Construction Documentation
Specifications
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Specification services comprise the research, analysis, and evaluation that lead up to preparation of written requirements for building materials, equipment, and construction systems. The scope of the research in this process depends on specific project needs and requirements.

The goal of construction documents is to communicate the needs of the owner as represented by a design in a form easily understood by those responsible for construction. Specifications, an integral component of construction documentation, outline the levels of quality and the standards to be met in construction of a project. Written specifications were first produced separately from drawings to cut down on the clutter caused by lengthy descriptions. In addition, placing descriptions together in one place avoided the contradictions and errors often caused when specifications are repeated in many places.

Specifications define the qualitative requirements of materials and products to ensure that everyone understands the product requirements. The numbering and titling format used to organize construction information in specifications, the Construction Specifications Institute’s (CSI’s) MasterFormat, provides a means of coordinating that information with a contractor’s submittals, cost accounting systems, material filing, and requests for interpretation.

As defined in the AIA General Conditions of the Contract, drawings and specifications are meant to complement one another rather than one having precedence over the other. It is important for drawings and specifications to be developed concurrently, with both increasing in level of detail as the project moves through the design development and contract document phases. Specification sections are organized into 16 divisions. Division 1, the general requirements, outlines the procedural and administrative requirements for a project. The specification sections for materials, products, and systems are placed in Divisions 2 through 16.

Firms prepare specifications in a variety of ways. Some choose to prepare specifications in-house, either hiring a specifications specialist or relying on a member of the project team. Other firms use the services of an independent specifications consultant. In some instances firms may employ a combined approach, for example, using a specifications consultant for specialized or complex products and systems and relying on in-house staff to document typical construction materials. It is not uncommon for a firm to employ a hardware consultant to develop hardware specifications for a project or a curtain wall consultant to produce specifications for the exterior wall system. Whether specifications are developed in-house or with the assistance of a consultant, they are based either on a unique office master specification system or a commercially available master guide specification system such as MASTERSPEC, a product of the American Institute of Architects (AIA).

Ten to fifteen years ago, a group of specifiers from a number of large firms around
the country began meeting informally. An informal survey they conducted indicated that larger firms employed an average of one specifier or specifications specialist for every 20 to 25 design professionals. Today the group’s research shows that number is about one specifier for every 100 design professionals. As a result, instead of the specifier developing project manuals for every project, he or she concentrates on maintaining a master set of specifications and supporting the development of project specifications by the project team.

Automation of the process has made specification writing more efficient. CADD programs and the development of object-oriented documentation provide opportunities to assign attributes to objects in the drawings that support links between the drawings and the specifications. This linkage results in better-coordinated documents and supports the concurrent development of drawings and specifications. It is not hard to visualize a future in which construction information will be included in a single database or a series of linked databases and the paper-based drawings and specifications we now produce independently are reports formatted to present information in a way that is familiar.

CLIENT NEEDS

Product evaluation and development of specifications offers an agreed-upon format for recording and communicating decisions made during the design process. The intent is to develop an accurate match between the needs of a project and the products selected.

At the outset the architect and the owner must come to an agreement about the goals and expectations for a project. Their understanding will have a major impact on the performance characteristics of products selected for use in a project. Reaching a clear understanding of project requirements prevents the tendency to overspecify a product or to identify performance characteristics that go beyond the stated project requirements, either of which can add unnecessarily to the cost of a project.

Accurate documentation of selected materials and products can ensure owners will get what they have agreed to pay for and that the expected level of quality will be met. The specifications process is particularly critical when an owner has identified special performance requirements.

SKILLS

Product selection is an analytical process, requiring an aptitude for investigation and an eye for detail. It also requires an understanding of how buildings are put together that is gained from years of practical experience. A creative approach to problem solving and an understanding of the application of test procedures is also important. Products being evaluated don’t stand alone in a project but must interface with adjacent materials. Therefore knowledge of construction sequence and compatibility of materials improves the evaluation process. Access to multiple information sources and an extensive network of people with varied experience are necessary supports for those writing specifications.

Because material selection and installation involves complex issues and concepts, those writing specifications must be able to communicate well. Specifications should be composed in a concise and comprehensible manner so that they can be understood by individuals with varying levels of experience in the construction industry.

Knowledge of specification principles is basic for writing specifications, and the primary resource is CSI’s Manual of Practice. It is also important to understand the formats used to organize information in specifications, MasterFormat and SectionFormat. Basic computer skills, which include using word processing, database, and spreadsheet applications, are essential, and being CADD-literate is a big advantage.

Manufacturers and material suppliers play an important role in the process of material research and product evaluation. For established materials, they often represent the primary information resource, although many materials are represented by trade associations that develop standards for them and/or products made from them. For verification of manufacturers’ claims, specifiers refer to the work of testing agencies, insurance underwriters, and product certification agencies that evaluate the performance of many materials and products.
PROCESS

Specifications development is concurrent with the design process, which continuously yields performance or specific material or product requirements. The specifier must research products and materials that will meet the designer’s requirements. The final specifications reflect decisions made by the owner and designer throughout the process and serve as a record of those decisions. The specifications, assembled into a project manual in combination with the construction drawings, are then used by the constructor to bid and build the project.

Research Materials and Products

Material research is basic problem solving. A problem, or need, is defined; evaluation criteria are established; possible solutions are identified; potential solutions are evaluated against the established criteria; and the final selection is made.

Establish a need. The first step in the process is to establish the need for a material or product or the level of performance desired for it. What does this material or product need to do? What essential role does it play in the design?

Define evaluation criteria. In order to effectively evaluate the performance of various alternatives, project-specific evaluation criteria must be defined. Each material has many characteristics or attributes that contribute to its overall performance and to its applicability to a particular project. These attributes can be grouped by category. The list of categories below was derived from Construction Materials Evaluation and Selection: A Systematic Approach, by Harold J. Rosen, PE, FCSI, and Philip M. Bennett, RA, and from a list of attributes contained in CSI’s Manual of Practice. Examples of attributes are also provided for each category.

- Structural serviceability: natural forces, strength properties
- Fire safety: fire resistance, flame spread, smoke development, toxicity, fuel load, combustibility
- Habitability: thermal properties, acoustical properties, water permeability, optical properties, hygiene, comfort, safety
- Durability: resistance to wear, weathering, adhesion of coatings, dimensional stability, mechanical properties, rheological properties.
- Practicability: transport, storage at the site, handling at installation, field tolerances, connections
- Compatibility: jointing materials, coatings, galvanic interaction or corrosion resistance
- Maintainability: compatibility of coatings, indentation and puncture (patching), chemical or graffiti attack
- Environmental impact: resource consumption at production, life cycle impact
- Cost: installed cost, maintenance cost
- Aesthetics: visual impact, customizing options, color selection

Refer to CSI’s Manual of Practice for detailed discussions of the material attributes that would be included in the groups listed above.

Based on the project goals and the design concept, attribute categories are used to list the requirements for the material being evaluated. Each material will have its own profile of applicable categories, as some may not be needed while others are critical to the performance of the material. The goal is to define the level of performance required of the material for the particular project. The list of desired attributes and performance criteria becomes the evaluation criteria for each material.

The process of developing evaluation criteria is a great opportunity to involve the client in a project. Clients can help determine and establish the priority of the criteria. Everyone involved in the process has a different point of view regarding which criteria are the most important. From the specifier’s technical point of view, the durability of a material may be most important. To the designer, aesthetics may be most important. To the client, cost may be the driving force in terms of material selection. It is important that all parties reach an understanding that results in the establishment and documentation of priorities.

Identify options. Once the criteria have been developed and prioritized, possible
material or product options are identified. Information about a material or product is collected and organized. In some cases a manufacturer’s product literature, product representative, or other information source may not be able to provide information about a specific performance characteristic of a product or material. This product or material should not be considered for a project, then, unless the material manufacturer or a testing authority will conduct the required tests and provide the missing information.

Evaluate materials and products. After material and product information has been compiled, it is compared to the evaluation criteria for the project. A system of pluses for criteria that meet project requirements and minuses for criteria that don’t meet them can be used to determine if a material is acceptable. Another method involves developing a rating system of 1 to 10 based on how well a material matches the criteria for a project. Each material is evaluated on each criterion, the scores are added up, and the materials are compared. The higher the score, the better a material satisfies the evaluation criteria. To take the process a step further, the evaluating criteria can be given a weight factor based on its assigned priority. The scores are multiplied by the weight factor and then added to get the total score. This is a simple explanation of the process used in a software package developed by Expert Choice, Inc. The software supports ASTM E1765, “Analytical Hierarchy Process: Standard Practice for Performing Multi-Attribute Decision Analysis in the Evaluation of Buildings and Building Systems.”

It is helpful to create a matrix to record the evaluation and rating process. This provides a useful document that can be referred to during bidding and construction if requests for substitute materials are submitted. A record of the criteria used to make your decision can also be helpful during submittal review if a manufacturer has changed its documentation and claims related to the performance of a material.

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**PRODUCT EVALUATION SUMMARY SHEET**

<table>
<thead>
<tr>
<th>CRITERIA</th>
<th>TEST RESULTS</th>
<th>SUBJECTIVE EVALUATION</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Structural serviceability</strong></td>
<td>Class A?</td>
<td>Ins. properties not affected by water</td>
<td></td>
</tr>
<tr>
<td><strong>Fire safety</strong></td>
<td>Water resistant; perm rate: &lt; .027; elongation: 1000%</td>
<td>Sees no thermal stress, protected from foot traffic</td>
<td></td>
</tr>
<tr>
<td><strong>Habitability</strong></td>
<td>Penetration: 110@77°F; Flow: none @ 120°F</td>
<td>Roof membrane not visible, more pavers and insulation to find leak</td>
<td></td>
</tr>
<tr>
<td><strong>Durability</strong></td>
<td></td>
<td>Adhered to deck; no migration of water if leak develops</td>
<td></td>
</tr>
<tr>
<td><strong>Practicability</strong></td>
<td>Fluid applied; bottle required</td>
<td>Can be installed w/o slope</td>
<td></td>
</tr>
<tr>
<td><strong>Compatibility</strong></td>
<td>Transitions made with neoprene</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Maintainability</strong></td>
<td>Insulation contains no CFC blowing agents</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Environmental impact</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cost</strong></td>
<td></td>
<td></td>
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<td><strong>Aesthetics</strong></td>
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**Definitions**

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**Habitability:** Thermal properties, acoustic properties, water permeability, optical properties, hygiene, comfort, safety

**Durability:** Resistance to wear, weathering, adhesion of coatings, dimensional stability, mechanical properties, rheological properties

**Practicability:** Transport, storage on site, handling at installation, field tolerances, connections

**Compatibility:** Jointing materials, coatings, galvanic interaction or corrosion resistance

**Maintainability:** Compatibility of coatings, indentation and puncture (patching), chemical or graffiti attack

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**Cost:** Installed cost, maintenance cost

**Aesthetics:** Visual impact, customizing options, color selection

Prepare Specifications

Specifications writing is a continuous process. The first draft specifications for a project define qualitative requirements of materials, products, and workmanship. Once product selections have been made, a definition of the salient qualities of each product that make it meet the project requirements should be added to the specifications.

There are four basic types of specifications—descriptive, proprietary, performance, and reference standard. The first three can be used to specify the essential qualities of materials for a project. Reference standard specifications are published by standards organizations or organizations that represent manufacturers of specific building elements and are typically referenced without customization.

*Descriptive specifications* require written descriptions for each material or product to be used in a project. These descriptions should include the attributes that are essential in order for a material or product to meet project requirements.

Care must be taken when drafting a description. If a specification is based on information provided by the manufacturer, include only those attributes required for your project. For example, literature from a manufacturer of clad windows may include the thickness of the cladding as a way to differentiate its product from that of other manufacturers. If the level of performance required for a project does not depend on the thickness of the cladding, the thickness should not be included in the description. If the thickness is included and the specification strictly enforced, only products with the specified skin thickness would qualify, limiting the options to the one manufacturer or forcing other manufacturers to customize their window to meet the specified requirements.

*Proprietary specifications* list only the products and manufacturers that are acceptable for use on a project. They are the most concise form of specification. If a product model number is identified and includes any options that may be applicable to the product, no lengthy description of the product is required. However, it is important to leave no salient option unidentified. If a specification does not mention an option that is essential to an acceptable product, a claim could result for additional cost if the desired option is not standard, or a contractor could select an alternative product without consulting the architect. A proprietary specification may include only one manufacturer or as many as meet the project requirements.

Including model numbers for all manufacturers selected is the best way to ensure a contractor will select an appropriate product. Another popular method, basis of design, is to list the desired product and manufacturer but allow for comparable products from other specified or approved manufacturers. Note, though, that this degree of latitude can require additional time when reviewing a submittal to determine whether the submitted product meets the requirements and is truly comparable to the specified product.

It is often tempting to combine proprietary specifications and descriptive specifications. Construction administrators complain that they need the description to ensure that the product submitted actually meets the requirements of the specification. However, if there is a slight discrepancy between the description of a generic product and an actual product identified by model number, this can be a problem. As well, the greater the number of manufacturers and products identified, the greater the risk of creating a conflict. Careful coordination is required when proprietary and descriptive methods are combined.

*Performance specifications* identify the performance characteristics that a product, assembly, or system must satisfy. Creating a true performance specification is difficult. A performance specification has two important components—the intended performance characteristics and a means by which that performance can be verified. The performance specification must include every aspect of desired performance. Missing performance criteria or an assumption that such criteria are understood can cause a contractor to propose a solution that meets all the stated criteria and yet completely misses the intent.

It is also important for performance criteria to be realistic and achievable. In some circumstances there may not be a product that can provide the required performance. Writing a performance specification that stipulates a particular performance won’t make a product that can offer that performance available. However, if a firm begins working with manufacturers of similar products as soon as a need is identified, this may be enough incentive for a manufacturer to do the research, development, and
testing required to bring a product with the desired level of performance to market. Few projects are able to bear the cost of new-product development. Getting a manufacturer involved early may also result in an alternative design for which a product with the desired performance already exists.

*Reference standard specifications* are published standard specifications that are incorporated into project specifications by reference. According to CSI’s *Manual of Practice*, reference standards are requirements set by authority, custom, or general consensus and are established as accepted criteria.

Specifying by using reference standards is very concise because a reference standard number can be cited in lieu of a lengthy description of a product. For example, portland cement can be specified by referencing ASTM C150 instead of including a description of the physical properties, chemical composition, and fabrication process of the cement. When using reference standards, it is important to have a copy of the standard and understand its content. Standards may sometimes include options or additional responsibilities for the design professional that should not be included in a project or that, if included, create contradictions or duplications of requirements specified elsewhere. When using a reference standard, make sure that all choices have been identified. For example, the standard for glass includes choices for type, class, quality, finish, and pattern. The reference for clear transparent flat glass would be ASTM C1036, Type I, Class 1, q3. Wire glass would be Type II, Class 1, Form 1, q8, m1.

**File Research Information for Future Reference**

The continually expanding library of construction information and data yielded by the design process can be used in different ways and for different purposes. Material and product data compiled while writing specifications for a project can be used both for other projects and later in the life cycle of the project for which they were first researched.

To make use of all the research performed during the specifications preparation process, an architecture firm will want to have a means of storing this information so that it can be retrieved again, both as general information and as project-specific information. For example, an architect can use programming information to establish criteria or rules against which preliminary design solutions can be evaluated. After a project has been completed and occupied, facility managers may find value in this programming information, which often has been discarded after design or occupancy. Along with the record documents, facility managers can use documented design performance criteria so that they will know if contemplated modifications violate any of the original criteria.

As the need expands to access this kind of information, it is important to document final decisions about materials and products and to describe the evaluation and selection process. This is especially important when systems are critical to the function of a project or when the project incorporates new materials or materials used in new and untested ways. However, not every material or product that goes into a project needs to be documented in this manner. Some materials have become commodities, and their use and performance is generally understood (e.g., portland cement, steel door frames, etc.). These, then, do not require extensive material or product research.

In most cases it is important to keep this documentation with the project. Prior to the explosion of electronic information, a folder was created in the main project file and product selection documentation was filed by MasterFormat 16-division specification number. Today the information can be appended electronically to the specification file or a separate folder created for this information. Whatever filing system is used, it is important for the information to be archived with the project when the project is closed out.

If a specifier feels the information would be of value for future projects, the information can be incorporated into a firm’s master guide specification system. The information can be integrated as notes in the text of the section, appended to the end of the section, or included in a separate evaluations folder tied to the specification section by the same file name. Most word processing applications provide for the use of hyperlinks. This gives the person accessing the specification section the option to activate the link from the text and jump to the evaluation sheets. This process is automated in MASTERSPEC.

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

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

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

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


For more information about AIA Contract Documents, visit [www.aia.org/contractdocs/about](http://www.aia.org/contractdocs/about)

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