisan organization that gathers and disseminates information about the properties and applications of concrete and promulgates recommended practices referred to as ACI standards. A catalog of publications of this institute is available from P.O. Box 19150, Detroit, MI 48219.

NFPA Standards

The National Fire Protection Association (NFPA) develops fire protection standards that are widely used as a basis for laws and ordinances. The more widely known standards used in construction are the National Electrical Code (NEC) and the Life Safety Code (LSC). Information on membership, technical committees, and NFPA standards may be obtained from the association at Batterymarch Park, Quincy, MA 02269.

AASHTO Standards

The American Association of State Highway and Transportation Officials (AASHTO) publishes standards on highway materials in two parts, one dealing with specifications for materials and the second with methods of testing. These AASHTO standards may be obtained from this organization at 444 N. Capitol Street, Washington DC 20001.

Standards of the National Institute of Standards and Technology

Commercial Standards (CS) and Simplified Practice Recommendations (SPR) are voluntary standards issued by the Institute and developed cooperatively with industry groups. CS establish quality requirements for products and SPR establish size and classes for stock items.

The Institute had consolidated these two types of standards and provided a new name, Product Standards PS, to describe these new standards being developed. The list of standards may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.