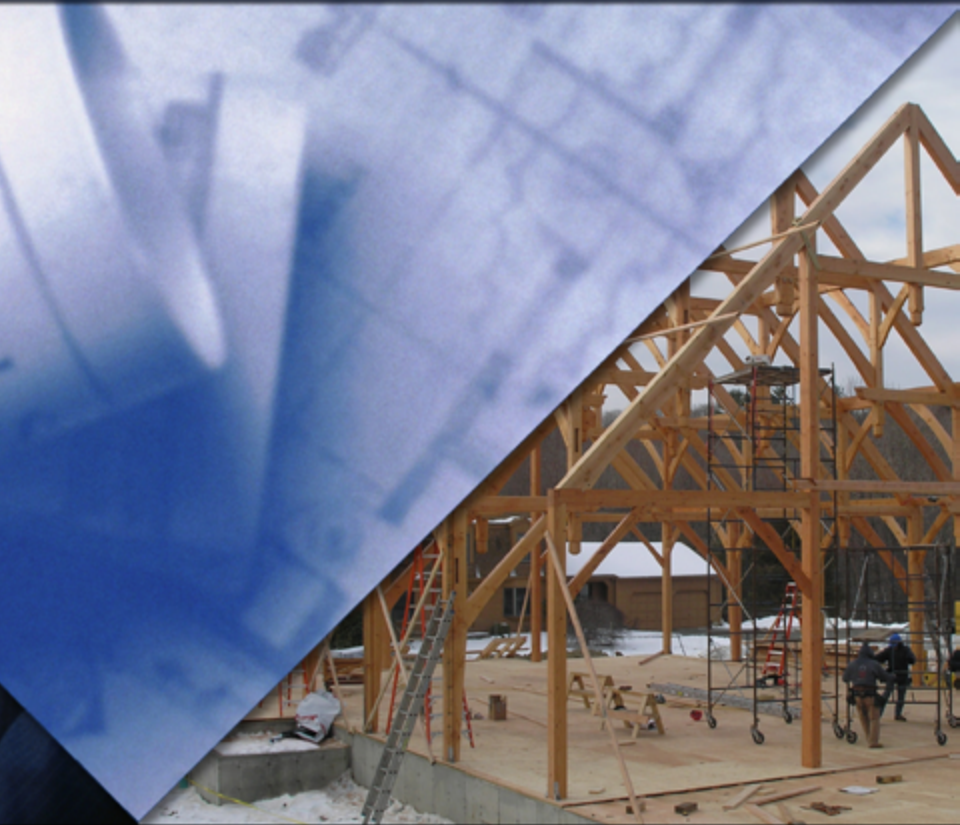




Connecticut Construction Guidelines

The Manual for Successful Building Projects



Connecticut Construction Guidelines

*The Manual
for
Successful Building Projects, 2nd Edition*

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• Forward •

The guidelines that follow are the work of a coalition of construction professionals representing all of the major disciplines of the design and construction process. Our goals have been to put forth a document that is of use both to the owner and to the specific professionals who make up the project construction team. We have endeavored to present information with clarity and brevity. We hope that the use of these guidelines will lead to the creation of dedicated teams on construction projects in Connecticut, working together toward a clear common objective- the successful completion of a great construction project.

These guidelines are not intended as a substitute for professional services, nor do they purport to establish any professional or legal standard. Users of these guidelines should consult with the appropriate professionals regarding the subjects discussed herein. These guidelines do not necessarily reflect the opinions of the authors, their firms, participating associations or members of the Connecticut Construction Guidelines Coalition.



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Connecticut Building Congress

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• Preamble •

The Three-Legged Stool

The construction process can be thought of as a three-legged stool, whose three legs are: 1) scope, 2) cost and 3) duration. Scope answers the question: “Exactly what are you building?”- including building size, function, layout, quality of materials, and site. Cost deals with the total cost of designing and building that which defines the scope, and duration establishes how long the process will take from initial conception to final completion.

The three-legged stool metaphor offers a good way to describe these three basic elements because they are interdependent- each leg depends on both of the others, and all are required for a satisfactory finished product. Depending on what you are building, it will take more or less time and will cost more or less money. Equally though, the cost will depend not only on what is being built but how long it will take to design and build it, and the duration will depend on what is being built and how it is being built.

This last element- the “how”- can be thought of as the struts connecting the legs on the stool, establishing a procedure for integrating the three legs of the stool and thus completing a total project. We call this the “Project Delivery Method”. (See Guideline 1.4)

• Planning •

- **1.1 Getting Started** ... General principles
- **1.2 Owner Objectives** ... Owner project goals
- **1.3 Roles in Planning & Pre-construction** ... Who does what
- **1.4 Project Delivery Methods** ... Choice of a construction system
- **1.5 Standardized Contract Documents** ... Selecting coordinated documents
- **1.6 Selection of Design Professionals** ... Securing the most qualified design professionals
- **1.7 Insurance & Risk Management** ... Completing projects in spite of default by one or more participants
- **1.8 Alternate Dispute Resolution** ... Procedures alternate to litigation to prevent or resolve disputes
- **1.9 Sustainability** ... Planning projects to minimize negative impact on the natural environment
- **1.10 Site Investigation** ... Ensuring that the project site is suitable for the project
 - **1.10.1 Environmental Investigation & Remediation** ... Identifying and dealing with potential polluting substances on the site
 - **1.10.2 Geotechnical Engineering** ... Ensuring that the site will structurally support the building & accommodate sanitary drainage if necessary
- **1.11 Regulatory Approvals** ... Obtaining required governmental approvals for a project



Planning

Guideline 1.1 • Getting Started

ISSUE

How to achieve a smooth, error-free and conflict-free process for construction projects.

DISCUSSION

By their very nature, construction projects are complicated and susceptible to common mistakes made by multiple participants, from the owner to architects, engineers, general contractor, subcontractors and countless vendors. Opportunities for conflict between two or more of these parties may be reduced or eliminated by the careful consideration of the following factors:

- Use of a process for selecting design professionals and contractors based on quality, not just on lowest bid
- Recognition of the long-term nature of construction projects
- Selection of a “project delivery system” appropriate to the project (See Guideline 1.4)
- Creating truly complete drawings and specifications
- Making realistic cost projections
- Doing realistic scheduling (avoiding “haste makes waste”)
- Early identification of as many site and weather conditions as possible
- Good communication and coordination among participants
- Prevention of attempts by parties to unfairly shift project risks onto other parties
- Provision of adequate contract administration

RECOMMENDATIONS/BENEFITS

The Ten Commandments of Construction

Most of the problems that typically arise in construction projects can be avoided or mitigated by adhering to the following vital, basic recommendations:

- 1. Deal with Responsible People:** All industries suffer from the actions of a few people doing business who are either incompetent or dishonest, or both. In construction, the consequences of dealing with such people are more severe due to the large amount of resources and time being committed. Take the time to check out the qualifications and experience of all proposed major participants in the project.
- 2. Use Common Sense:** Owners must not rely too easily on commitments which are way out of line with those being made by the competition. If one bid is far lower than

Planning

Guideline 1.1 • Getting Started

all of the others, or a promised completion date is far sooner than all the others, be extremely wary. Only rely on such a proposal from a very dependable, experienced person or company on the basis of plausible, objective factors.

- 3. Conduct a Very Thorough Site Inspection:** At the outset of the project, the owner and design professional should, by test borings and other site investigations, obtain as complete information as they can concerning subsurface conditions; site utilities; presence of polluting substances; project boundaries; character of surrounding properties; access to the site; weather history; applicable governmental laws, ordinances and regulations; and any other information which would be useful in preparing a comprehensive set of contract documents. The more information the parties have available to them when they begin the project, the more smoothly the job will proceed.
- 4. Define and Communicate Clear Project Goals:** The owner must be clear about the purposes of the project and then communicate them fully to the others involved. The design professionals should elicit these purposes and goals from the owner and express them clearly in the project documents so that they are completely understood by all the project participants. (See Guideline 1.2)
- 5. Enter into and Enforce a Fair Contract:** Parties to a construction project must be willing to commit themselves, by an enforceable written contract, to fully and fairly perform their agreed tasks on the job. Each party will also be able to enforce the commitments made by the others if such commitments are within the actual control of such other parties. If, however, one party tries to make others unfairly responsible for project risks such as job delays, cost over-runs and changes in the work, over which such other parties have no control, even further costs and delays will be caused by the ensuing dispute.
- 6. Develop Comprehensive Drawings and Specifications:** Owners must give the design professionals adequate time and money to provide a comprehensive design appropriate to the project delivery system selected (see Guidelines 1.4, 2.1). This relatively small upfront investment will pay large dividends by reducing problems and disputes that typically arise when participants lack the information they need to do a competent job.
- 7. Make and Monitor a Realistic Construction Schedule:** Everyone recognizes the need to carefully plan and constantly monitor job progress as it is impacted from so many separate but inter-related points throughout the duration of the project. It is equally important to avoid setting up impossible targets that soon cause the job to run behind schedule and to generate disputes.
- 8. Make a Realistic Budget Projection:** A dollar's worth of construction costs a dollar. The owner should know the resources actually available for the project and make this known to the design professional, whose design should be based on these resources. Hedging bets by loading the documents with too many variables or catch-all clauses will result in disputes generated by uncertainties in the scope of the work, the quality or quantity of the materials to be used, or the procedures to be followed.

Planning

Guideline 1.1 • Getting Started

- 9. Face Problems Promptly and Squarely:** Construction is a complicated process subject to a high incidence of “Murphy’s Law”. Yet, most of the problems may be anticipated and solved if the participants don’t try to deny their existence. Problems will be resolved best if faced earlier rather than later. There are processes available such as the appointment of a neutral party at the beginning of the job- a “job-site neutral”, functioning as a mediator of disputes during the actual construction process, who may be able to resolve small disputes before they become big ones. If problems are swept under the rug, you can be assured that they will reappear later, even after completion of the project.
- 10. Work Together:** Parties traveling to the same destination won’t arrive together if they all use different road maps that they conceal from one another. Costly problems can be nipped in the bud if the parties agree from the beginning to share all relevant information. On larger projects, the parties have available to them a process known as “partnering”, in which the parties meet regularly during the project to share information and concerns. (See Guideline 1.8) New delivery methods, such as “Integrated Design”, which requires a team approach to the construction process, may offer an appropriate model. (See Guidelines 2.1 & 2.2 - BIM)

If participants in construction projects make a conscientious effort to follow the above recommendations and thereby avoid “the adversarial dance” too often associated with construction, they will all realize time and money saved, and owners will get the projects they want with the budgets available.

RESOURCES

- American Arbitration Association. www.adr.org
- Martindale Hubbell Dispute Resolution Directory. www.dispute.martindale.com



Planning

Guideline 1.2 • Owner Objectives

ISSUE

The generating force for any construction project is the original goal of the owner. Yet sometimes an owner, who may be an individual or an organization, commences a construction project without elucidating a clear objective that is well understood by all participants.

DISCUSSION

Owners undertaking a construction project need to define the original purpose for the project, whether it be a personal, business or public policy purpose, and communicate it clearly.

Regardless of the scale of the project the owner, at its outset, needs to elucidate clearly the reasons for its construction and to communicate these to the design professional and contractors engaged in the project. Because the participants in a project may begin with differing ideas of what the goal is, this uncertainty must be cleared up quickly, so that decisions made during the construction process work toward reaching the true objective. The owner must maintain vigilance to assure that the basic objective is not obscured by decisions in the process, thereby avoiding needless expense of money and time.

RECOMMENDATIONS/ BENEFITS

In order to keep on track and achieve the original goals of the construction project, the owner should:

- Clearly articulate the project objective and commit it to writing
- Communicate this objective clearly and unambiguously to all members of the project team
- Evaluate all major project decisions, such as choosing a project delivery system (see Guideline 1.4), setting a budget, selecting design professionals (see Guideline 1.6), and awarding bids, in terms of achieving this project objective
- Provide oversight during the development and construction of the project to insure that the project objectives are met

Planning

Guideline 1.3 • Roles in Planning & Pre-construction

ISSUE

Regulatory requirements at the local, state, and federal level have become increasingly prescriptive and can exert major impacts on building design and performance. In addition, several agencies have promulgated standards that are in conflict with one another. These issues must be addressed at the outset of the project and preferably even prior to site selection.

DISCUSSION

The owner's program requirements must be clearly developed in conjunction with an early evaluation of any anticipated regulatory approvals that may be required; analyses of physical constraints that may be dictated by building configuration and occupancies; and impacts on surrounding environments and neighborhoods. Global issues of energy conservation, greenhouse gas emissions, carbon footprint and the overall sustainability of the project suggest the desirability of the integrated design process, which will bring many disciplines to the table at the project outset. The relatively small up-front costs of these investigations can be offset by resultant cost effective solutions both during construction and throughout the life of the building.

Not every project requires the services of all the consultants listed below. The inclusion of some or all of the consultants may be required in the approval process at local land use level as well as before statewide agencies. The project is "fleshed-out" in the planning process, and typically the method of project delivery is established. This decision sets the roles of the relevant consultants and establishes finite areas of responsibility as well as how the flow of the information is developed.

PLANNING ROLES:

- Architects can provide programming services for the Owner, offering an objective evaluation of present facilities and operations and developing the scope of the desired outcome. This is accomplished by inventorying space, interviewing personnel, meeting with persons or committees in charge of the project, and presenting the findings. From this process, actual physical requirements are established. These are used in conjunction with the other consultants to review buildings and properties to determine the suitability for the project.
- Land Surveyors provide accurate mapping of physical features, property lines, easements and rights-of-way that will impact the project. The owner contracts for these services and provides the information to the design team.
- Land Planners are brought into the process for large projects or large tracts of land. Land Planners provide services that shape the project's form on the parcel of land. Off-site impacts may also be explored by the planning consultant.
- Soil Scientists, Archeological Consultants and Environmental Consultants provide services that map and describe wetland soils, biological species habitats, significant

Planning

Guideline 1.3 • Roles in Planning & Pre-construction

archeological features and artifacts, and the presence or absence of hazardous materials.

- Civil Engineers provide design services for site utilities, grading, erosion control, parking areas, driveways, roads and pedestrian circulation systems. Off-site services may also be required based upon the project's location.
- Structural Engineers may be brought into the planning process to evaluate the suitability of a structure for the intended use. They typically interface with any Geotechnical Consultants with regard to the evaluation and suitability of the soil types on the site.
- Mechanical, Electrical and Plumbing Engineers design the HVAC, electrical and plumbing systems for the project. Their roles in pre-planning have become more important, as basic decisions on energy-efficiency and sustainability have huge impacts on the design of these systems. This information needs to be incorporated early on in the process, as it may impact site selection and building configurations.
- “Green” and Sustainability Consultants are playing an increasingly crucial role in project planning. Energy efficiency, “Green Building” technologies and sustainability issues need to be addressed early in the process, as these will have vital impacts in the decision-making throughout the entire project and will affect any accreditation that is being sought.
- An expert in estimating and project costs may become involved at an early stage to identify the project costs and industry cost trends as they may impact the project. These services may be part of the project delivery process.
- Specialty Consultants that may be required in the early stages of the project include traffic engineers, air-quality consultants, acoustical engineers and industrial process engineers.

PRE-CONSTRUCTION ROLES

During Pre-Construction, the specific duties of each consultant are outlined for inclusion into the contract documents. The chain of responsibility is determined by the chosen project delivery method. Traditionally the architect has been the prime consultant to whom all sub-consultants report. In the traditional design-bid-build project delivery method, the architect is responsible for the coordination of all the pieces of the project. However, as discussed elsewhere, various other project delivery methods may distribute this responsibility differently. Due to the prescriptive credit requirements of the various “green” agencies, the green and sustainability consultants must be included in the decision-making process throughout the development of the contract documents. As budgets are firmed up and the project takes shape, any value-engineering that may be employed to maintain costs within the limits set by the owner could have a significant impact on the green credits being sought. The green consultant must review the proposed changes and inform the project team of any potential impacts on the certification requirements.

Planning

Guideline 1.3 • Roles in Planning & Pre-construction

RECOMMENDATIONS/BENEFITS

- Develop a spreadsheet of owner requirements and regulatory parameters and prioritize orders of importance and magnitude of impacts.
- Involve the design team prior to site selection, if at all possible, to minimize conflicts and costs associated with fitting a building onto a site which is at cross-purposes with the owner's needs and desires.
- Engage contract administration services that are critical to ensuring that sustainability goals will be achieved.

RESOURCES

- American Institute of Architects. www.aia.org
- Associated General Contractors. www.agc.org
- Connecticut Green Building Council. www.ctgbc.org
- American Council of Engineering Companies. www.acec.org



Planning

Guideline 1.4 • Project Delivery Methods

ISSUE

After deciding to undertake a building project, the owner needs to choose from the several ways in which project teams may be organized in order to get the project designed and built in the best way.

DISCUSSION

Project delivery methods can be classified into three categories—traditional methods, construction management (as agent or constructor), and design-build (standard or bridging). The responsibilities, risks, and rewards for the project team members will vary with the method selected.

Traditional Methods

Design/Bid/Build

Most building projects follow a traditional method in which an owner hires an architect at the beginning of the process to develop a design and prepare the documents needed to build it. In this method the process follows in a linear fashion, completing the design, bidding and construction phases without overlap. During the bidding phase, the owner hires a general contractor under a separate contract to construct the building. The architect is often paid a fee proportional to the cost of construction, while the contractor's compensation is typically built into the cost of construction. The advantages of this method are that the owner knows that the design is complete at the time of construction, the construction price is fixed, pricing is competitive, and the owner is somewhat insulated from subcontractor claims. The disadvantages of this method are that the process may be adversarial (architect vs. contractor vs. owner); the general contractor usually includes a mark-up on subcontractor prices in his pricing; the contractor rarely provides preconstruction services; and there is a relatively long time between project inception and completion. Further, if the owner has a separate contract with each of the two parties, a question is raised as to who acts in the owner's interest?

The general contractor approach is the conventional method common to many types of undertakings, particularly those initiated by public clients with legal requirements to select the low bidding contractor (see Figure 1).

A negotiated select team approach has the same contractual relationships as the general contractor approach, but the general contractor joins the project much earlier and the process is much less formal. The contractor can provide preconstruction services to the owner. (See Figure 1.)

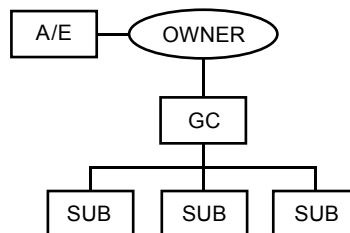


Figure 1

Planning

Guideline 1.4 • Project Delivery Methods

In some instances the owner may wish to act as the contractor, contracting with subcontractors directly. This approach has the advantages of eliminating the contractor's profit and mark-ups and may support phased "fast track" construction. However, this approach diminishes the owner's ability to impose responsibility on a single construction entity, and the owner may lack the capability of adequately organizing and managing the construction process.

Construction Management

Construction management (CM) is a broad term covering a variety of project delivery methods in which a construction manager is added to the building team to oversee such elements as schedule, cost, construction, quality, project management, or building technology. CMs can serve in a variety of capacities with varying degrees of authority, depending on how the project is structured. Construction management is particularly appropriate for both public and private projects that are relatively complex, for which budget or schedule must be closely monitored, and those requiring extensive coordination of consultants or subcontractors.

CM as Advisor: The CM can perform as a consultant to the owner. The CM's fee is based upon the services to be performed, which may range from advising during a particular phase of the building process to acting as the owner's agent in all matters (see Figure 2).

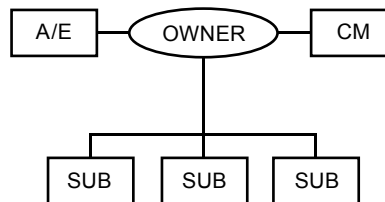


Figure 2

CM as Constructor (at risk): In this delivery method, the construction manager is typically hired prior to the completion of design to act as the project coordinator and general contractor (see Figure 3). Using this method, the owner may obtain pre-construction services, a guaranteed maximum price, insulation from subcontractor claims and the potential to put construction activities on a "fast track". The CM as Constructor may be retained by bid to deliver the building for a guaranteed maximum price or by creating multiple bid packages. In either case, the construction manager assumes all the liability and responsibility of the general contractor, which explains why the method is also known as "construction manager at risk."

With the CM constructor method, the owner may first retain either the CM or the architect to help the owner to define the scope of the project. When the architect is retained first, the owner may solicit competitive proposals including construction budgets from CM candidates. When the design is sufficiently complete (75-100%), the CM will propose a guaranteed maximum price (GMP) which will include a contingency fund. The size of the contingency will generally depend upon the extent to which the scope of the project and the associated risk has been defined. The GMP proposal is subject to the acceptance of the owner.

Planning

Guideline 1.4 • Project Delivery Methods

This method is common among owners for whom cost, schedule, or construction is expected to be complicated to manage, as when a project will be fast-tracked. Fast-track construction requires the owner to make some design decisions earlier in the process, fixing elements of the project before all ramifications and cost implications are known. Fast-track construction often costs more than traditional construction, but is intended to deliver the project in a shorter time.

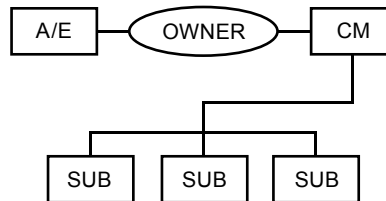


Figure 3

Design-Build

The design-build delivery method combines the design and construction responsibilities into one entity (see Figure 4). This provides the owner with a single point of responsibility and allows contracting with a single entity, thus avoiding the need to coordinate the activities of the designers and contractors. All responsibilities for coordination are handled within the design-build entity.

The design-build entity is usually selected based on a statement of design and technical performance requirements. The owner may choose between one or more design-build entities that have been invited to submit technical and cost proposals. The selected entity prepares the design and construction documents.

Design-build is appropriate for a wide variety of project types where the owner is in a good position to specify the design requirements. The owner may retain an architect to develop design guidelines and requirements for the project and to oversee the work of the design-build entity for compliance with those requirements. This process is commonly called “bridging.”

The design-build entity may also be in a position to provide the owner with expanded services:

- *Turnkey*: The design-build entity provides financing for project development, turning the project over to the owner upon completion.
- *Build-leaseback*: The design-build entity retains ownership of the project, leasing it back to the client who commissioned it based on terms negotiated at the outset.
- *Build-operate-transfer*: The design-build entity retains ownership of the project, operating it according to the client’s requirements.

Planning

Guideline 1.4 • Project Delivery Methods

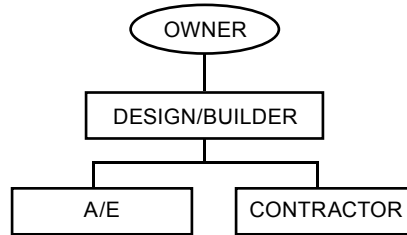


Figure 4

Other Services

Program Management Services

An owner may also engage a construction manager, architect, or contractor to provide a broader range of services commonly designated as “Program Management” services. These services are contracted by the owner on a consulting basis at the outset of the project, with the project manager to act in the owner’s behalf on a wide range of services. Program managers are most effective when they undertake the management of complex, multi-phased or multi-building projects for owners who may not have the in-house staff or capabilities to undertake such projects on their own.

Construction Administrator Services

An owner may engage a construction manager or contractor to act as a “construction administrator” during the design and construction phases. During the design phases the construction administrator provides preconstruction services to the owner such as cost estimates, value engineering, and constructability reviews. During construction, the construction administrator may act as the owner’s field representative, processing change orders and requests for payment, advising the owner on safety issues and organizing project meetings.

RECOMMENDATIONS/BENEFITS

The choice of one method over another will depend on which method best satisfies the owner’s interests: quality of construction, design and construction schedule, total project cost including construction costs and fees, functionality, operations and maintenance costs, aesthetics and flexibility. Owners should also consider their own capabilities: their resources for design project management and construction; their ability to make decisions; and their ability to provide necessary information. It is also necessary to consult any guiding legislation or procurement regulations for bidding and construction requirements.

The Coalition recommends that owners undertaking a building project begin by evaluating their goals and aspirations for the project and match these goals with the most appropriate project delivery method. Architects, contractors, and developers may be of assistance to the owner in this process. Selection of the project delivery method most appropriate for a project will be most likely to produce a finished building project that satisfies an owner’s needs.

Planning

Guideline 1.4 • Project Delivery Methods

RESOURCES

- Adapt: Handbook on Project Delivery. Sacramento, CA: American Institute of Architects, California Council.
- The Architect's Handbook of Professional Practice, Volume 2, *The Project*. Washington, DC: AIA Press.



Planning

Guideline 1.5 • Standardized Contract Documents

ISSUE

Does it make sense for owners, architects, engineers, contractors and subcontractors to find a standardized set of agreements, construction conditions and other documents that are related and integrated for use on construction projects?

DISCUSSION

The use of standardized documents is intended to provide a common basis for legal and business relationships within the design and construction process. When non-standardized or modified documents are used, conflicts may arise between incompatible documents. Gaps in responsibility may arise, or disagreements may occur about the meaning of terms and conditions.

The American Institute of Architects (AIA), the Engineers Joint Contract Documents Committee (EJCDC) and other construction related organizations have developed and coordinated standardized documents for use on building projects. AIA documents, in particular, have been developed over a period of many decades. The Associated General Contractors (AGC) has also developed a set of standard construction documents called “Consensus Documents.” Each of these collections of standardized documents express the complex expectations, relationships, responsibilities and rules that tie together the parties in design and construction.

Attention should be given to the revision date of the standardized documents selected. Standardized documents are periodically reviewed and revised to reflect the conditions of their time as well as recent legal opinions and decisions resulting from relevant disputes on other projects.

RECOMMENDATIONS/BENEFITS

The coalition recommends the use of standardized document forms such as those published by the AIA, EJCDC or AGC for use on construction projects in Connecticut. The owner’s attorney can give experienced advice on the choice of which set of documents to use on a particular project. The goal behind these standardized documents is to fairly allocate project risks among the participants in a project. Regardless of the source of standard documents chosen for the project, the particular documents suited for the project will depend on the project delivery method chosen (see Guideline 1.4). Standardized documents are also available for technical specifications and for both project-specific and general requirements.

Planning

Guideline 1.5 • Standardized Contract Documents

RESOURCES

- American Institute of Architects. www.aia.org
- Engineers Joint Contract Documents Committee. www.ejcdc.org
- Associated General Contractors of America. www.agc.org
- Construction Specifications Institute. www.csinet.org



Planning

Guideline 1.6 • Selection of Design Professionals

ISSUE

How do you select a design professional for your building project?

DISCUSSION

While the design fees for a project typically represent only a fraction of the construction budget, the quality of those services is the most important factor in the overall construction and life cycle costs of a project. Design professionals do more than design a project. They typically observe the construction process to represent the owner's interests and ensure compliance with the design documents (see Guidelines 1.2, 3.8, 3.11). A well-conducted selection and negotiations process such as qualifications-based selection (QBS), recommended below, clearly defines the scope and responsibilities for the project so that both the owner and the design professional can join in a common goal of successfully completing the project.

Qualifications-Based Selection (QBS) of design professionals is a fair and objective process for selecting the services of design professionals who are most qualified for a particular project based on competence and experience. QBS is widely used within the construction industry. All Federal agencies have used QBS since 1972, and a recent University of Colorado study validated the cost savings of QBS. The Connecticut Departments of Transportation and Public Works and many municipalities and private owners have used QBS successfully for years. The American Public Works Association recommends QBS in their "Selection and Use of Engineers, Architects and Professional Consultants." The American Bar Association recommends QBS in their "Model Procurement Code for State and Local Governments." State law requires a QBS process for the design of local school building projects using state funds.

Specific steps necessary to carry out the QBS process can vary widely from agency to industry and according to project type. However, the objective is the same—to allow an owner, manager or procurement official to identify the three or four professional design firms which are most qualified for the project at hand, and then attempt, through negotiation, to engage the one firm which will best provide the professional services required at a fair and reasonable cost.

RECOMMENDATIONS/BENEFITS

Prior to initiation of the Qualifications-Based Selection process, outlined in detail below, the following steps should be undertaken:

- Describe, in general terms, the need, purpose and objective of the project
- Identify the various project components
- Set a desired timetable for the project
- Identify any special skills required or expected problems
- Analyze budgeting requirements

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Guideline 1.6 • Selection of Design Professionals

The selection process begins with an invitation to submit information. This can be accomplished through:

- Existing relationships from previous projects, possibly the best place to start because both sides know what to expect from each other
- Public announcement in local newspapers or other periodicals
- Direct requests to pre-qualified firms in the client's file
- Discussions with other owners, particularly those with similar projects
- Suggestions from contractors with experience working with local firms
- Lists of firm names secured from local design professional organizations

If a firm is interested, it will respond with a letter of interest and qualifications information. An evaluation of responses follows the submission of qualifications. This task should be accomplished by objective and knowledgeable individuals whose goal is to develop a short list of the three or more most-qualified firms. Generally, each firm on the short list should then be called in for an interview with principals and key personnel to determine which firm is most conversant with the proposed project, their capability to perform the work, qualifications of proposed team members (other consultants necessary for the project), previous experience with the owner or references from other owners, their workload, and who will manage the project for the firm.

Following these interviews, the reviewer ranks the interviewed firms in order, according to criteria developed before the interviews. This review should be performed with qualified individuals who will be responsible for successful completion of the project and the personnel responsible for negotiating the contract.

Cost is a major consideration in any procurement process. Once firms have been ranked, the opportunity for ensuring the best possible price presents itself during contract negotiations, not during the request for qualifications or the interviews, where there would be a comparison of "apples to oranges."

Ideally, a successfully negotiated contract should provide for maximum design capability for fair and reasonable compensation, with particular attention paid to reducing related project costs while maintaining project quality. These desired results are most often accomplished when the firm ranked most qualified to perform the work is awarded the contract.

If negotiations with the first ranked firm fail to reach an agreement on scope of services, fee and contract terms, then negotiations with the first ranked firm are terminated and negotiations begun with the next ranked firm.

An important objective of the negotiation process is to reach a complete and mutual understanding of the scope of services to be provided and the degree of detailed study, analysis and consideration of alternatives desired. The general scope of services

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developed during initiation of the procurement process is of necessity too broad to serve as the basis for a contractual arrangement. The negotiation process offers the opportunity for refinement, amendment and complete definition of the services to be rendered, as well as the areas of responsibility and compensation for those services. Mutual understanding on these points at the negotiation stage can minimize the possibility of misunderstanding as the project progresses.

Owners who purchase design services frequently may be able to shorten the QBS process. They usually have a group of design professionals that they work with regularly and so they can skip the advertising process. Some public owners may be required by law to seek price proposals. However, there is almost always a way to request a waiver and use the QBS process. If required to use price as part of a selection process, the price should be only one factor in a selection process using weighted criteria.

The Connecticut QBS Council is a nonprofit organization whose purpose is to improve the quality of construction by promoting and supporting the QBS process. The Connecticut QBS Council offers written information and the services of a facilitator to public and non-profit owners at no cost. As a person who is knowledgeable about the QBS process, the facilitator's role is to educate and act as an impartial guide. The facilitator will not participate in the actual selection or recommend firms for consideration.

RESOURCES

- Connecticut QBS Council. www.ctqbs.org
- American Public Works Association. www.apwa.net
- American Bar Association. www.abanet.org



Planning

Guideline 1.7 • Insurance & Risk Management

ISSUE

As risk is a part of every construction project, the issues of risk allocation and risk management are always very important.

DISCUSSION

There are several different types of insurance policies commonly associated with construction projects. Each type of policy varies in its application, coverage and exclusions. In addition, there are new insurance policy types and coverages to respond to changes in the construction industry. It is important to carefully review the types of policies associated with a project to understand what coverage is being provided and whom the policy is meant to protect. The policies discussed in this guideline assume standard terms found in these policies.

Builder's Risk

Most standard property insurance policies exclude the risks associated with construction. A special type of property insurance, Builder's Risk insurance, is usually purchased by the owner. Builder's Risk insurance reimburses the owner and other parties on the project for damage to both the partially constructed building and unincorporated construction materials on the site.

Builder's Risk policies are written to cover losses either from named perils or from "all risks." Even with an "all risk" policy, however, there are still certain risks that are not insured. Any property damage on a construction site may be the result of the negligence of one or more parties. A major reason for providing Builder's Risk insurance is to permit construction to resume quickly after a disruptive event without the parties arguing over liability. It is customary, therefore, that the owner and the other parties on the project contractually waive their rights to seek reimbursement from each other if Builder's Risk insurance is provided.

Professional Liability (PL) Insurance

Design professionals are subject to claims for malpractice when they fail to meet the applicable standard of care in the performance of their duties. To cover this liability exposure, the prudent design professional should secure professional liability insurance, commonly referred to as errors and omissions (E&O) insurance.

Professional liability (E&O) insurance protects the design professional firm from claims arising out of negligent acts, errors or omissions in the performance of their professional services.

Professional liability practice policies have several unique features that narrowly define coverage, including:

PL insurance is provided on either a claims-made or a claims-made and reported policy form. Both of these policies cover claims made against the firm during the policy period

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Guideline 1.7 • Insurance & Risk Management

and require that such claims be reported to the insurance carrier in accordance with policy terms—typically within the policy period and any extended reporting period.

PL policies also contain certain insurance exclusions. Typically, PL coverage may not apply (in part or in whole) to claims arising from express warranties and guarantees; contractual liability; products liability; actual construction services; workers' compensation; employers' liability; and asbestos liability. This is just a partial list. Exclusions may be added or removed by endorsement (amendment) to the policy.

Commercial General Liability

Commercial General Liability (CGL) insurance is the contractor's primary insurance coverage, although the owner and architect/engineer will likely have CGL policies of their own. CGL insurance policies are typically written on an industry standard form approved by the Insurance Service Office (ISO).

General liability also differs from professional liability in that it is generally written on an occurrence basis. This means that if an insured event, such as a visitor's tripping in your office, takes place while the policy is in force and later results in a claim—perhaps years later—coverage would be provided under the policy in force when the occurrence took place, irrespective of when the claim was made.

CGL insurance covers claims for damages resulting from bodily injury or property damage that are caused by the insured. CGL insurance policies typically exclude coverage for claims arising from intentional acts, motor vehicles, guarantees of performance, property damage to the contractor's own work or products, and contract based liability. In addition, CGL policies exclude coverage for a contractor's rendering of professional services, including design. It is possible to purchase riders to extend the CGL policy's coverage to many of these exclusions.

There are two broad categories of CGL policy coverage. The first type of CGL policy coverage includes the contractor's premises operations, i.e. the day-to-day construction site activities during the construction process. The second type of CGL policy coverage extends insurance coverage to the contractor's completed operations and products, including the call-back work after completion that is common with construction projects.

As an added protection, it is common for an owner to be listed as an additional insured on the contractor's CGL policy. Additional Insured status is always added by endorsement, which amends the "Who Is an Insured" section to add another person or organization as an Insured. Therefore, an Additional Insured will only have the extent of coverage offered to other Insured's or as defined by the endorsement.

Developments in Project Delivery Methods and Insurance Products

Recently, there have been significant shifts in the way many projects are constructed including the increased use of both construction management and design/build project delivery methods. The services of a Construction Manager (CM) or Design/ Builder (D/B) may be classified by an insurance provider as the rendering of professional services and

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therefore excluded from basic CGL coverage. The insurance industry now offers policies which will provide the CM and D/B with insurance coverage for their professional services.

There have also been significant changes in the manner through which insurance coverage is obtained for a particular project. In the traditional insurance format described above, there may be gaps in coverage between the Builder's Risk, E&O, and CGL insurance policies. In addition, the presence of multiple insurance agreements invariably adds cost to the project. In response, the insurance industry now provides owners with the option to establish "wrap-around" or Owner Controlled Insurance Programs (OCIP) where all the insurance coverage for the project is secured from one source.

RECOMMENDATIONS/BENEFITS

Before commencing a construction project, an owner should consider all of the risks and consult an insurance professional. The contracts for construction should designate what insurance is needed and who will pay for it.

Surety

With a surety bond, the surety company and its financial resources stand behind the contractor, which enables the contractor to enter into a contract. The owner receives a bond from a financially responsible surety company licensed to transact surety. Surety bonds provide protection by screening out unqualified contractors. Before contractors can obtain a surety bond, they undergo a rigorous pre-qualification process, called underwriting, to determine whether they are capable of performing a given contract. When a surety underwrites performance and payment bonds, it stands behind the contractor's promise to perform the work according to the contract's terms and conditions, and to pay certain subcontractors, laborers, and material suppliers.

Types and Benefits of Contract Surety Bonds

- *Bid Bond*: Assures that the bid has been submitted in good faith, the contractor intends to enter into the contract at the price bid, and the contractor will provide the required performance and payment bonds.
- *Performance Bond*: Protects the owner from financial loss should the contractor fail to perform the contract in accordance with its terms and conditions.
- *Payment Bond*: Assures that certain subcontractors, laborers, and material suppliers will be paid in the event of contractor default, and prevents subcontractors from filing mechanics' liens on the project, or, if they do file a lien, enables the owner to substitute the bond for the lien by a short court proceeding.

Subcontractors have a significant impact on the profitability of an owner's projects. Two significant risk factors are the subcontractors' ability to fulfill their contractual obligations and their right to file mechanics' liens. Performance and payment bonds offer substantial protections from both. Subcontractors who are unable to perform can bring the project to a halt, particularly if the subcontractor is responsible for a significant portion of the contract,

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Guideline 1.7 • Insurance & Risk Management

or is a specialty contractor that is difficult to replace. The general contractor is responsible for its subcontractors. However, when the general contractor requires key subcontractors to obtain performance bonds, the owner is assured of qualified subcontractors on the project.

Subcontractors deserve the protection of a payment bond. No matter how qualified the subcontractors are, if the general contractor fails to pay them the owner runs a significant risk of project delays and mechanics' liens. However, when the owner specifies a payment bond, certain subcontractors, laborers, and suppliers are assured payment in the event of default by the general contractor.

The cost of a performance bond is a one-time premium, which typically ranges from 0.5 – 2% of the contract amount, depending on the size and type of the project and the contractor's bonding capacity. There is often no charge for the bid bond, and the payment bond may be issued at no additional charge when issued in conjunction with a performance bond. The contractor generally includes the bond premium amount in the bid.

RESOURCES

- Deutsch, Kerrigan & Stiles. Construction Industry Insurance Handbook. New Orleans, LA: J.W. Wiley. 1991, 1998 Cumulative Supplement.
- Shea, O. and Patin, D. Construction Insurance: Coverages and Disputes. Commercial Law Library
- Surety Information Office. 1994. www.surety.org



Planning

Guideline 1.8 • Alternate Dispute Resolution

ISSUE

As construction projects have become more and more complex, the potential for misunderstanding and conflict has greatly expanded.

DISCUSSION

Too often, parties let their construction disputes build up and then try to resolve them through costly and time-consuming litigation. The courts are often not the best venues for resolving construction disputes, since these disputes involve complicated fact situations which are usually outside the experience of judges and juries.

Alternative dispute resolution (ADR) is a term which means dispute resolution by means alternative to court litigation. It encompasses a number of techniques used to promote better communication and to identify or avoid disputes before they harden into litigious positions, or to resolve them after they have gotten to that stage. The most common dispute avoidance techniques are “partnering”, “jobsite neutrals” and “dispute review boards”, which may be agreed to by the parties at any time during a project. ADR also includes arbitration and mediation procedures to resolve disputes that may be required by the contracts between the parties.

Partnering is a team-building effort among the parties in a construction project in which the parties, at the outset of the project, establish cooperative working relationships through a formal, mutually-developed strategy of commitment and communication. The participants, often aided by an independent facilitator, become acquainted with and understand each other’s project objectives and expectations, recognize common aims, initiate open communications, and establish non-adversarial processes for resolving problems early. This type of agreement among the parties will be effective only by the continuing voluntary action of the parties, although the commitment to use the process should be incorporated into the contract documents.

A Jobsite Neutral is a single neutral expert, while a Dispute Review Board usually consists of three neutral experts in the field of construction of the type involved in the particular project, selected and approved by the owner, contractor and design professional, with costs shared equally by owner and contractor. The neutral individual or board visits the project site regularly during construction, confers with the principals, and monitors job progress and any incipient disputes. If disputes do arise, the neutral immediately holds informal hearings with all involved parties and recommends solutions. While the decisions of these neutrals are not legally binding on the parties, in practice this process has enjoyed a high degree of success in Connecticut.

Mediation is a process in which the parties to a dispute present their respective positions to a specially-qualified third person who tries to settle the matter. There is no compelled resolution- the mediator has no authority to render a decision nor to compel any of the participants to do anything. There are many organizations, such as the American Arbitration Association (AAA), which provide qualified neutrals to conduct a mediation. Or, the parties, independently of any organization, can mutually agree on someone to act as a mediator. Most mediations last less than one day, but mediations in large construction disputes, called mini-trials, may last several days.

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Guideline 1.8 • Alternate Dispute Resolution

Arbitration is a procedure in which the parties formally agree to submit their dispute to an impartial arbitrator or arbitrators who have the legal authority to make a decision binding on all parties. No one can be forced to arbitrate a construction dispute; all parties must agree to arbitrate the dispute, and the scope of the arbitration (the issues to be resolved) will be determined by the language of the agreement to arbitrate. The agreement to arbitrate can be a separate contract to arbitrate all disputes in the project, a specific refer-all to arbitration of a particular dispute that has already arisen, or a general arbitration clause in a more comprehensive agreement, such as one between an owner and an architect, or between an owner and a contractor, or between a contractor and a subcontractor. Arbitrations are conducted in accordance with much simpler rules than those that apply in court- rules promulgated by the AAA or other organizations. The parties can mutually agree to follow any rules of arbitration that are in accord with federal and state statutes. Such rules provide for a number of different methods for selection of the arbitrator(s) by the parties, but usually the parties select an arbitrator or arbitrators from a list of individuals who have expertise and experience in construction, such as architects, engineers, contractors, or construction attorneys. Lists of such pre-qualified people are supplied to the parties by the arbitration agency. After selection by the parties from these lists, the arbitrator(s) hold(s) one or more hearings and then render(s) a decision enforceable in court, but the procedures followed in arbitration do not have to follow the legal requirements of litigation. The right of appeal from an arbitration decision is extremely limited so as to bring a prompt, final resolution to the dispute.

RECOMMENDATIONS/BENEFITS

If parties to construction projects use ADR methods as outlined above, they will very likely save time, money and headache. Although there are dissenters, most construction people feel that mediation and arbitration are preferable to litigation because they are usually faster, less expensive, more flexible and more private. Further, the lack of broad appeal rights means that the dispute is brought to a final end much sooner. In addition, the procedures of the AAA and other organizations, and the roster of experts that they maintain, means that the parties can have input in the selection of their adjudicator and will have a knowledgeable person who will more fully understand their respective positions. The downside for some parties and their attorneys is that the arbitrator's services, unlike those of a court judge, are paid for by the parties, although this cost may be assessed against one party in the judgment awarded by the arbitrator.

RESOURCES

- Construction Industry Dispute Resolution Procedures. New York, NY: American Arbitration Association. 2005. www.adr.org
- Connecticut General Statutes, Section 52-408 through 52-424. Hartford, CT: State of Connecticut, Joint Committee on Legislative Management. 1999.

Planning

Guideline 1.9 • Sustainability

ISSUE

The issues of energy efficiency and the responsible use of resources are global concerns, as climate change and the diminishing of natural resources have become generally accepted.

DISCUSSION

Applied to buildings, sustainability means planning them so that they make the best possible use of natural processes and materials and impose the least possible negative impact on the natural environment. Sustainability has become an essential consideration in the planning, design and construction of buildings, alongside code and accessibility compliance. In Connecticut, recent legislation has mandated that all public and private projects over certain thresholds meet the requirements of designated sustainable building codes for both new construction and renovations. In addition, several local planning commissions have adopted sustainable standards for site development and drainage that impact development coverage and density. Some owners have voluntarily complied with the requirements of sustainable rating systems for their projects in order to make them more attractive to tenants, the community and their own sense of environmental responsibility.

Rating Systems

Building rating systems establish criteria for measuring building performance, environmental and human health impacts, and sustainability. Several are now available. The cost of certification within the rating system is a factor in project costs.

The United States Green Building Council (USGBC), an early proponent of sustainability nationally, was one of the first generators of a rating system, called Leadership in Energy and Environmental Design, (LEED™) for buildings. LEED™ now has expanded to a variety of building types: LEED™ for New Construction, Existing Buildings, Commercial Interiors, Core and Shell, School, Retail, Healthcare, Homes, and Neighborhood Development. Levels of certification are: LEED™ Certified; LEED™ Silver; LEED™ Gold; and LEED™ Platinum.

Green Building Initiative (GBI) sponsors the Green Globes System for New Construction, with four levels of certification, one, two, three or four Green Globes.

The National Home Builders Association's (NHBA) National Green Building Standard, an ANSI approved ICC-700-2008 Standard, is applicable for single and multifamily homes, residential remodeling projects and site development projects. It has four levels of certification: Bronze, Silver, Gold, and Emerald.

Other useful measures related to rating systems are the International Institute for a Sustainable Built Environment's SB07 tool, a building performance assessment system providing a framework for almost every building type; and ENERGY STAR, a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy, which offers tools and resources for energy management for both commercial and residential buildings.

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Guideline 1.9 • Sustainability

Connecticut State Codes

Requirements for energy efficiency have been set by the model energy code for new construction, renovations and alterations that are encompassed by the State Building Code. Codes in Connecticut are regularly updated so that current versions of both code and standards are referenced.

Areas of Interest in Sustainable Construction

The main areas related to sustainability in construction are energy efficiency, energy sources, water use, site selection, materials, resources, indoor environment, and transportation issues. Other significant concerns are storm water management and site density. The rating systems that address these concerns are constantly evolving and changing the value that is placed on each area.

Systems and Materials

In the state of Connecticut there are incentives and rebate programs for the use of some systems and materials for achieving energy efficiency or conservation. The Connecticut Clean Energy Fund chiefly funds photovoltaic installations, combined heat and power projects and geo-thermal systems. The Connecticut Energy Efficiency Fund offers incentives and rebates for efficient technologies in both commercial and residential projects. There are other national sources for incentives, tax credits, and tax deductions for energy efficiency (see Resources).

RECOMMENDATIONS/ BENEFITS

The owner needs to define the priority for sustainability issues when establishing the criteria for the project. Just saying that the project will be sustainable or “green” does not provide guidance to the design team or establish a decision tool for selecting materials or systems to go into the actual construction. The owner needs to decide if energy efficiency is more important than material selection, system selection or any other combination of factors and should identify the budget that he or she is willing to spend for any additional features and concepts. The owner’s definition needs to be established as a goal for the project.

The owner should select a design team that will help achieve the goals for the project, understanding that these may be refined during the design process and even be changed as the realities of the project develop. The design team’s responsibility is to help the owner understand the effect of both code requirements and sustainability goals on the defined goals and budget. The owner’s responsibility is to make sure that the goals are achieved.

The owner must decide if the project will be registered with and scored under one of the rating systems. This decision has financial implications for the design team and the constructors. The decision to achieve a rating may have other benefits for the owner.

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Guideline 1.9 • Sustainability

RESOURCES

Organizations

- Advanced Building Solutions. www.advancedbuildings.net
- American Institute of Architects Tool Kit. www.aia.org/toolkit2030
- AIA 50to50. www.aia.org/fiftytofifty
- Building Green. www.buildinggreen.com
- Connecticut Green Building Council. www.ctgbc.org
- Connecticut Wind Working Group. www.windct.org
- Energy Star Program. www.energystar.gov
- Green Building Initiative. www.thegbi.com
- National Institute of Building Sciences. www.wbdg.org
- Northeast Sustainable Energy Association. www.nesea.org
- US Green Building Council. www.usgbc.org
- Connecticut Clean Energy Fund (CCEF). www.ctcleanenergy.com
- Connecticut Energy Efficiency Fund (CEEF). www.ctsavesenergy.org



Planning

Guideline 1.10 • Site Investigation

ISSUE

The basic objective of a site investigation is to determine the feasibility of a proposed project site by analyzing the opportunities and constraints of the site prior to the owner's investing significant time and dollars on a project.

DISCUSSION

Site investigations are performed by an architect or engineer and are comprised of the following major components:

- Site inspection
- Site analysis and mapping
- Site selection evaluation
- Specialty studies
- Summary report of findings

The use of existing information on the physical attributes of the site for items such as topography, utilities, property lines, wetlands, floodplain, etc., is normally sufficient for this level of evaluation. The professional conducting the study will observe and identify parts of the information which are outdated or changed and require updating prior to the initiation of the design process.

The study requires a comprehensive collection of information documenting factors that could accommodate or restrict the development program. The study covers legal, physical, and regulatory areas. Specifically, a typical site investigation includes:

- Review and evaluation of previous reports or studies completed for the site
- Site visit to observe the existing conditions and surrounding area
- Legal:
 - ✓ Land ownership from land records
 - ✓ Title information and recorded easements
 - ✓ Deed conditions and covenants
 - ✓ Parcel subdivision history (if any)
- Physical:
 - ✓ Location of existing structures, paved areas, etc.
 - ✓ Observation of adjacent property ownership, land use, encroachments, etc.

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Guideline 1.10 • Site Investigation

- ✓ Roadway access and sight distance
- ✓ Site topography
- ✓ Drainage patterns and watershed impacts including floodplain and storm water management issues
- ✓ General soil information from existing soils maps of the US Soil Conservation Service
- ✓ Utility infrastructure availability, suitability and capacity
 - Water system information for sizes, pressure, and availability for both domestic and fire protection
 - Gas, electricity, cable, telephone, fiber optic
- Regulatory
 - ✓ Zoning and land use requirements
 - ✓ Consistence with the municipality's plan of development
 - ✓ Local regulations

The results of the site investigation are normally summarized in a report and accompanied with the plans, maps, and graphics to show the information clearly. The report also should identify cost items and flag issues of concern that could impact the costs or the timeline of the building program.

Additional information and studies are normally identified as a component of the site investigation where detailed information necessary for design is required. These items are:

- **Boundary, Topographic, and Utility Survey** –a plan prepared by a Registered Land Surveyor showing the physical features of the site, the topography, and the legal boundary of the site. The surveyor also will show easements on file in the land records of the community. The plan is prepared to industry standards of accuracy dictated by Connecticut practice and established by the Connecticut Association of Land Surveyors (CALs).
- **Wetland Delineation** – Wetlands in Connecticut are based on the presence of vegetation, hydrology, and soils that precipitate wetland conditions. All three factors must be present as determined by a Connecticut Certified Soil Scientist. Once the wetland line is established by the scientist through field investigation, he or she affixes flags (or ribbons) labeled to identify the boundary limit of the wetland. This boundary is then surveyed by the Land Surveyor and added to the plan.
- **Subsurface Investigation and Geotechnical Report** –In order to determine the composition of subsurface soils and the soil's ability to support construction, a geotechnical engineer conducts a subsurface exploration composed of borings and test pits determining the types of soils and the approximate vertical location, the level and

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Guideline 1.10 • Site Investigation

presence of groundwater, and the depth and type of rock (or ledge) if encountered. The investigation provides valuable data for determining the suitability of the subsurface soils for construction.

- **Preliminary Environmental Assessment** – The preliminary site assessment provides any future landowner with documentation of potential environmental liabilities from prior use or environmental contamination of the site. The assessment limits future liability of the Owner and is a critical element of any site investigation. These assessments are done in Connecticut by a Licensed Site Professional.
- **Traffic Study** - Traffic studies are normally required by the local community as part of the local zoning approval process and possibly by the State Traffic Commission (STC) if the project meets certain thresholds. The STC process and requirements are discussed in Section 1.11 of these guidelines. In general, the Traffic Study evaluates the impact of the site on the general area and more specifically the capacities of the local roads and intersections in proximity to the site to accommodate traffic from the proposed building program. The study will normally recommend traffic improvements to offset the impacts of the building program through improvements and modifications to the intersections or areas of roadways negatively impacted by increases in traffic.

RECOMMENDATIONS/BENEFITS

Site investigations are an integral part of the successful development of a Building Program. The evaluation provides valuable information as to the suitability of the site to support the proposed building program and identifies potential cost items for utility upgrades, premium site development costs due to soil conditions and regulatory constraints that can be addressed prior to beginning the design and permitting process.

RESOURCES

- “The Land Development Handbook”, by the Dewberry Companies, McGraw-Hill Publishing, Co, 2009
- “Site Planning Standards” by Joseph DeChiara and Lee E. Koppleman, 1984, revised 2007
- “Time Standard Savers for Site Planning”, Joseph DeChiara and Lee E. Koppleman, 1984, revised 2007
- American Planning Association (APA). www.planning.org
- Urban Land Institute (ULI). www.uli.org

Planning

Guideline 1.10.1 • Environmental Investigation & Remediation

ISSUE

Under what circumstances is it desirable or necessary to engage an environmental engineer to investigate the potential environmental conditions of a site?

DISCUSSION

As part of the initial stages of due diligence and data gathering for a particular piece of property, an owner will typically engage an environmental consultant to assess potential environmental conditions of a site. Depending on the information readily available, the initial assessment of a site could be as simple as a review of available historic environmental reports, or it could involve a Phase I Environmental Site Assessment (ESA) complying with standards promulgated by the American Society of Testing and Materials (ASTM). In any case, the purpose of the preliminary assessment is to identify potential environmental conditions at the site that may adversely affect project financing, result in increased construction premiums, and/or require regulatory agency involvement.

Global environmental issues as they relate to all aspects of a construction project are often overlooked or underestimated. Environmental impacts to a site can include contaminated soils, groundwater, soil vapor, and buried building materials (i.e. asbestos, lead, and PCBs). The following are some key questions to be answered as a project progresses:

- Has a Phase I ESA been conducted on the site? This is a critical step in the due diligence process. The purpose of the Phase I ESA is to identify potential or existing environmental conditions associated with a site. Environmental conditions are identified based on the review of historic or current environmental information such as regulatory agency databases, historic property uses, site reconnaissance, etc. The Phase I ESA may, if deemed necessary, provide recommendations for further evaluation of the site in the form of a subsurface investigation of the identified environmental conditions. To provide an owner with some level of protection from potential liability, the Phase I ESA should be conducted by a qualified environmental professional in accordance with ASTM rules and standards. Most lending institutions require an ASTM-compliant Phase I ESA for real estate transactions, prior to the release of funding.
- Are soil, groundwater, or soil vapor investigations recommended on the site? If so, an owner needn't panic. Recommendations for additional investigation will typically be outlined in the Phase I ESA. A technically strong environmental consultant can help sort through the identified environmental conditions and determine the best, most economical approach to investigation. Further investigation can range from additional historic research, to excavation and sampling of soils, groundwater, soil vapor, and/or buried building materials to determine how the environmental conditions have impacted the site.
- Is the site considered an "Establishment" in accordance with Connecticut regulations? This is a unique component to investigations in the State of Connecticut, whereby the State Department of Environmental Protection (CT DEP) can deem a site to be an "Establishment" based on a specific set of criteria associated with historical site activities and uses. If a site is considered an "Establishment", it is subject to the Connecticut Property Transfer Act when the

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Guideline 1.10.1 • Environmental Investigation & Remediation

property undergoes a real estate or change of business transaction, and the CT DEP becomes involved, requiring that the property be fully investigated and remediated in accordance with the remediation standard regulations promulgated by CT DEP, and completed within a specific timeframe. Typically, CT DEP will request that a Connecticut licensed environmental professional be engaged to manage the environmental activities. This very important aspect of real estate transactions in Connecticut should be fully understood before proceeding with the purchase, sale, or transfer of business at a property.

- How will known environmental impacts affect future construction activities? It is important to understand the proposed development program when evaluating how environmental impacts may affect construction. Some examples are as follows:
 - If contaminated soils are identified on the site, and the project calls for significant excavation, there will likely be a premium cost associated with the excavation and disposal of the contaminated soils. A proper soil management plan and coordination with geotechnical recommendations for earthwork are critical in controlling costs.
 - If demolition of an existing structure is required, and asbestos/lead/PCBs have been identified during site investigation, abatement of these materials will be necessary prior to demolition, and a premium cost will be associated with the proper abatement and management of these materials.
 - If below-grade construction is anticipated, and there are impacts to groundwater at a site, off-site disposal of dewatering effluent may be difficult and costly.
- Do the construction specifications address environmental concerns at the site? In trying to determine comprehensive construction costs, it is critical that environmental issues identified during the due diligence and design phase are incorporated into the project bid specifications. For example, if contaminated soils exist in an area of proposed disturbance, the bid specifications should clearly identify the location of the contamination, the concentrations of the chemicals identified, and the proper management and handling procedures. This is typically addressed in a Contaminated Soils Management specification, prepared by an environmental consultant.

The above questions provide brief insight into a number of key issues that should be considered during the due diligence and design phase of a development project. While many development projects are not subject to regulatory agency involvement, the appropriate state and federal environmental regulations still apply to the project during the construction phase. The owner will likely maintain some level of risk associated with existing environmental conditions at the site. Maintaining the involvement of an environmental consultant in some capacity can help to manage that risk.

A few key items to consider during the construction phase are as follows:

- A common problem in construction is the illegal disposal of contaminated materials at sites that are not permitted to accept these materials. Ultimately, the owner assumes the risk for any material which is removed from the building site.

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Guideline 1.10.1 • Environmental Investigation & Remediation

Therefore, it is very important to know where the materials are being transported, and to determine that the end disposal facilities are appropriately permitted and licensed to accept the materials. It is recommended that an environmental consultant be engaged to check out the proposed material disposal facilities proposed by the contractor, to minimize the owner's risk. This work should be conducted before the contract is awarded to avoid an unanticipated change order from the contractor that could be significant.

- Depending on the levels and types of contaminants present in groundwater at a site, pre-treatment and/or permitting may be required in order to discharge dewatering effluent during construction. Understanding the testing requirements and obtaining the necessary permits at the onset of the construction phase or earlier may help prevent delays to the project schedule.
- Unanticipated environmental conditions are a common occurrence, even on sites where environmental issues have previously been identified. It is not feasible or practical to investigate every inch of a site before development so it is good practice to maintain an allowance for some unanticipated environmental discoveries, based on the information gathered during the due diligence phase.

RECOMMENDATIONS/BENEFITS

If not identified in a timely fashion, environmental conditions on a site can have a profound effect on the overall construction and post-construction costs of a project. To that end, it is very important to engage a competent, experienced environmental consultant to help identify, manage, and rank the environmental risks on a given site during the initial stages of a project. Obtaining quality information and understanding the potential of existing environmental conditions on a site prior to development is critical to the successful completion of a project. Recommendations for various project phases are:

Preliminary phase:

- Engage an experienced environmental consultant, with Connecticut licensed environmental professionals on staff, to conduct the appropriate environmental assessment of the site to identify potential concerns and provide recommendations with respect to additional investigation and potential site development issues.

Design Phase:

- Ensure that environmental issues identified during preliminary due diligence and design are properly addressed and included in the design and bid specifications for the project.
- Engage an experienced environmental consultant for the following services:
 - To provide input to the design team on environmental issues as they relate to design and construction of the proposed development
 - To review contractor bids with respect to environmental issues identified on the site

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Guideline 1.10.1 • Environmental Investigation & Remediation

Construction Phase:

- Engage an experienced environmental consultant for the following services:
 - On-site inspection of environmental activities conducted by the contractor to ensure compliance with the appropriate regulations and specifications
 - Continuation of mandatory sampling and testing which may be required to satisfy regulatory requirements
 - Identification and confirmation of unanticipated environmental conditions as discovered during site development

RESOURCES

- CT Department of Environmental Protection. www.ct.gov.dep/site
- Environmental Professionals of Connecticut. www.epoc.org
- National Association of Industrial and Office Properties. www.naiop.org
- Connecticut Building Congress. www.cbc-ct.org
- National Brownfield Association. www.brownfieldassociation.org



Planning

Guideline 1.10.2 • Geotechnical Engineering

ISSUE

When is it appropriate or necessary to engage a geotechnical engineering firm for a construction project?

DISCUSSION

As part of site data-gathering in the design phase of a project, most owners will employ a geotechnical engineering firm or soils-testing laboratory to conduct a soils investigation at the site to provide foundation recommendations for the proposed development. In many cases, the completion of this work is a requirement of state building code and is viewed as a necessity to obtain a building permit. However, geotechnical engineering goes far beyond that. Geotechnical engineering relates to the study of soil, rock, and groundwater conditions at a site in an effort to assist the project design team in a variety of design and construction related issues such as foundations, retaining wall design, earthwork, slope stability, excavation support, groundwater control, and more.

A proper geotechnical assessment during the design phase and continued involvement by the geotechnical engineer during the construction phase of a project often leads to considerable cost savings. In contrast, the wrong geotechnical engineering recommendations at a site can lead to significant cost overruns during construction, unanticipated maintenance costs during operation of a structure, or worse, unsafe conditions that could compromise the integrity of the structure, putting the public at risk.

Engaging a locally-experienced geotechnical engineer early in the process can help the design team in identifying up-front site problems which, if not revealed until later in the process, can result in potentially game-changing or deal-breaking issues. Having a trusted project team member that understands local geologic and soil conditions from previous regional experience, and that can help identify these conditions so that they can be addressed by the design team as the project progresses, is sometimes vital for the economic viability of a project.

Here is an overview of some of the issues that should be addressed by the geotechnical engineer during the design phase of a project:

- What is the geologic setting of a site? Understanding the nature of the soils which underlie a site is vital from both a foundations and earthwork point of view. For example, it is important to understand whether a site is located in an area generally underlain by compressible or organic soils or whether an area consists of reclaimed land covered with uncontrolled urban fill. These materials are generally unsuitable for shallow foundation support without some type of ground improvement, or may require deep foundations.
- What are the historic uses of a site? Particularly in more urban settings where previous site development may have existed, a review of historic maps, aerial photos, etc. may uncover information related to potential abandoned structures or obstructions that could exist below-grade. While these obstructions don't always lead to design changes, they often have significant impacts on the project cost and schedule if they are not identified until the construction phase.

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Guideline 1.10.2 • Geotechnical Engineering

- What is the nature of the structures adjacent to a site? Understanding the boundary conditions of a site and the foundation conditions of adjoining properties can help in the design phase to guide the foundation design and excavation support requirements for a site, and can identify the need for easements that may be required. Easements can be particularly difficult to obtain in some instances, and can create significant delays to a project. Identifying these issues early in the design process can allow for negotiation prior to bidding and create the ability to maintain the overall project schedule.
- What is the most economical foundation solution for the project? An experienced geotechnical engineer can assist the design team in evaluating several potential foundation solutions at a site, and can even pull from previous experience to offer “out-of-the-box” types of solutions such as ground improvement or innovative new foundation support technologies that may sustain the financial viability of a project.
- What types of retaining wall construction are viable on-site given the existing soil conditions? Different types of retaining walls are more advantageous for certain soil types than others. Understanding both retaining wall design, construction techniques, and the soil conditions for which certain types of walls apply is important during the design phase, and can prevent delays and cost over-runs during construction.
- Are the soils on site suitable for reuse as structural fill on the project? Earthwork on smaller urban projects with small amounts of cut and fill may not be as critical; however, larger sites with significant quantities of soil to be graded can run into significant problems if the soils do not meet compaction requirements. Identifying up front the types of soils on-site and what remedial measures may be required to allow for adequate on-site reuse during construction can again save time and money during the construction phase.
- What are the groundwater conditions at the site? Understanding the general groundwater conditions at a site will assist the design team in implementing the proper waterproofing/water retention/water control systems during design, and reduce the chances for water infiltration once the structure is fully constructed. Additionally, understanding what temporary groundwater control measures may be required during construction can also help avoid delays to the project.

RECOMMENDATIONS/BENEFITS

These represent the major issues that should be addressed during the design phase of a project by the geotechnical engineer. However, the responsibility of the geotechnical engineer does not end with the issuance of an initial geotechnical engineering study. The construction phase of a project is generally considered the “final phase of design” by most geotechnical engineers, so on most projects it is necessary for the geotechnical engineer to be involved during construction. This will avoid project delay or extra project cost resulting from the inability of other project participants to deal with subsurface conditions which are discovered during construction which they do not have the expertise to deal with.

Engaging an experienced geotechnical engineer early in the project and continuing him or her on board throughout the design and construction process can provide the owner,

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Guideline 1.10.2 • Geotechnical Engineering

the design team and the contractor with information on subsurface conditions or other site constraints that can be addressed early in the process, avoiding delays to schedule and cost overruns later in the process.

RESOURCES

- Connecticut Society of Civil Engineers. www.csce.org
- Geo-Institute. www.geoinstitute.org
- Deep Foundations Institute. www.dfi.org
- Connecticut Building Congress. www.cbc-ct.org
- Structural Engineers Coalition. www.ct-sec.org
- Construction Institute. www.construction.org



Planning

Guideline 1.11 • Regulatory Approvals

ISSUE

Building projects must conform with the building code, local zoning and environmental regulations, wetlands approval where applicable, and at times federal approvals.

DISCUSSION

The permitting can be extremely complex and involved and can affect the design of the project. When state funding is involved, the local project is often subject to approvals in addition to the local requirements.

Local

- Building Permit – Application to the building official for issuance of a building permit must be made prior to the initiation of construction (see Guideline 2.4).
- Zoning Approvals – Land use requirements vary within each of our Connecticut communities. Local land use codes define the requirements and the process required for projects.
- Wetlands- Project work within the regulated wetland areas requires local approval from the Inland Wetland Commission (IWC). State statute requires that IWC approval be obtained prior to the local zoning authority's rendering its decision approving the project. Under some circumstances, a Water Quality Certificate issued both by the Connecticut Department of Environmental Protection and the U.S. Army Corps of Engineers may also be required if certain thresholds are exceeded with respect to the project's impact on wetlands.

State Level

- Water Quality Certificate Connecticut Department of Environmental Protection (DEP)

The 401 Water Quality Certification program, administered by the Bureau of Water Protection and the Inland Water Resources Division of the Office of Long Island Sound Programs, regulates any applicant for a federal license or permit who seeks to conduct an activity that may result in any discharge into the navigable waters, including all wetlands, watercourses, and natural and man-made ponds. Such persons must obtain certification from DEP that the discharge is consistent with the federal Clean Water Act and the Connecticut Water Quality Standards. Any conditions contained in a water quality certification become conditions of the federal permit or license. In making a decision on a request for 401 Water Quality Certification, DEP must consider the effects of proposed discharges on ground and surface water quality and existing and designated uses of waters of the state.

Projects that fill more than 5,000 square feet of wetlands require a Water Quality Certificate in order to secure approval from the US Army Corps of Engineers, the federal agency responsible for permitting within "the navigable waters of the United States", under which most wetland areas and water bodies fall.

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Guideline 1.11 • Regulatory Approvals

- State Traffic Commission Connecticut Department of Transportation (DOT)

Connecticut state statutes require that a development of the regulated size which has a driveway on a state highway, or which abuts or adjoins a state highway, or which substantially affects state highway traffic, must obtain a certificate of operation to assure that traffic from the proposed building program will not adversely impact public safety.

State Traffic Commission (STC) regulations define a development needing a certificate of operation as any which abuts a state highway and provides 200 or more parking spaces or has a gross floor area of 100,000 square feet or more. For those developments which do not have a driveway on, or abut, or adjoin a state highway, a determination of impact (certificate determination) must be made. In these cases, the developer is asked to submit enough information so that an evaluation of the impact on the nearest state highway intersection(s) may be made.

- Encroachment Permit Connecticut Department of Transportation

A DOT encroachment permit is needed for all work within the right-of-way of state highways. These permits are considered part of the construction process and are normally the responsibility of the contractor. Detailed plans, insurance certificates and a performance bond are required for these permits, which are issued by the local district where the work is being performed. The four district offices are:

- District 1 -Rocky Hill 860-258-4540
- District 2 -Norwich 860-823-3230
- District 3 - New Haven 203-389-3010
- District 4 - Thomaston 860-585-2785

RECOMMENDATIONS/BENEFITS

Owners need to be aware of and to deal with all project requirements for regulatory approval at the earliest possible time. These requirements are often many and must be addressed sooner or later. The design professional can advise the owner about approvals and insure that they are dealt with expeditiously. Attending to requirements late in the construction process can delay the project and engender additional expense.

Planning

Guideline 1.11 • Regulatory Approvals

RESOURCES

- Connecticut State Building Code. http://www.ct-sec.org/html/ctbuilding_code.html
- Connecticut Department of Environmental Protection (DEP), Permits. www.ct.gov/dep/cwp/view.asp?a=2709&q=324224&depNAV_GID=1643

• Preconstruction •

- **2.1 Drawings & Specifications** ... The basic printed graphic images and writing that describe the project.
- **2.2 Computer Technology in the Construction Industry** ... Recent developments in the technology of project planning.
- **2.3 Performance Specifications** ... Specifications based on results
- **2.4 Building, Safety, Energy and Accessibility Codes** ... Governmental provisions governing building and site design.
- **2.5 Independent Structural Engineering Review** ... Requirements for a second opinion.
- **2.6 Prequalification of Contractors** ... Procedures for narrowing the field.
- **2.7 Selecting the Contractor** ... Means of obtaining materials and labor
- **2.8 Cost Estimating** ... Methods for predicting project costs.
- **2.9 Unit Prices** ... Pinning down material costs.
- **2.10 Value Engineering** ... A procedure for reducing costs.



Preconstruction

Guideline 2.1 • Drawings & Specifications

ISSUE

Drawings (graphic images) and specifications (writing) are the basic printed materials that describe the project and define its scope. Their accuracy and completeness are essential for a successful construction project.

DISCUSSION

While drawings and specifications cannot be expected to be absolutely perfect, it is vital to limit errors and omissions as much as possible. Drawings are now generally produced by CAD (Computer Aided Design), and more recently by Building Information Modeling (BIM), which is software that enables the production of drawings and associated cost estimating in three dimensional models. This provides the possibility of much better coordination of information between the various design professionals in the project but also means that the design professionals must put in place means for thoroughly checking the accuracy and completeness of drawings before they are issued in final form. Sometimes it is beneficial and appropriate to have this checking procedure performed by an independent entity. (See Guideline 2.2)

The drawings, specifications and other documents required to complete the construction of the project are often collectively referred to as “construction documents”. The construction drawings show, in graphic and quantitative form, the extent, configuration, location, relationships, and dimensions of the work to be done. They generally contain site and building plans, elevations, sections, details, diagrams, and schedules. In some cases, especially for small projects, the drawings can include the project specifications, which, in larger projects, are printed separately. The level of architectural and construction information contained in the documents may be affected by the method by which the project will be constructed. For example, traditional design-bid-build project delivery generally requires a more complete set of drawings than does design-build delivery. (see Guideline 1.4) This is due to the need to provide more complete information to prospective bidders who have no familiarity with the site or project. The level of information provided in the drawings may vary in different areas of the country or from country to country.

Specifications describe the quality of materials, the types of products, and the nature of the craftsmanship required in the construction of a building project.

RECOMMENDATIONS/BENEFITS

It is important that the set of drawings and specifications be clearly and concisely organized and properly coordinated and that it contains all the necessary information to permit the contractor to accurately and completely bid and build the project.

The nearly universal use of CAD software by design professionals in all of the disciplines, and the rapidly growing use of BIM software does result in better coordination of drawings between these various disciplines during the design development phase, so long as they are using compatible software. This promises to reduce and even eliminate most inter-disciplinary conflicts, such as the classic case where a large duct is running through a structural beam. Such conflicts can now be discovered and corrected earlier in the design

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Guideline 2.1 • Drawings & Specifications

process. Advancements in this software continue yearly, and now enable the production of documents in three dimensions, which is beginning to replace actual physical three dimensional models of projects.

Drawing Information

Many architects or owners develop their own preferences for sequencing and numbering drawings. Professional organizations have developed guidelines for the preparation of construction documents. Typically, the site work and architectural drawings are presented first, followed by the structural, mechanical, plumbing, electrical, and any other special disciplines. The drawings for each discipline are given a distinctive prefix and are usually divided into groups within the discipline (e.g. A1 .1 refers to an architectural drawing, usually the first floor plan). Most architectural firms develop office standards for sheet size, layout, and title blocks. Title blocks contain basic information about the project including:

- Project title and address
- Owner's name and address
- Drawing title and sheet number
- Names and addresses of consultants
- Notation of who worked on the drawing including checking
- Dates drawing was issued and for what reason (permit, bid, etc.)
- Dates of revisions
- Architect/Engineer's seal and signature (as required by state law).

Title sheets generally include the same information included in the title block in a larger format and may also include:

- Building code information and zoning regulations
- Other applicable codes
- Abbreviations
- Symbols

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Guideline 2.2 • Computer Technology in the Construction Industry

ISSUE

Owners need to keep abreast of the rapid development of computer technology in the architectural, engineering and construction industry (AEC) and to realize its profound impact on the delivery of construction projects.

DISCUSSION

For many years, design professionals have been producing their drawings and specifications on the computer by using computer aided design (CAD) software. As this type of technology continues to develop at an astounding rate and becomes increasingly accessible and affordable, it is having a profound impact on how business is done and how projects are delivered.

Building Information Modeling (BIM) is a technology that has been used for quite some time in the aerospace and automotive industries, but only fairly recently in the building construction industry. The technical definition of a Building Information Model is “a digital representation (2D or 3D) of physical and functional characteristics of a facility. The graphical model components can contain non-graphical information that further defines their function, structure and/or other properties. This information can be extracted to a schedule or exported to a third party or complimentary application for downstream use by another discipline. Accordingly, a building information model can directly inform the fabrication or construction process. In layman’s terms, BIM allows for the creation of a parametric model that the entire project team can co-develop, essentially building a detailed, virtual project with a wealth of project-related information, even before a shovel of dirt is turned.

Although BIM is a much more demanding and complex initial implementation process for the design team members, this change in approach to building design and documentation allows for all team members (architects, engineers, other consultants, constructors and owners) to collaborate during the design and construction phases of a project using the same information. Using BIM, design teams now have the flexibility of designing and documenting their projects in three dimensional terms to a much higher level of accuracy, specificity and with less redundancy than previously available. The resulting models can enhance a project team’s understanding of design intent by serving as visualization tools for consultants, owners and contractors to evaluate aspects of a project’s design before construction. They can also be a repository for specifications-based information.

In addition to space planning, there are additional ‘add-on’ tools within BIM software platforms to help evaluate project design aspects such as systems coordination, energy modeling, solar, daylighting and thermal performance, lighting design, acoustical design, cost estimating, construction scheduling, and more. Employing the accuracy and quantification functions of BIM, architects and owners can use the same three-dimensional model to more precisely convey the design intent to contractors (which can help reduce bidders’ contingencies during competitive bidding periods). Contractors can even use BIM to fabricate portions of the design, thereby transforming the design to constructed reality in an accelerated fashion. The building information model, with its wealth of information, is a tool that can be used analytically by all project team members and can even end up being used for facility management by the owner after construction is completed.

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Guideline 2.2 • Computer Technology in the Construction Industry

With BIM, individual construction drawings, which typically are two-dimensional representations of three-dimensional designs (and which continue to be contractually required) are essentially specific and exported views of the model. Since information within a model (a wall, for example) may show up in multiple views on drawings (building plans, sections, interior elevations, reflected ceiling plans, finish schedule, etc.), a change to that element of the model, regardless of which view the change is initiated in, will automatically update that element's characteristics, location and/or properties in all views. This allows for seamless coordination between the different views of (or drawings produced by) the building information model.

Today, progressive design teams are employing BIM to create parametric models of their designs - one three-dimensional model that is shared by all project team members. This joint effort, usually managed by the architect, allows for early visualization, systems coordination, materials quantification and more accurate estimating of projects before construction. When shared with members of the construction team, clarity of design intent and project scope is conveyed. This enhanced level of project understanding, communication and collaboration is helping to erode the differences in perspective between designers, contractors and owners which have historically led to disputes between these parties. Better clarity of project scope during a project's construction phase can lead to fewer contractor Requests for Information to the Design Team (see Guideline 3.5), and fewer change orders to the owner (see Guideline 3.10). This helps to maintain the project schedule and budget as well as reduce the stress level and enhance the long-term relationships of project team members.

RECOMMENDATIONS/BENEFITS

While BIM technology continues to develop, and members of the AEC industry continue to navigate through the many ways in which to employ it on their projects, the benefits can prove to be very beneficial for all project team members. To be effective, however, BIM requires both rigorous development and accuracy, beginning during early phases of a project, and good project management to maintain the accuracy of the building information model. BIM - as a major new tool in the arsenal of commonly-employed construction industry technologies e-mail, video conferencing, project websites, file-sharing platforms, digital photography and laser surveying-- is transforming the way in which project team members work together and how projects are ultimately delivered.

RESOURCES

- National Institute of Building Sciences (NIBS). <http://www.buildingsmartalliance.org/index.php/nbims>

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Guideline 2.3 • Performance Specifications

ISSUE

Many projects incorporate products or systems that are engineered by specialists in the design of a particular component and whose expertise in that specific area may be more focused and detailed than that of the project design professionals. The criteria that govern the ultimate performance of such products or systems must be comprehensively defined and clearly communicated via the contract documents to the bidding contractors using performance specifications.

DISCUSSION

There are two general types of performance specifications: the first is used when the building design incorporates features that are either proprietary or otherwise special in nature; the second are those related to the contractor's means and methods of constructing the project.

Proprietary performance specifications incorporate products which are engineered by specialists in the design of a particular component with particular expertise in that specific area. Examples of proprietary systems that might be incorporated into a performance specification include custom curtain wall systems, custom skylight systems or bleacher systems. Several different manufacturers who have unique products that perform the same function may be identified as acceptable manufacturers in the specifications. The performance specification should contain all applicable criteria to which the manufacturer is expected to adhere, such as structural loading capacity, deflection limitations, and thermal properties. Prior to specifying a manufacturer, the design professional needs to ascertain that the manufacturer's product is appropriate for use in the intended applications.

A wide array of components and assemblies are used on building projects that are designed by the contractor, either traditionally, or as the result of the unique nature of the product. The larger end of this scale includes complete building superstructures such as pre-engineered metal buildings or precast concrete parking garages. The smaller end of the scale includes the design of connections for structural elements. Other contractor-designed elements might include cold-formed metal framing systems, stair and railing systems, micro-piles, rock anchors, and metal-plate-connected wood trusses. The performance specifications for these products should also include the required design loads and serviceability limitations as well as any special connection requirements or limitations. Where possible, the design professional should indicate the sizing of typical members to enable the contractor to propose components with adequate but not excessive and unnecessary structural properties. If this information is not provided for certain components, the contractor may have to qualify his bid by indicating the component sizes that it assumed.

With the second type of performance specifications, those related to the contractor's means and methods of construction, design professionals typically will not interfere with this broad area of contractor responsibility so as not to restrict the contractor and inhibit the use of systems with which the contractor is experienced and efficient, and because the design professional has no control over this area and cannot be held responsible for it.

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Guideline 2.3 • Performance Specifications

Examples of construction means and methods that fall into this category include temporary shoring systems and excavation bracing systems. These types of systems are critical to the structural integrity of the building and the safety of the occupants during construction. The contractors must know the criteria to which they are expected to design these systems, which must be furnished in the performance specification. The design professional should furnish to the contractor pertinent supplementary information such as the geotechnical engineering report, shoring design loads and allowable movement, to enable the contractor to properly engineer these systems.

For purposes of quality assurance, components and systems designed under performance specifications are generally required to be prepared by a registered professional engineer. In some cases where the design requirements are not considered complex, this requirement may be waived at the discretion of the design professional so as to avoid unnecessary costs.

Components and systems furnished under performance specifications are generally designed subsequent to the time when the construction documents have been submitted to the Building Official for a Building Permit. Such items are categorized as “Deferred Submittals” under some model Building Codes. Under this designation, the items to be designed under a performance specification are to be identified on the construction documents submitted to the Building Official. After the submittals have been reviewed by the design professional, they are to be forwarded to the Building Official with a notation that they have been found to be in general conformance with the building design.

RECOMMENDATIONS / BENEFITS

The design professional is responsible for generating the “performance” criteria for which a desired end result or product will be produced and for reviewing all contractor submittals relating thereto. In the contract documents, the design professional should:

- Indicate the appropriate performance criteria, including loads and serviceability requirements, as applicable.
- Furnish applicable supplementary information such as geotechnical engineering reports.
- Verify that the specified proprietary systems are suitable for use under the cited performance criteria based on the manufacturer’s published literature.
- Provide adequate design information pertaining to proprietary components so that the contractor may prepare a reasonably accurate bid.
- Indicate any requirements unique to the project.
- When using performance specifications for structural steel framing connections, indicate the connection design forces as well as any special requirements or limitations that would affect the contractor’s bid.

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Guideline 2.3 • Performance Specifications

- Assure that all information shown on the construction documents is consistent with the performance criteria of the products expected to comply with the specifications.
- Determine if a design by a professional engineer is required for the specified component, and, if so, clearly indicate this in the construction documents.
- When required by the Building Code, forward Deferred Submittals to the Building Official after they have been reviewed and found to be in conformance with the building design.
- When the project exceeds one or more of the “threshold limits” and is subjected to an Independent Structural Engineering Review, forward Deferred Submittals related to the primary structural systems to the Independent Structural Engineering Consultant for their review.

The contractor should fulfill the following responsibilities relating to performance specifications:

- Perform the design of applicable components or systems in accordance with specified performance criteria.
- Submit comprehensive design calculations prepared by a professional engineer, as required.
- Provide detailed submittals, as required.

Performance specifications properly used as outlined herein will enable the project to benefit from the expertise of those specializing in special pre-engineered components incorporated into the job.

RESOURCES

- Construction Specifications Institute (CSI). www.csinet.org
- American Institute of Architects, MasterSpec Systems. www.arcomnet.com



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Guideline 2.4 • Building, Safety, Energy & Accessibility Codes

ISSUE

Many laws and regulations, generally referred to as codes, affect the construction industry. Parties involved in planning and executing construction projects need to understand the broad impact of these codes and the power wielded by the local code officials in each town who enforce them. Owners must also be aware of the continuing responsibility which they and their design and construction professionals bear with respect to the implementation of these codes, regardless of the action or lack thereof on the part of the local code officials.

DISCUSSION

The primary codes establishing standards for the design and construction of buildings in Connecticut include:

- The Connecticut State Building Code, which is based substantially on the following International Codes Council model codes:
International Building Code/2003
International Mechanical Code/2003
International Plumbing Code/2003
International Residential Code/2003, and also upon the following:
National Electric Code, NFPA 70/2005
International Energy Conservation Code/2003 (Connecticut amendments adopt the 2006 edition)
ICC/ANSI A117.1/2003 Accessible and Usable Buildings & Facilities
Connecticut Supplement/2005/State Building Code
2009 Connecticut Amendment to the State Building Code
- The Connecticut Fire Safety Code, which is based substantially on the International Code Council's International Fire Code/2003, The National Fire Protection Association's Life Safety Code (NDFPA 101), and the National Fire Protection Association's Uniform Fire Code (NFPA 1) 2003, as modified by the 2005 Connecticut Supplement to the Fire Safety Code
- Occupational Safety & Health laws. These are embodied in a set of regulations published and administered by the Occupational Safety & Health Administration of the United States Department of Labor (known as "OSHA"), which regulate the practices of building owners and their contractors with respect to maintaining safe and healthy work environments during the construction and operation of buildings. OSHA is administered in Connecticut by the Connecticut Department of Labor, Division of Occupational Safety and Health (CONN OSHA).

Connecticut has a volunteer 18-member "Codes & Standards Committee", whose primary responsibility is to keep the codes up to date with advances in technology and improvements in construction materials. Due to the State of Connecticut regulations review procedures, including the requirement for a public hearing on any proposed code changes, there is a built-in time delay between the publication of the model codes and the adoption of new State Codes. In order to adopt the model codes for use in Connecticut, the State

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Guideline 2.4 • Building, Safety, Energy & Accessibility Codes

publishes the Connecticut Amendments, which are necessary to accomplish several important functions:

- to coordinate the model codes with Connecticut General Statutes
- to change the model code provisions where there is a conflict between them
- to coordinate the model codes with recent federal legislation
- to adapt the model codes to circumstances unique to Connecticut
- to alter model code provisions which are unclear or below standards acceptable for the State of Connecticut

The administration and enforcement of the building codes is under the overall control of the State Building Inspector in the Connecticut State Department of Public Safety. Similarly, the administration of the fire safety code is under the overall control of the State Fire Marshal in another section of the same department. These state officials have the authority to modify or overrule a decision by a local building official or fire marshal, on the basis of application and review procedures established by them.

Because of the growing concern about global warming and the need to conserve energy and reduce the introduction of carbon into earth's atmosphere, Connecticut is currently in the process of adopting building code requirements that incorporate "green" building principles. Complying with these new requirements may be challenging for building owners, due primarily to the difficulty in measuring the requisite degree of compliance with these new energy-saving and sustainability requirements. These requirements may create the need for additional professional fees for a person or organization qualified to certify that the new requirements have been met by the project.

Finally, if you are reading this guideline more than six years after its publication, there may be newer codes in effect than those cited here. The website below for the State Building Inspector and State Fire Marshal in the office of Connecticut's Department of Public Safety will be a reliable source for up-to-date codes in effect.

RECOMMENDATIONS/ BENEFITS

Persons planning a building project are advised, at a very early stage, to confer with their design and construction professionals to familiarize themselves in a general way with the requirements of all of the codes applicable to their particular project and to keep firmly in mind the following basic principles:

- The code provisions are for the most part prescriptive, but they generally state minimum legal requirements.
- Code enforcement personnel have a ministerial duty to enforce the codes as they see them, but they are not infallible, nor can owners expect or demand that they take certain actions, nor can owners rely on the decisions of these officials to shift responsibility from themselves.

Preconstruction

Guideline 2.4 • Building, Safety, Energy & Accessibility Codes

- In reference to the last point, owners cannot assume that the code has been met simply because the code official does not cite a violation. Regardless of any decision by a code official, conformance to code requirements remains the primary legal responsibility of the building owner, even though the owner engages the services of a design or construction professional to assist or advise him or her. This principle has particular application to enforcement of accessibility codes, which, although they are dealt with in the building code administered by the local building official, may have application beyond the rulings made by the local official.
- On the other hand, the local code officials are the persons charged with code enforcement, and everyone must deal with them, even though their opinions on particular code provisions are not entirely uniform from one jurisdiction to another. Applications for building permits (prior to construction), and certificates of occupancy (after the building is completed), must be signed off by the local code officials, so it is very important to cooperate in any reasonable way with them. In the event of a dispute with a local building official, the owner's recourse is to appeal the local official's decision to the State Building Inspector or to the local Board of Building Code Appeals, and from there to the State Codes and Standards Committee, and finally to the courts. In the event of a dispute with the local fire marshal, the owner's recourse is to ask for informal assistance from the State Fire Marshal, or to appeal to the State Codes & Standards Committee, and from there to the courts.
- After the building is completed, the owner remains responsible to maintain and operate the building in conformance with codes, especially those relating to means of egress, fire safety, health, accessibility and energy efficiency.

RESOURCES

- Connecticut Department of Public Safety. www.ct.gov/dps/site/default.asp
- Connecticut Department of Labor. www.ctdol.state.ct.us/osha/htm
- National Fire Protection Association. www.nfpa.org
- International Code Council. www.iccsafe.org
- United States Department of Labor. www.osha.gov

Preconstruction

Guideline 2.5 • Independent Structural Engineering Review

ISSUE

Independent Structural Engineering Reviews are required by the Connecticut State Building Code in order to verify that the design of the primary structural support systems of a building or structure is adequate and in conformance with the Building Code.

DISCUSSION

The Connecticut General Statutes require all buildings that exceed one or more “threshold limits” to have an independent design review prior to the issuance of a building permit. Such a review is intended to provide an increased level of confidence regarding the predicted performance and safety of the project as documented by the design. As few building departments within Connecticut are capable of assessing the adequacy of a structural engineering design, this ensures that the structural design of the larger buildings or structures will be properly evaluated.

An “Independent Structural Engineering Review” is an independent and objective technical review of the design of the project by a structural engineering consultant experienced in the design of projects similar to the one being reviewed. It is intended to encompass an actual review of the design, using independently generated calculations, with the goal of establishing whether or not the building or structure conforms to the minimum structural design standards established by the Building Code. The independent review differs from the special inspections (see Guideline 3.8), in that independent reviews are examinations of the structural plans to verify compliance with the building code while special inspections are the testing and inspection of materials of construction to verify compliance with the plans and specifications.

The Connecticut General Statutes defines the following basic “threshold limits” that apply to any structure or addition: four stories, sixty feet in height, a clear span of 150 feet, 150,000 square feet of total gross floor area, or an occupancy of 1,000 persons. The following occupancy categories have the following additional threshold limits: institutional with 150 beds or persons; residential hotel/motel (single structure) with 200 rooms; residential multifamily (single structure) with 100 dwelling units; parking structures with 1,000 cars; and storage with 250,000 square feet. If the proposed building or structure exceeds any one of these “threshold limits,” then an Independent Structural Engineering Review conducted by an independent structural engineering consultant will be required.

RECOMMENDATIONS / BENEFITS

The design professional should inform the owner if a project will require an Independent Structural Engineering Review as soon as possible so that the owner can budget time and money for the review. The owner should select an independent structural engineering consultant using the qualifications-based selection recommendations in Guideline 1.6. The independent consultant must be a professional engineer licensed in Connecticut. In addition, the independent consultant should be actively engaged in the practice of structural engineering and should have experience with the design of buildings/structures and structural systems comparable in size and complexity to those under consideration. The

Preconstruction

Guideline 2.5 • Independent Structural Engineering Review

owner should contract with the independent consultant directly. The fee for the independent review is not included in the design fees. This consultant should be completely independent of the design team and the contractors and suppliers who will be involved with the construction of the structure.

The owner should coordinate with the design and construction teams to ensure that the time required for the independent review is properly reflected in the project schedule. For large and complex projects, a preliminary independent review at the completion of the design-development phase is recommended. If discrepancies are detected relative to the basic design assumptions, they are more readily resolved at this earlier stage than they would be at the completion of the construction documents phase.

Independent Structural Engineering Reviews verify that the design of the primary structural framing components comply with the applicable requirements of the building code. These independent reviews do not encompass the review of secondary structural components or cladding. If changes are made to the structural design subsequent to the completion of the independent review or if the design of any primary structural framing components has been delegated to one of the subcontractors (e.g. deferred submittals), such items must be submitted to the independent consultant for evaluation.

RESOURCES

- Connecticut General Statutes, Section 29-276(b), "*Threshold Limit*" Defined. Hartford, CT: Joint Committee on Legislative Management. 2009. www.cga.ct.gov/LCO/Statute_Web_Site_LCO.htm
- Recommended Guidelines for Performing an Independent Structural Engineering Review in the State of Connecticut (Document SEC/CT-301). Structural Engineers Coalition of the American Council of Engineering Companies of Connecticut. www.ct-sec.org

Preconstruction

Guideline 2.6 • Pre-qualification of Contractors

ISSUE

How can owners planning a construction project avoid getting involved with under-qualified or unscrupulous contractors?

DISCUSSION

Pre-qualification of contractors is the way to ensure the selection of a competent, qualified bidder. Under-qualified or unscrupulous contractors can exploit a bid system to gain the contract solely on the basis of the lowest bid, and then fail to follow contract documents, leading to low building quality, and perhaps jeopardizing or negating any required or desired green certifications. The aim of pre-qualification is to minimize disruption, delay and disputes on the job, to eliminate unwarranted claims for extras, and to document the disbursement of wages to the appropriate employees and payment to the subcontractors and suppliers.

Public and private owners can use a system to pre-qualify bidders before the bidding process even begins. Such a system can predict the ability of potential bidders to successfully complete a project on time and within budget. The owner can prepare an application form and follow-up procedures that provide the information necessary to make certain that the owner obtains bidders with applicable experience, capacity, management ability and integrity. In addition to adopting a system for pre-qualifying bidders on the general contract, the owner can also adopt a system for pre-qualifying subcontractors for areas of work greater than a specified dollar amount, or where the complexity of the work requires special technical skills. The owner can solicit, receive and use information from sources other than the applicant, that is, from any person or entity having knowledge of the applicant's experience, abilities, past performance, integrity or financial status. As a part of the pre-qualification system, the owner can require that applicants furnish, in addition to a completed form containing general qualifications to bid, answers to a series of questions specific to the particular project; an audited financial statement; a history of any legal proceedings related to the contractor's prior work; experience with a Safety & Loss Control Program (see Guideline 3.2); and any other documentation deemed relevant.

RECOMMENDATIONS/BENEFITS

- The owner should reserve the right to reject any and all applications or to waive any irregularities, informalities or technical defects in the application, subject to the legal requirement of fairness on public bids.
- The owner should also have the right to disqualify any applicant with respect to a current project even though the applicant has been pre-qualified in the past for similar projects.
- The bidders should provide sufficient information on the individuals from the contractors' staff who will actually manage the project.
- The owner should interview each bidder as a part of the pre-qualification process.

Preconstruction

Guideline 2.6 • Pre-qualification of Contractors

- The applicant should be expected to fully and accurately complete, and fairly respond to, all questions and requests for information contained in the application.
- Where the information given by the applicant is deemed incomplete, the owner should request the applicant to provide additional information, or the owner may obtain such information from any source it deems appropriate.
- Any failure of the applicant to completely and fairly respond to any of the questions in the application, or to provide any requested documentation, to the reasonable satisfaction of the owner, should constitute grounds for the refusal to pre-qualify the applicant.
- If an applicant is found to be unqualified, the owner should give that applicant a full explanation of his reasons for finding the applicant deficient for the particular project.
- The owner should be sure that the notice to applicants for pre-qualification contains all of the above points, in particular the right of the owner to supplement the information provided by the applicant.
- When the owner has made the determination as to which applicants are pre-qualified, the owner should promptly notify all applicants.

The time and money spent by an owner in a comprehensive pre-qualification system for contractors will be repaid many times over by the benefits of a successful project.

If pre-qualification is not feasible for an owner, then the owner should make sure to carefully define the qualifications required in the bid documents.

RESOURCES

- American Institute of Architects. A305 Contractor's Qualification Statement. www.aia.org
- Associated General Contractors of America. AGC Core Family of Contracts. www.agc.org
- Associated General Contractors of America. Manual of Bidding. Estimating and Accounting Documents. www.agc.org

Preconstruction

Guideline 2.7 • Selecting the Contractor

ISSUE

Because the owner has a choice of project delivery systems, the owner has an increasing choice of procurement procedures to select its contractor(s) for the project construction.

DISCUSSION

The industry standard is the traditional design-bid-build process. Under this system, the contract documents are completed, the bidding documents are prepared, and the project is put out to open bid. Based upon funding and regulatory requirements, the project may be subject to minimum percentages of minority- and small-business participation.

Variations of this standard include negotiated bids and invited bids. The project schedule may require that a fast-track approach be implemented. In this case, the contract documents are prepared in discrete work packages tied to the schedule of construction. For example, the construction documents for site work may be completed and put out to bid while the foundation and steelwork documents are being completed, resulting in bids that are received serially during the construction process. Multiple prime construction contracts are another variation, based upon project schedule and complexity. The owner may also go through a bidder pre-qualification process, and then invite selected bidders to bid on the project. Integrated project delivery, construction alliances, design-build, construction managers at risk and construction managers as advisors are now options for methods of project delivery that are moving beyond the traditional methods of bidding and construction (see Guideline 1.4).

RECOMMENDATIONS/BENEFITS

- Based upon project funding sources, traditional open bid procedures may have specific requirements for advertising and qualifying bidders.
- Pre-qualification of bidders may be performed. Selected bidders would then be asked to bid the project.
- Negotiated bids provide a method to be used if the owner has a good relationship with a contractor or subcontractor, especially if the owner has previously contracted for numerous projects over a long period of time.
- Project schedules may require that sequential bid packages be prepared, often without waiting for the entire construction document package to be completed.
- Construction documents may transition from paper printing and distribution to electronic Building Information Modeling (BIM) files posted on an owner's or industry website, and made available to bidders by paying a limited license fee. (See Guideline 2.2)
- Based upon schedule and complexity, multiple bid packages may be prepared and offered for bid either simultaneously or sequentially.

Preconstruction

Guideline 2.7 • Selecting the Contractor

- Owners with large physical plant holdings and in numerous locations may prefer to advertise for overall construction and design services, the providers of which would be brought into an alliance with the owner for a set period of time. Multiple projects for the various facilities would then be bid as the need arose over the life of the alliance contract, to meet the owner's capital expense budget.

RESOURCES

- American Institute of Architects. www.aia.org
- Associated General Contractors. www.agc.org



Preconstruction

Guideline 2.8 • Cost Estimating

ISSUE

Cost estimating is necessary to provide an understanding of the levels of budgeting required for the different stages of planning a project.

DISCUSSION

Depending on the level of accuracy needed and purpose of the cost estimate, there are four different types of estimate which may be provided for a project budget: Order of Magnitude Estimate, Square Foot Estimate, Conceptual (Assembly) Estimate and Final Detailed Estimate.

The Order of Magnitude Estimate, used for obtaining a rough idea as to the project costs, can be obtained with little information and in a short amount of time. It is typically derived in less than one day. Very basic or no construction documents are used to prepare this estimate, which has approximately a plus or minus 20-25% margin of error. The Order of Magnitude Estimate is typically performed prior to any great investments into the project by the owner, design team or contractors. This estimate can guide the parties involved in making the decision of whether or not to move forward with the project.

The Square Foot Estimate is also obtained with minimal information regarding the project. This estimate requires a little more time to prepare than the previous method but is fairly quick in the turn around. This type of estimate can be derived in one to three days. The construction documents are minimal for this type of estimate, and its margin of error is plus or minus 15 to 20%. The construction or design professional uses past project cost data or current construction cost publications to establish a rough project budget. The Square Foot Estimate is based on a rough size for the area of the project (square foot), the intended use of the project, and an idea of the construction materials to be used.

The Conceptual or Assembly Estimate is an intermediate estimate. The construction documents are 40-75% complete for the creation of this estimate. This type of estimate can be derived in two to three weeks. The margin of error of this estimate is plus or minus 10 to 15%. The three main methods for creating detailed project costs are Unit Cost method, Assembly method and Subcontractor/Trade estimates.

The Unit Cost method requires the estimator to quantify each component that is required to construct a project. The items are placed in a grid, and then unit prices are applied to each item to create a cost for the component. This method is time consuming and very detailed. For example, a wall typically has numerous components. A quantitative take off will count the number of studs needed for the wall, the number of sheets of sheetrock, and the amount of insulation needed in the wall.

The Assembly method uses multiple components to create an "assembly." This assembly is used to provide a cost for a certain portion of the project. A unit type is created for the assembly. For example, a wall assembly can be comprised of wood studs, insulation and sheetrock. A quantitative takeoff of the linear feet of wall will be performed. A linear foot unit cost will be applied to this assembly. The assembly method speeds up quantitative take-off by estimating multiple components at one time.

The specialized trades performing the work will create their estimate based on the above

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Guideline 2.8 • Cost Estimating

two methods, submitting it to the company that provides the overall estimate. The company providing the estimate uses the cost collected through subcontractor/trade estimates, unit prices and/or assemblies to prepare a budget for the project.

The Final Detailed Estimate is completed after the contract documents are 100% complete. This type of estimate can be derived in two to three weeks. The margin of error for this estimate is approximately 5%. All of the above methods are used in creating a Final Detailed Estimate.

The percentage of accuracy and time to complete estimates can vary, based on the complexity and size of the project. Estimates are also subject to changes through the life of a project. Severe weather or market conditions can affect the estimate: projects planned for summer construction that actually start in the winter can increase costs for winter conditions, such as heating, additional snow removal, and temporary structures that allow the work to progress.

RECOMMENDATIONS/BENEFITS

The completion of accurate estimates is one of the most important aspects of any construction project. The accuracy of the estimate will allow all parties involved to plan for the financing of the project. There are many different software packages that facilitate the creation of the different types of estimates. Depending on the delivery method of construction, the estimate should be a major factor in selecting the contractor.

RESOURCES

- Means Estimating Handbook. Kingston, MA: R.S. Means Company, Inc.

Preconstruction

Guideline 2.9 • Unit Prices

ISSUE

What are “unit” prices, and when is it appropriate to use them to secure mutually fair pricing on extra work by a contractor after the contract is awarded?

DISCUSSION

A “unit” price is a price assigned by the contract agreement to a basic amount of a material, such as a price per cubic yard of concrete or per ton of asphalt paving. The purpose of doing this is to maintain a known amount for the contract even though quantities of the priced materials vary during the project. This unit price method of adjusting quantity and cost within trades can be effective in this way, but it is not so effective if all of the parameters of the work are not figured out and established by the contract. For example, while providing a unit price-per-ton for additional asphalt paving may be satisfactory in most cases, the same cannot be said for concrete work. Does the unit for a ton or a cubic yard of concrete include forming, reinforcing, placement, and finishing? Does it apply whether the unit is installed on grade or on the 20th floor?

Where changes in the scope of the work are anticipated subsequent to the award of the contract, those units of work that are expected to be involved in the change can be thoroughly defined and competitive pricing solicited during the bid by means of unit prices. This can be done on an add or deduct basis. However, the effectiveness of using unit prices in adjusting contract price is limited by many factors. The cost of an installation is often based on the repetitive nature of the work, efficiencies in the purchasing of the materials, the familiarity of the work force in making the specific installation, and the degree of variation between similar installations. The unit price can work well when it is used to make adjustments within the quantity range and installation conditions the contractor is anticipating in his planned purchase of materials and labor.

The timing of the use of the unit prices can also create problems. The unit price assumes a certain time period in purchasing bulk quantity materials, and their installation in a certain time period. If some of the material for which the unit price was established turns out to be installed at a different time or place than anticipated, the unit price may then become invalid.

Evaluation and comparison of bids containing unit prices may be difficult at the time of award, since the low base bid (excluding the work areas subject to unit pricing) may not be the actual lowest bid if a certain quantity of material subject to the unit prices is anticipated, and the low base bidder has a higher unit price for some of the materials in question. There should be a sufficient time allotted to compare bids before award so that the owner can determine the lowest overall bid including the areas of work subject to unit prices, based on anticipated quantities of materials subject to the unit pricing.

RECOMMENDATIONS /BENEFITS

- Unit prices should be included in a bid only for those materials for which exact quantities cannot be established.

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Guideline 2.9 • Unit Prices

- Unit prices should be used within ranges. As an example, a common installation plus or minus 10% of the original quantity could be requested as one unit price, while additions or deletions of greater quantities could be covered by a different price.
- The time duration in which unit prices are valid should be specified and established prior to awards of contract. The time duration may also be tied to a specific milestone during the course of construction.
- The scope of work covered by the unit price should be very clearly defined, such as by inclusion of the following particulars:
 - Does the price include complete installation with all necessary labor and incidental materials?
 - Where, when and under what conditions is the material to be installed?
 - Does the unit price include all overhead, profit, taxes, insurance, bonds, etc.?

When used within these parameters, unit prices in bid documents can be one effective means of insuring fair pricing on inevitable changes in scope of work due simply to quantity of materials furnished.

RESOURCES

- Means Building Construction Cost Data. Kingston, MA: R.S. Means Company, Inc. 2000.
- Manual of Labor Units. Bethesda, MD: National Electrical Contractors Association. 1999.
- Labor Estimating Manual. Rockville, MD: Mechanical Contractors Association of America. 1999.

Preconstruction

Guideline 2.10 • Value Engineering

ISSUE

What are the circumstances and methods by which an owner can “value engineer” a project: that is, identify and eliminate unnecessary costs in the project and find lower cost but equally functional alternatives for goods, products and services?

DISCUSSION

The concept of value engineering evolved from the work of Lawrence Miles, a General Electric purchasing engineer, who, facing material shortages during World War II, concluded that if a product needed for production could not be obtained, an alternative product performing the same function must be found and used. When alternatives were tested and approved by the designer, Miles observed that many of the substitutes were providing equal or better performance at a lower cost. Hence, the concept was born.

The concept of value engineering has since migrated from the manufacturing sphere to the design and construction industry, and it offers one way to reduce project costs. However, owners should also realize that while costs may be reduced through value engineering, there may also be some trade-offs in the fulfillment of programmatic goals, effects on the project life cycle and in aesthetic considerations. There may be compelling architectural considerations, especially relating to the building's façade in the context of surrounding buildings, that do not permit the lowest cost materials to be used on the exterior of the building.

The basic steps in the value engineering process are:

- Information gathering: asking what the requirements are for the object and function analysis, to determine what functions or performance characteristics are important.
- Alternative generation (creation): what are the various alternative ways of meeting project requirements? What else will perform the desired function?
- Evaluation: in this stage all the alternatives are assessed by evaluating how well they meet the required functions and how great will the cost savings be.
- Presentation: the best alternative is chosen and presented to the owner for final decision, with reasons for the choice.

Value engineering in construction projects has had a wide range. Some past examples are:

- The elimination of excessive fills over cuts in the rough grading of a building site was accomplished by lowering the elevation of the building.
- Proprietary mechanical equipment was switched to a type where several manufacturers could compete, saving a substantial amount of equipment cost without compromising the quality and performance of the equipment.

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Guideline 2.10 • Value Engineering

- Specified non-standard sized windows were changed to standard sized windows, saving substantial material costs.
- The specified lighting fixtures on a project were changed to an equally functional type of fixture at a substantially reduced cost. (See Guideline 3.7)

RECOMMENDATIONS/BENEFITS

Where value engineering does not compromise program objectives or design goals, it is an acceptable means of controlling project costs. Successfully accomplished, it may provide the owner with substantially the same or possibly a better project for less cost, a reduction of risk, improvement to the schedule, and even, in some cases, improved design and value over the life of the building.

RESOURCES

- Misronet Construction Information Services. www.misronet.com



• Construction •

- **3.1 Pre-construction Meeting** ... Achieving early project coordination.
- **3.2 Safety & Loss Control** ... Procedures to minimize injuries on the project
- **3.3 Construction Scheduling** ... Keeping the project on schedule.
- **3.4 Temporary Job Utilities & Services** ... Incidental needs during construction.
- **3.5 Requests for Information (RFIs)** ... Forms for essential communicating between project participants.
- **3.6 Shop Drawings & Submittals** ... Graphic images of project components.
- **3.7 Substitutions & Approved Equals** ... Using alternate materials to those initially specified.
- **3.8 Special Inspections/ Quality Assurance** ... Procedures for verifying the performance capability of key structural materials
- **3.9 Commissioning** ... Procedure for assuring functionality of HVAC, electrical & mechanical systems
- **3.10 Changes in the Work** ... Means of accommodating changes in the project.
- **3.11 Payments to the Contractor** ... Orderly provisions for tying the payment schedule to job progress.
- **3.12 Mechanic's Liens** ... Statutory rights of contractors to secure payment by putting a restriction on the owner's property.
- **3.13 Retainage** ... Percentage hold-back on payments to protect owner.



Construction

Guideline 3.1 • Pre-construction Meeting

ISSUE

The pre-construction meeting or conference is designed to provide acceptable ground rules for all parties concerned in a project and to assure that each contractor understands the complete job requirements and coordinates the work to produce a completed job in a minimum amount of time with maximum economic gain. All too often, this meeting does not occur in a timely fashion, has insufficient attendance or an improper agenda, or does not occur at all.

DISCUSSION

The optimum time to hold the pre-construction meeting is after most of the subcontracts have been awarded, but prior to the beginning of actual construction. It is essential that all key members of the construction team be represented at this meeting. The owner will have an opportunity to get better acquainted with the construction team and to appreciate some of the operational issues encountered during the construction process.

The agenda or topics for discussion will depend on the nature, size, and complexity of the project. Although each project is unique, there are certain factors that will always be common to all types of construction.

RECOMMENDATIONS/BENEFITS

The architect/engineer's construction administrator should call the pre-construction meeting when the general contractor or construction manager advises that the major subcontracts have been awarded, but not later than two weeks prior to actual start of construction.

Full attendance and participation by all key team members can be assured by including a requirement in the general conditions of the contract that all major contractors and subcontractors must attend the meeting.

A pre-printed agenda should be developed to encompass the following topics:

- Safety
- Contract signing or Notice to Proceed dates
- Progress schedule
- Progress payments and Form of Payment request
- Schedule of Values
- Insurance and or permit requirements
- Shop drawings and sample submittal requirements
- Substitution Procedures
- Listing and identification of all tiers of sub-contractors

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Guideline 3.1 • Pre-construction Meeting

- Temporary facilities and controls
- Hazardous materials abatement
- Coordination drawings
- As-built or record drawings
- Requirements for interference and/or composite drawings
- Change orders and process of dealing with change orders
- Requests for Information (RFI) process
- Architect's Supplemental Instructions
- Job Meetings (schedule and purpose)
- Storage/staging areas
- Punch list procedures
- Final payment and retainage
- Identification of key points in critical path, (see Guideline 3.3, Construction Scheduling)
- Consideration of Partnering (Guideline 1.8)

A properly coordinated and attended preconstruction meeting will aid the construction team by providing greater insight on specific owner needs and will help the A/E to secure team cooperation. It should be designed to benefit all concerned by fostering team-work and by identifying responsibilities for the various tasks before construction is begun. Additional benefits include the following:

- Recognition and elimination of delays and disagreements
- Establishment of agreements that curb increases in construction costs
- Predisposition of gray-area responsibilities that might otherwise be the source of disputes
- Unification of management requirements and the establishment of clear understanding of these requirements

RESOURCES

- Fisk, E. Construction Project Administration. Upper Saddle River, NJ: Prentice Hall. 1999.

Construction

Guideline 3.2 • Safety and Loss Control

ISSUE

Jobsite accidents have a costly impact on the trillion dollar-a-year United States construction industry. Work-related injuries and illnesses in construction, including fatalities, occur at a rate that is 54% higher than the rate for any other industry, making it one of the most hazardous activities. This guideline explores steps that can be taken to make construction projects safer.

DISCUSSION

The Occupational Safety and Health Act (OSHA) provides that no contractor or subcontractor for any part of the contract work, including painting and decorating, shall require any person employed in the performance of the contract to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous to their health and safety. It is the responsibility of employers to initiate and maintain such accident-preventions programs as may be necessary to comply with the Act. The direct and indirect costs of construction accidents run into the billions of dollars annually. These may be divided into direct (insured) versus indirect (non-insured) costs. The direct costs of accidents include medical costs, premiums for workers' compensation benefits, plus liability and property losses. Significantly, the indirect costs constitute the bulk of the total cost. These include such items as reduced productivity, delays in project schedules and administrative time, and damage to equipment and to the facility itself.

RECOMMENDATIONS/BENEFITS

Owners can successfully influence construction job safety. The degree to which owners involve themselves in this process should be based on the relative costs, benefits and risks involved. The owner carrying out responsibility on the project can hire contractors who have a record of good safety performance. This requires attention during the process of qualifying contractors for bidding work and selecting contractors for a contract award. A prospective contractor with a history of good safety performance is more likely to perform safely in the future than a contractor with a poor or lower-than-average safety record. Several relatively objective measures of past safety performance are available, notably the "experience modification rate", which is applied to worker's compensation insurance premiums, and OSHA recordable injury and illness incidence rates. Both may be obtained from contractors, and both indicate a contractor's accident experience on past work. Contractors who hold their management accountable for accidents, as well as for productivity, costs, schedules and quality, generally have the best safety records. The fact that accidents can occur should not carry with it the assumption that they must occur. Owners should set a goal of zero accidents, and back up words with action in the form of good owner-contractor communications, which include the owner's safety expectations, understanding of the contractor's safety program, and effective dialogue throughout the life of the project. Any goal other than zero accidents may leave the contractor with the impression that injuries are bound to occur and must be accepted. The owner must also not lose sight of the fact that it has a legal duty to use reasonable care to correct or warn against hazards actually known to the owner or the owner's agents on the construction site, but which are not readily apparent to others. We recommend that owners, after consultation with their legal counsel and insurance representatives, take the following steps to improve safety on their construction projects:

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Guideline 3.2 • Safety and Loss Control

- Recognize the high cost of construction accidents so as to reinforce the moral and legal commitment to provide a safe working environment.
- Require the contractor to develop a meaningful safety program for the project, specifically tailored to its anticipated possible risks.
- Explain to the contractor prior to the bidding process what is expected regarding safety performance.
- Make a firm commitment to the management of the safety program.
- Require that the contractor designate a responsible and competent supervisor to coordinate safety measures on the site.
- Discuss safety audits during construction and require prompt reporting and full investigation of accidents.
- Insure that all workers receive appropriate safety and health training and that they are provided with all personal protective equipment required to perform the job safely.
- On larger projects, consider hiring an outside safety consultant to help coordinate job safety.

Beyond the many moral, legal and public relations reasons for improving job safety, both the owner and contractor will even reap cost savings from better safety performance and avoidance of lawsuits stemming from accidents. If owners recognize that the principles of management control commonly applied to costs, schedules, quality and productivity are equally applicable to job safety, they will stand to realize these savings.

RESOURCES

- *Safety and Health Regulations for Construction*, OSHA Regulations. Washington, DC: U.S. Department of Labor. 1998. www.osha.gov

Construction

Guideline 3.3 • Construction Scheduling

ISSUE

How does project construction scheduling help to attain the goals of finishing on time and on budget?

DISCUSSION

After the selection of the project team, a properly planned and maintained construction schedule will give participants the best chance of achieving the above goals. The construction schedule will help all parties plan, direct, organize and control the various aspects and seemingly endless tasks associated with a project. At the outset of the project, the owner should make it clear to all parties that the schedule will be used for its intended purpose, to help construct the project in a proper sequence.

There are several methods of construction scheduling used in the industry today. The two most prevalent methods are the bar chart and the Critical Path Method (CPM).

A bar chart is constructed by simply assigning a period of time to each particular activity. The activity is shown graphically as a horizontal line over a time scale. For example, two specified weeks for drywall, or one specified month for plumbing. Bar charts have advantages: they are compact, easy to understand, and allow for a time scale presentation. A bar chart also has disadvantages: it does not show interrelationships well (the effect one activity has on other activities), and it is not good for complex projects.

The Critical Path Method (CPM) schedule is constructed by first creating specific activities and then assigning each of those activities a time duration. This is similar to a Bar Chart schedule. However, the CPM schedule goes further by linking activities to each other to create a sequence for the work based on the completion of one activity prior to the next activity's beginning. The string of activities that must start and finish exactly when they are supposed to is *the critical path*. For example: by linking the tasks "drywall first floor south (5 days)" and "painting first floor south (3 days)" one creates a sequence for the work.

A simple way to understand CPM is to think of what you do when you go to work in the morning. Assume that you make coffee, brush your teeth and then get in the car to go to work. You can start the coffee perking and then brush your teeth while the coffee is finished perking. After the coffee is finished and your teeth are brushed, you can head for your car. Notice that both the coffee and the brushing can go on concurrently, but both must finish before you get into the car. Whatever activity takes the longest (brushing or coffee) is the critical activity. If you finish brushing your teeth a minute before the coffee is done, the brushing is said to have float. That is, you could take a minute longer to brush your teeth and still get in the car at the same time because you have to wait for the coffee in any case.

CPM scheduling has its advantages: it is good for complex projects, it defines and organizes the project, and it actually builds the project "on paper." The CPM also has its disadvantages: it is time consuming to create, it requires detailed information, and it requires a visual presentation to be effective.

The advent of technology has made CPM scheduling somewhat easier to manage. Today

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Guideline 3.3 • Construction Scheduling

several scheduling software packages are available at reasonable prices. However, the scheduling software will not create the CPM. The CPM logic (the sequence of activities and their relationship to each other) must still be created manually. The data is then put into the program and the software calculates the schedule and corresponding critical path. Once the data is input, the maintenance of the schedule then becomes quite simple

Proper scheduling does afford all parties the best chance of success and meeting the expectations of all parties. But construction is the birthplace of “Murphy’s Law.” At times things happen that are unexpected by all parties. The beauty of a proper schedule and scheduling software is that they make the unexpected manageable. In most instances, dates can be reassigned to the relevant activities and the software will automatically re-sequence the critical activities. All parties can now better assess the allocation of resources to deal with the issue.

The selection of a scheduling method depends on several factors:

- Size and complexity of the project
- The scope of services required
- Sophistication of users
- Available scheduling systems
- Owner preference
- Scheduling costs versus savings

RECOMMENDATIONS/BENEFITS

When a complex project is undertaken—and bear in mind that complexity does not necessarily translate into high dollars—a CPM schedule should be considered. The CPM is the only way to make reasonably sure that all the intricacies of the complex project are considered and planned for. Alternatively, for a straight-forward project, however large, a bar chart is usually adequate.

Regardless of the method selected, one must always remember that a schedule is a tool that needs constant maintenance and updating to be effective. To achieve maximum benefit from the schedule, owners should require the contractor to update the schedule on a monthly basis. Some owners make the update a condition of monthly progress payments. The frequency of the updates depends on the complexity and duration of the project. Short complex projects may be updated weekly or biweekly as opposed to monthly schedules.

It is further recommended that the owner use the contractor’s scheduling capability and expertise as a factor in selecting the contractor for the project.

No matter what type of scheduling system is used, scheduling provides the owner and the

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Guideline 3.3 • Construction Scheduling

contractor with an effective vehicle to monitor and coordinate the work, which increases the possibility of an on-time finish. Moreover, careful monitoring increases the chance that costly delays due to poorly coordinated work will not be encountered. Furthermore, an accurate schedule helps the owner with cash-flow projections.

RESOURCES

- Perrault, R. Construction Management Courses. New Britain, CT: CCSU.
- Associated General Contractors of America. *Construction Planning & Scheduling Manual*. www.agc.org



Construction

Guideline 3.4 • Temporary Job Utilities and Services

ISSUE

The responsibilities for furnishing the many temporary utilities and services that must be provided during construction for a project to run safely and smoothly must be clearly allocated among the project's various contractors and subcontractors.

DISCUSSION

Contractors and subcontractors should be provided with a workable list of assignments for responsibilities associated with temporary job utilities and related services. These functions should be accurately reflected in the project budget. The temporary facilities' work that must be done by the mechanical and electrical trades are normally specified in the separate sections of the specification for each of those trades.

RECOMMENDATIONS/BENEFITS

Temporary utilities and services should in most cases be paid for and managed by various contractors and subcontractors and should be allocated among the various contractors on the following basis:

Access

The general contractor should provide adequate access to the building site as required for the execution of the work. The general contractor should also provide and maintain at least one temporary or permanent access to each working floor level.

Hoisting Facilities

The general contractor and individual subcontractors should be responsible for providing hoisting of their own materials on a specified number of floors or less above grade. A tower hoist or other hoisting facility of suitable capacity to carry all normal items of material should then be provided on an agreed-upon basis to subcontractors by the general contractor on construction more than the specified number of floors above grade. Subcontractors should conform to a mutually-agreeable schedule during normal working hours. Hoisting facilities should be maintained until most of all materials are stored in the building. When materials exceed the capacity stored in the building, or exceed the capacity of normal hoisting facilities in either size or weight, or when they demand excessive time, individual subcontractors should be required to make their own arrangements. When the magnitude of the work force and the height of the work requires it, a suitable personnel elevator or man-lift should also be provided by the general contractor.

OSHA compliance for all hoists, conveyors and elevators on the jobsite will be the responsibility of the installing contractor. Maintenance of the facilities in compliance with the law will be the responsibility of the contractor or subcontractors operating the equipment.

Guardrails, Floor and Wall Openings, and Stairways

The general contractor should provide guardrails and covers for floor, roof and wall openings, and all stairways installed by his own forces. If removal of any of these protective facilities is required for work to be performed by a subcontractor, that subcontractor

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Guideline 3.4 • Temporary Job Utilities and Services

should give prior notice to the general contractor and replace the temporary protection in a satisfactory manner. The subcontractor should be made responsible for temporary protection of the opening during performance of its work.

Trash

The general contractor should be required to provide trash receptacles on each floor of the building. Each contractor or subcontractor should collect and deposit debris in the trash receptacles. The general contractor should remove all trash from the job site. Trash and debris should not be allowed to accumulate. Subcontractors should collect and remove their own liquid waste and asbestos waste from the job site.

Sanitation Facilities

The general contractor should be made responsible for furnishing adequate temporary toilet facilities on the job site.

Drinking Water

Potable drinking water on the jobsite should be provided in convenient and accessible locations free of charge to subcontractors by the general contractor as long as any workers are on the job site.

Fire Protection

The general contractor normally provides the temporary fire protection. Subcontractors will be responsible for their own specialty requirements. Permanent fire protection equipment used for fire protection during construction is typically the responsibility of the installing contractor.

Weather Protection and Temporary Heat/Ventilation

During construction of the project, temporary weather protection and heating/ventilation may be required for protection of workers and completed construction work. Specifications for the project should require that the heating/ventilating contractor furnish temporary connection to the permanent heating or ventilation system and later remove the temporary connection. Provisions for removal should also include transferring the system over to the owner. Also, in order that an allowance can be established in the contract price, the architect or engineer should incorporate in the specifications a lump-sum dollar amount or a total number of hours that the HVAC contractor's bid shall include for the cost of temporary heat and/or temporary ventilation. In such a case, the HVAC contractor should also state the hourly rates for furnishing labor for temporary heat, in order that a cost adjustment can be made against the stated allowance. The cost of all fuel, water, electricity, and other consumable energy products may be paid by the owner subject to mutual agreement.

Water Service

The plumbing contractor generally furnishes a temporary water supply at each floor of a building, and at other access points if indicated by the architect or engineer in the specifications. The specifications should indicate the size, quantity, and pressure at the water outlets, but in any case, the plumbing contractor should be required to provide a water hose of a stated minimum length. If not provided by the plumbing contractor, water during construction should be provided by the general contractor.

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Guideline 3.4 • Temporary Job Utilities and Services

Electrical Service

The electrical contractor should furnish and maintain temporary electrical service for both power and lighting as indicated by the architect or engineer in the specifications. The specifications should indicate the type, quantity, wattage, amperage, and voltage characteristics of temporary circuits and lighting, and should provide for a minimum number of temporary outlets per floor. Any contractors having additional requirements for power, lighting or service can then make the necessary arrangements at their own expense.

Storage

The general contractor should coordinate the allocation of all temporary storage areas to the various subcontractors.

The owner, design professionals and contractors will all fare better under the procedures outlined above. It is strongly recommended that these procedures be followed for a functional, safe and efficient jobsite.



Construction

Guideline 3.5 • Requests for Information

ISSUE

What is the intent and acceptable use of the Request for Information (RFI) in the construction process?

DISCUSSION

The RFI is a necessary and useful tool in the construction process because it is a mechanism by which contractors and/or construction managers, as well as their subcontractors, communicate with design professionals to make inquiries about the project. When properly used, the RFI generally provides an orderly and efficient method of resolving questions posed by the contractor or construction manager concerning the contract documents. The RFI is most commonly used to request information during the construction phase of a project. However, many contractors and construction managers utilize the same tool during the bidding process for essentially the same purposes.

RECOMMENDATIONS/BENEFITS

Proper uses of an RFI include: (1) requests for information that may have been omitted from the contract documents; (2) requests to resolve conflicting information in the contract documents; (3) requests for interpretation of information stated in the contract documents; (4) requests for the design professional's assistance in correcting an error made in the field; (5) resolution of differing or conflicting field conditions; and (6) confirmation of a conversation with the design professional concerning one of the aforementioned uses.

However, the RFI should not be used as a complete substitute for direct personal communication between the contractor or construction manager and design professional. Although some issues require a detailed written submission and response, the majority of issues that arise during the shop drawing process and in the field can be handled via direct communication in an expeditious and efficient manner, using the RFI as a tool to document the resolution of the issue as opposed to initiating the question. Such communication also fosters team building and trust between the project participants.

An RFI should include enough information to ensure complete and thorough review, analysis and resolution of the issue at hand. The RFI should: (1) be as specific as possible; (2) cite specific drawings and details (including revision dates), specifications and addenda if applicable; (3) cite the specific area of the project in question; (4) provide sketches or drawing excerpts as reasonably necessary to clarify the question; (5) include the name of the person who prepared the RFI and the name of the person who approved its content; (6) include a specific reasonable response time; (7) describe any impacts on the project schedule; (8) delineate the purpose of the RFI (i.e., omission, conflict, interpretation or request for assistance to correct field error); (9) be numbered or ordered in a standard way for ease of tracking; (10) ask a question; and (11) should propose a solution to the design professional, if possible.

A properly prepared RFI requires a fair amount of thought and due diligence and a thorough review from all project participants. One of the construction manager's

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Guideline 3.5 • Requests for Information

responsibilities to the owner is to conduct this review and streamline the process, eliminating unnecessary RFI's. Sometimes the answer can be ascertained by virtue of the due diligence process thereby eliminating the need for the RFI. However, if the answer cannot be ascertained, the properly prepared RFI focuses the design professional and promotes a speedy resolution as well as fosters trust and confidence among the project participants.

With respect to the design professional's response to the RFI, the response should: (1) be specific; (2) include appropriate sketches, drawings and other supplementary information as necessary to resolve the issue; (3) be returned in a timely fashion so as not to delay the work; and (4) include the responder's name, firm and date of response.

The design professional should only clarify the issue and not modify or expand upon the scope of the work set forth in the Contract Documents.

In some instances, the number of RFI's generated on a project has been used as evidence of defective contract documents. Although a disproportionately high number of RFI's may be an indicator of the quality of the contract documents, that is not necessarily the case. The number of RFI's on a project can become skewed if they are used for improper purposes, such as requesting substitutions for materials and systems. In addition, RFI's are typically used to request assistance for the resolution of field errors. These types of RFI's cannot be attributed to the design professional, yet typically are not segregated from the total number of RFI's on the project.

Moreover, an inordinate number of RFI's are sometimes generated as a result of financial pressures caused by overly competitive bidding or solely to generate claims for additional costs. RFI's are not meant for this purpose.

RFI's are invaluable tools in the construction process to resolve legitimate questions posed by the contractor or construction manager. When RFI's are prepared and used for proper purposes they promote the orderly and efficient exchange of information thereby facilitating the construction of the project. To review a sample RFI, please visit www.cbc-ct.org.

RESOURCES

- Industry Practice Committee (IPC) of the Connecticut Building Congress. www.cbc-ct.org

Construction

Guideline 3.6 • Shop Drawings & Submittals

ISSUE

What is the role of shop drawings in insuring a successful project?

DISCUSSION

A successful project requires shop drawings, which are drawings with detailed configuration and dimensions of the components which are to be built into the construction project, prepared by the manufacturer of the component. These can include everything from steel beams to cabinets, and the purpose of requiring them is to be certain that the component will fit properly into the overall construction. When used by all parties correctly, the submittal/ shop drawing process helps in coordination and communication. Misconceptions can be ferreted out and potential issues can be identified. If the process of shop drawing submittal and review is not managed expeditiously, serious job delay and disruption can occur.

As soon as possible after being awarded the contract, the general contractor should prepare and submit to the architect a correlated construction schedule, a proposed list of manufacturers and suppliers, and a detailed schedule of shop drawings, product data, certifications and sample submissions, as required by each section of the specifications. The shop drawings, product data, certifications, and samples are generally submitted by subcontractors and suppliers to the architect or engineer through the general contractor (GC) or construction manager (CM), who must see that they comply with the requirements of the contract documents. If the general contractor or construction manager believes that they do comply, he or she will stamp them accordingly and forward them to the architect. The architect should review the materials within the time periods set in the shop drawing schedule, and return them to the general contractor marked "Reviewed," "Reviewed as corrected," "Revise and resubmit," or "Not accepted." Any items needing to be resubmitted should be so resubmitted and acted upon within the time periods established in the shop drawing schedule.

RECOMMENDATIONS/BENEFITS

The following steps should be taken to ensure an efficient system of shop drawing processing:

- The specifications should clearly indicate which items require submission of shop drawings, product data, certifications or samples and should require contractors to submit a schedule of such submissions.
- The specifications should also provide that no portion of the work requiring a submittal can begin until the submission has been made and acted upon.
- Shop drawings for interrelated items should be submitted together.
- Shop drawings for continuing materials such as reinforcing steel should be submitted in stages so that the items needed first can be on the job as early as possible.

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Guideline 3.6 • Shop Drawings & Submittals

- The shop drawing schedule should allow the design professional an adequate period of time to review shop drawings. Not all submittals should be treated equally in terms of review time & effort. Some require much more review than others. Coordination meetings should be expected to work out some shop drawings.
- Where corrections or revisions are requested, or shop drawings are not accepted, the design professional should provide the reasons for such action in writing.
- The design professional should hold submittals without action only where partial submissions cannot be reviewed until the complete submission has been received, or when they cannot be reviewed until correlated items have been received. In either case, the architect or engineer should notify the contractor in writing of such reasons for holding the submittal
- Trade contractors should refrain from making changes or substitutions through shop drawings (see Guideline 3.7).
- The general contractor or construction manager should take the time to review the shop drawings for compliance with the contract documents submitting them to the design professional. In his or her comments on shop drawing submittals, the architect or engineer should specify clearly what action should be taken by the contractor in response.
- Contractors should review the design professional's comments on all returned submittals and make appropriate adjustments and response.

If the project participants adopt and follow conscientious and expeditious shop drawing submittal, review and monitoring procedures, they will help to ensure that the job runs smoothly, stays on schedule, and that all components fit into the total project in the intended manner.

RESOURCES

- American Institute of Architects, A201 General Conditions of the Contract for Construction, Sections 3.10, 3.11 and 3.12. www.aia.org

Construction

Guideline 3.7 • Substitutions and Approved Equals

ISSUE

Most construction documents make provision for the contractor to offer substituted material or equipment if such material or equipment can be shown to be “equal to” those specified. The challenge is to encourage and expedite such substitutions only when they truly serve to improve the project schedule or budget, or to solve some problem imposed by the specified product, equipment or method of construction.

DISCUSSION

The term “substitute” is defined as a material, product or item of equipment or system, in place of that specified. The term “approved equal” is defined as a material, equipment or system proposed by the contractor and approved by the design professional for incorporation into the work as equivalent in essential attributes to the material, equipment, or system specified in the contract documents. Three factors should be kept in mind before proposing a substitution. First, the original specification is a first choice, based on valid but possibly undisclosed reasons, and that any substitution may only approximate its requirements. Second, time and effort will be required for the design professional and owner to investigate the proposed substitution. This may involve compensation for the reviewer. During the review time, the work and other necessary activities may be delayed. Third, adjacent construction or systems may have to be altered to accommodate the substitution. Nevertheless, reasonable competition leading to economy is an important consideration for almost every owner.

RECOMMENDATIONS / BENEFITS

The design professional or owner should receive and consider the contractor’s request for substitution when one or more of the following conditions are met:

- The proposed change is in keeping with the specified system or item in the contract documents.
- The request is timely, fully substantiated, and properly submitted with cost implications.
- The specified product or method of construction cannot be provided within the contract schedule.
- The requested substitution offers the owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities the owner must assume as a result of the substitution.
- The specified product, equipment or method of construction cannot receive necessary approval by a governing authority, whereas the requested substitution can receive such approval.
- The specified product or method of construction cannot provide a warranty required by the contract documents but the substituted product or equipment can provide such warranty.

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Guideline 3.7 • Substitutions and Approved Equals

- The substitution is required for compliance with a final interpretation of code requirements or by insurance regulations.
- During the construction process, it sometimes becomes apparent that specified products or equipment may not perform properly or fit into designated spaces.

If proposed substitutions do, in fact, benefit the project by cutting costs without sacrificing job quality, saving project time, or solving one or more of the above problems, they will be well worth the time and effort to process and consider.

RESOURCES

- American Institute of Architects. The Architect's Handbook of Professional Practice, Volume 3. www.aia.org

Construction

Guideline 3.8 • Special Inspections

ISSUE

What are special inspections of construction materials, their requirements in the State Building Code, and the procedures by which they are implemented in the construction process?

DISCUSSION

Several spectacular and well-publicized building collapses in the 1980's resulted in tragic loss of life. Engineers and code officials who studied the causes of those events recognized that an increase in quality assurance during the construction process was required due to the increasing complexity of that process, the involvement of so many different parties and entities, and the use of new materials. Their recommendation was that the building code require continuing inspections of building materials by independent authorities during the construction process. For all structures requiring the seal and stamp of a professional structural engineer (generally all structures containing 5000 square feet or more), the building code now mandates that the plans for the project contain provisions for periodic independent special inspections during construction. These inspections of materials, typically including soils and foundations, structural steel, concrete, load-bearing masonry, pre-engineered wood members, spray-on fireproofing, and even EIFS (exterior insulated finishing systems), assure that they meet the specifications prepared by the project design engineer and thus meet the goal of protecting public safety. They are distinct from, and supplementary to, the peer reviews by structural engineers of the design itself for so-called "threshold buildings" under other provisions of the building code. (See Guideline 2.5)

As a part of the contract documents, the project engineer is required to prepare a "Statement of Special Inspections" form describing the exact schedule of inspections to be performed during the construction phase of the project. The owner retains the firm which will perform the testing, subject to the approval of the local building official. This firm is identified on a form presented to the local building official at the time of the application for a building permit for the project.

The special inspector co-ordinates the inspections and reviews the testing and inspection reports prepared by the field inspectors, typically engineers and others from the testing laboratory. The special inspector then submits both interim and final reports to the building official, attesting with a signed statement that the inspections have been performed and that any discrepancies have been addressed. The signed statement is necessary to obtain a certificate of occupancy from the building official.

The owner is required by the building code to pay all fees and costs of the special inspections. These fees are in addition to design fees and the costs of construction and can be accounted for in the owner's contract with the design professional for the project or in an independent separate contract between the owner and a separate entity responsible for the special inspections. Usually, however, the engineer of record, who designed the building's structure and who has an understanding of its unique structural requirements, is in control of selecting the special inspector and identifying the critical materials and processes which must be inspected, thereby insuring the safety of the public. Notwithstanding the requirements and procedures of special inspections, the contractor remains responsible for

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Guideline 3.8 • Special Inspections

providing quality control of materials and for the means and methods of construction. This responsibility includes the proper and safe performance of the cranes and other project lifting equipment and the operators of such equipment. The contractor is also responsible for notifying the special inspector when structural components are ready to be inspected.

RECOMMENDATIONS/ BENEFITS

Owners have the prime responsibility to comply with the building code, including the requirement for special inspections for all buildings over 5,000 square feet, excluding one and two-family dwellings. The project architect and engineer should make the owner aware of these requirements early in the planning of the project. The owner should insure that the special inspections are properly provided for and thoroughly carried out. The special inspections will not only insure that the project is being built with materials and processes that are safe for the construction workers and the occupants and users of the project, they will also insure that the owner is getting what he or she paid for.

RESOURCES

- 2003 International Building Code (IBC) portion of the 2005 Connecticut State Building Code
- Guide to Special Inspections and Quality Assurance, Third Ed. Council of American Structural Engineers (CASE). 2004.



Construction

Guideline 3.9 • Commissioning

ISSUE

A frequent and ongoing problem faced by building owners is the operation of mechanical, heating, ventilating and air conditioning (HVAC) and electrical systems in a manner other than as originally designed, even if the general installation was substantially correct and complete. As a result, such systems are considered unsatisfactory by the owner or occupants, due to high operating costs, discomfort, or poor air quality.

DISCUSSION

Commissioning means an overall quality management process that works to integrate all mechanical, HVAC and electrical systems in a building project in order to achieve optimal performance of all the components. The commissioning process has become much more important recently due to application of the “green building” concept (See Guideline 1.9) and the high cost of energy. These factors have caused owners to pay close attention to keeping the life cycle cost as low as possible. Indoor air quality and its effect on occupant satisfaction is also a high priority.

Because of the complexity, sophistication, and interrelatedness of current building systems, designers, installers and system operators are required to possess greater knowledge of current technological advances in building materials, installation methods and building management systems. The complexity of these systems logically demands that the participants in a building project adopt the commissioning process.

HVAC systems are the main focus of the process, but it should encompass all “dynamic” building systems, especially as numerous participants with widely varying roles and perspectives are currently required for work on large construction projects: designers, mechanical and electrical contractors, control system installers and various other subcontractors, equipment suppliers, test and balance specialists, inspectors, technicians of various disciplines, equipment start-up specialists, and operating staff often come together in a competitive pricing environment, making it difficult to achieve the end result of optimal building performance.

One important way to achieve the desired result is to have a commissioning agent on board as the owner’s advocate to oversee the entire commissioning process from the beginning of the job. The commissioning agent can insure that the designers, installers and future operating personnel work together in a coordinated manner to achieve optimal performance of the building systems. The commissioning process does not take away the accountability or responsibility of the other project participants; rather it checks that these participants’ efforts are leading to a project that meets the owner’s objectives. The commissioning agent will perform sample testing and systems review at periodic stages of the project.

Commissioning can be performed by the design engineer (basic commissioning) or by a third party commissioning agent. Basic commissioning is a prerequisite for any LEED certified building. (see Guideline 1.9) The commissioning agent is typically hired directly by, and reports to, the owner. Sometimes the testing, adjusting and balancing firm is hired by and works under the direction of the commissioning agent.

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Guideline 3.9 • Commissioning

RECOMMENDATIONS / BENEFITS

For optimal results, an independent commissioning agent should be an integral part of the owner's team from the conceptual design of a building, through the start-up and operation of the building's systems, and continue all the way through a full four-season period of the building occupancy.

The use of commissioning is recommended for all types of construction that involve significant HVAC systems. It is an all-inclusive process which begins at the pre-construction phase and continues through at least a full year of the occupancy of the building. The commissioning team should consist of the commissioning agent, the mechanical and electrical engineers, major electrical and mechanical equipment suppliers, the mechanical, electrical, sheet metal, and controls and balancing contractors, and – as soon as practicable – the future facility's operating personnel. This group should work as a team from design coordination through to the realization of fully-functional, finely-tuned and well-operating mechanical, electrical and HVAC systems- complete with all required documentation and a well-trained operating and maintenance staff.

All parties should be aware from the beginning that the project will involve commissioning and the contract document specifications should include commissioning sections clearly outlining the responsibilities of all participants.

The proper commissioning of mechanical, electrical and HVAC systems will result in a better total understanding and achievement of the building's requirements, as embodied in the designer's assumptions and design intent. Owners will experience far fewer hidden deficiencies at takeover, and therefore will not incur further costs for later corrections or be forced to live with unsolvable problems. After completion, a properly-commissioned building will actually operate in accordance with design intent, thereby making the building more responsive to the owner's needs by producing a consistent high level of thermal comfort, air quality, energy efficiency and occupant satisfaction. Commissioning can achieve a greatly reduced lifetime cost for the building for an initial expense in the range of 2% to 6% of the construction cost of a typical office building.

RESOURCES

- ASHRAE, Guideline 1.1-2007. www.ashrae.org
- ASHRAE, Guideline 0-2005.
- ASHRAE, 2007 Application Handbook, Chapter 42.
- United States Green Building Council (USGBC). www.usgbc.org
- Building Commissioning Association. www.bcxa.org
- AABC Commissioning Group. www.comissioning.org

Construction

Guideline 3.10 • Changes in the Work

ISSUE

What are the kinds of circumstances that necessitate changes in the work of a project, and what are the processes by which the changes may be made contractually?

DISCUSSION

Unforeseen conditions, changes in work scope and conflicts or omissions in the contract documents can occur on any construction project. Examples of the circumstances that may arise during construction that will require a modification of the contract between the parties are:

- The owner changes his mind and wants something different from that which is currently called for in the contract between the parties, such as a different type of brick, larger rooms, different plumbing or electrical fixtures.
- The market conditions change: a specified product may become unavailable or take longer to procure than the parties originally anticipated or a new product may become available that offers significant advantages to the parties. (See Guideline 3.7)
- Hidden conditions are discovered: unanticipated soil conditions, underground obstructions, unforeseen utilities, asbestos or other hazardous materials.
- The design professional provides additional information that corrects discrepancies in the original contract documents.

Changes in scope and those caused by unforeseen conditions or the correction of omissions also affect time and scheduling, as they are often disruptive to the logical flow of a construction project. As an example, the discovery of contaminated soil during excavation will delay the placement of the foundation until the site is properly remediated. Moreover, seemingly harmless changes, with little time impact by themselves, if multiplied, can have a drastic affect on the project schedule if their cumulative impact is taken into account.

When a change becomes necessary for one of the reasons cited above, the “change order” is the vehicle to deal with the change. However, the contract between the parties must expressly provide for changes in the work and how they are to be addressed. There are generally two forms of change initiation:

- A change proposal initiated by the owner or design professional, commonly called a request for proposal (RFP) or construction change directive (CCD), is generated by the designer and asks the contractor to price the scope change. The cost and accompanying time impact are then submitted for review. If approved, a change order document is issued to the contractor for billing purposes.
- Contractor-initiated proposals are generally the result of the contractor's discovering a hidden condition or a discrepancy in the documents. The contractor will send the design professional a request for information (RFI), and if the answer is returned with

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Guideline 3.10 • Changes in the Work

additional work, the contractor will generally assess the cost and time impact of the answer. The contract may contain a notice provision requiring the contractor to give notice to certain of the other participants within a specified period of time. Failure of the contractor to observe these contract requirements could result in the contractor's request for the change being rejected.

A change in the contract can be accomplished in several ways. The three most common are:

- **Lump Sum:** the contractor prices the work, generally before it is performed, and the parties agree to the cost and time impacts.
- **Time and Material:** the contractor is reimbursed for the actual labor time spent and material used for the change. The time element is generally tracked in the field by the owner's representative or the design professional, and the contractor supplies material invoices with his bill. This method is faster because the work can proceed without being priced out first.
- **Unit cost:** the parties to the contract agree contractually in advance to the cost for the more typical items in the project. For example, a large site project may call for unit prices for excavation and back fill. Changes are paid by multiplying the unit or work by the agreed unit price. (see Guideline 2.9)

RECOMMENDATIONS/BENEFITS

As with any contract, success depends on each party's mutual expectations. The contract should define the initiation, review, approval and management of changes and what the roles of each party are. Regular and periodic scheduling meetings should be held to assess the impact of changes on the overall project schedule.

Realization on the part of the owner that changes will occur, properly defined change management procedures, and proper review of the impact of the change on project schedule will go a long way towards avoiding potential disputes.

RESOURCES

- American Institute of Architects, A201 General Conditions of the Contract for Construction. www.aia.org
- Associated General Contractors. Consensus Documents. www.agc.org

Construction

Guideline 3.11 • Payments to the Contractor

ISSUE

On construction projects, one key challenge for owners is to establish a contract provision governing payments to the contractor that adequately compensates the contractor periodically for work performed on the project while also enabling the owner to have funds in the project to complete it should the contractor fail to do so.

DISCUSSION

This is one of the most basic elements of any construction contract. If the contract unduly limits payments by the owner to the contractor, i.e., if it fails to provide the contractor with sufficient funds in a timely manner to enable the contractor to keep reasonably current in the contractor's payments for labor and materials on the project, then the project may be impaired by labor disruptions or interruptions in the flow of materials to the project which make it impossible for the contractor to continue on schedule. On the other hand, if the contract's payment provisions are too generous to the contractor, i.e., if the contract pays the contractor too much too far in advance of when the work is performed, the owner runs the risk of being left with an incomplete project without the funds available to complete it. This latter type of contract is said to be "front-loaded".

The solution to this dilemma is to negotiate a contract provision governing payments to the contractor that maintains enough cash flow to the contractor to enable the contractor to expeditiously proceed with the work without paying the contractor before work is actually performed. On smaller projects, such a payment provision may simply set up a limited series of specified payments upon the completion of certain stages of the work known as "milestones". For example, on a small residential project, the payment schedule may call for an initial payment amount by the owner to the contractor upon the execution of the contract (which shows good faith on behalf of the owner and which enables the contractor to order materials required to commence the project), a second specified payment amount upon completion of the foundation, a third specified payment amount upon completion of the roof, exterior walls and exterior doors and windows of the structure (commonly referred to as "closing in", or "drying in" of the building), a fourth specified payment amount upon completion of drywall (which necessarily means that all roughing in of HVAC, electrical and plumbing work has been completed), a fifth payment upon "substantial completion" or issuance of a certificate of occupancy(see Guideline 4.1), and the final payment upon final completion of the project. Typically, these smaller projects do not have a provision for retainage (see Guideline 3.13) This schedule of payments may be broken down into additional stages depending on the size and complexity of the job.

On larger projects, it is common for the contractor and owner at the beginning of the project to establish a "Schedule of Values", which establishes the "value" or cost of specified work items or components of the project. Depending upon the size and complexity of a construction project, different construction projects may have different categories and detail for various work items. For example, the schedule of values may have separate specified monetary amounts for the "value" of excavation, backfill, footings, foundation walls, site rough grading, site finish grading, landscaping, walks and retaining walls, wall framing, floor framing, roof framing, finish roofing, finish siding, chimneys, fireplaces, roughing of HVAC, roughing of plumbing, roughing of electrical, insulation, drywall, exterior

Construction

Guideline 3.11 • Payments to the Contractor

painting, interior painting, plumbing fixtures, HVAC finish trim, appliances, kitchen cabinets, bathroom cabinets, bathroom accessories, elevators, and lighting fixtures. Normally, a design professional will need to assist the owner in evaluating, and perhaps modifying, the schedule of values to assure that the schedule of payments in the contract is reasonably related to the progress of construction and is not overly “front loaded”. The latter condition could occur if the values for work performed earliest in the process are disproportionately high, and the values for work performed later in the process are disproportionately low.

The second challenge, after the schedule of values is finalized, is to establish a means of managing and properly timing payments to be made by the owner to the contractor pursuant to the schedule of values. On larger construction projects, obviously the contractor will require periodic funding from the owner in order to maintain progress on the project. During each of those time periods, the contractor will usually simultaneously perform work on multiple line items described in the schedule of values. Therefore, contracts on larger construction project typically establish a process whereby payments to the contractor are required to be made by the owner at specified time intervals, typically thirty (30) days. On most private commercial (non-residential) projects the owner is required by law to pay the contractor within thirty (30) days after a written request for payment and the contractor in turn is required to pay its subcontractors within thirty (30) days after being paid by the owner. Similarly, on public works projects, contractors are required by law to pay subcontractors within thirty (30) days after payment to them by the State or municipality.

At each time interval, the contractor presents a requisition for payment to the owner and/or the owner’s representative, showing the percentage of the work performed by the contractor in each category contained on the schedule of values that have been completed by the contractor during the previous time period. The AIA has a requisition form typically used by parties for this purpose. The form has columns running across the page for scheduled value of work, percentage of work completed prior to the particular requisition for payment, percentage of work completed in the current payment period, total work completed, retainage (see Guideline 3.13), and value of work remaining to be completed. The form will show all of these amounts for each item in the schedule of values. The bottom row of the form will show the totals of these values for the total contract.

Contracts on larger construction projects will also typically contain a provision by which each of these payment requisitions are reviewed by the design professional on behalf of the owner, and then modified or approved. The design professional will make his or her evaluation of the requisition based on site visits and a review of project progress photographs, to verify that the percentage of work shown as completed on the requisition fairly represents actual progress on the job. The owner will then have a specified time period within which to make payment of the reviewed/approved amount. Contracts typically require also that each payment requisition by the contractor be accompanied by mechanic’s lien waivers from subcontractors and suppliers for the work done during the payment period. (see Guideline 3.12) At the conclusion of the project, payments to the contractor at “substantial completion” and at “final completion” are covered by Guideline 4.1.

Construction

Guideline 3.11 • Payments to the Contractor

RECOMMENDATIONS/ BENEFITS

Establishing a fair contractual provision for payments to the contractor, and its proper implementation during the progress of the construction work, is absolutely vital to a successful construction project, and it is one of the most important points contained in these guidelines. Failing to establish and administer a fair payment provision is one of the most frequent causes of disputes between the parties to a construction contract.

RESOURCES

- American Institute of Architects. www.aia.org
- Associated General Contractors of America. www.agc.org
- Engineers Joint Contract Documents Committee. www.ejcdc.org



Construction

Guideline 3.12 • Mechanics Liens

ISSUE

What are mechanics liens and lien waivers, and how do they protect both project owner and contractor?

DISCUSSION

A mechanics lien is the right of persons who supply materials, labor or services in the construction, repair or demolition of any building or other improvement to file a lien in the land records of the Town in which such building or improvement is located. The lien may be filed at any time within ninety days after the last date when such materials, labor or services were furnished, covering the value of such materials, labor or services for which the person filing the lien has not been paid. A properly prepared and properly filed lien will take precedence over any mortgage or other encumbrance filed in the land records after the date when such person first began to furnish materials or labor. Since the owner's payments on the project are normally made only to the general contractor, the owner may have limited knowledge of whether all potential lien holders have been paid.

Excluding those contracts where the contractor furnishes the owner with a payment bond to secure the owner against non-payment of subcontractors and suppliers, the standard method used to protect the owner from mechanic's liens is to have the contractor furnish to the owner waivers of lien rights at the times when the contractor applies for payment. Since even the simplest construction project is likely to have a long list of subcontractors and material suppliers, it is necessary for all owners to determine the identity of all subcontractors and suppliers and to obtain waivers of lien rights from all of them before paying for the work and to require subsequent documentation to demonstrate that payment was made to each subcontractor and supplier. Contractors and suppliers are willing to waive their mechanic's lien rights when they are paid, but usually not before. By Connecticut statute, advance waivers of lien rights for work not yet performed or materials not yet delivered on private commercial projects are invalid. This means that when the contract calls for a series of staged payments to the general contractor depending on progress of the work, the contractors and suppliers can be expected to furnish such waivers only for the labor and material furnished prior to the time of each periodic payment and then to provide a complete and final waiver of all mechanics lien rights only at the time of final payment. Waivers provided prior to payment typically state that the waiver is "subject to receipt of payment".

Even though a contractor or supplier has provided one or more partial lien waivers, its lien priority is based upon its first day of work (even if payment was made for the earliest work performed). When secured financing is required after work has started, a lender is likely to require that contractors and suppliers agree to "subordinate" their mechanics lien rights to the mortgage. In this way, the lien rights remain in effect for the protection of the contractor or supplier, while at the same time enabling the owner to proceed to put construction financing in place. Lien subordination is not restricted by statute.

The general contractor's provision of a payment bond provides an alternative avenue for the subcontractor and suppliers to secure their payment. However, the existence of a payment bond does not diminish the right of subcontractors and suppliers to file mechanics

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Guideline 3.12 • Mechanics Liens

liens. It only means that the owner will likely be able to substitute the bond for the liens in short court proceedings.

RECOMMENDATIONS/BENEFITS

The contractor's first payment application to the owner or the owner's design professional should be accompanied by a complete listing of all contractors, subcontractors and material suppliers who are expected to furnish materials or labor to the project. In all but the smallest projects, the values applicable to all such labor and materials should also be shown. The second payment application should be accompanied by the names of any additional contractors and suppliers and partial lien waivers from all those who were listed with the first application, waiving their lien rights as to labor and materials furnished prior to the first application. Each successive application for payment should be accompanied by the names of any additional subcontractors or suppliers and by partial waivers of lien rights for all subcontractors and suppliers on the previous application, covering materials and labor supplied to the project up to the time of the previous application. Where a particular subcontractor or supplier has furnished all of its materials and labor for the entire job as part of a particular progress payment, it would be appropriate to obtain a final waiver of lien rights from that subcontractor or supplier at the time of such final payment. Otherwise, subcontractors and suppliers should not be expected to furnish complete and final waivers until the final payment is made to the contractor, and as a condition thereof. The general contractor should also furnish its final waiver at the time of final payment.

If the contract between the owner and general contractor and the contracts between the general contractor and subcontractors all provide for an integrated, fair and orderly procedure for the furnishing of waivers of mechanics lien rights, the owner and contractors will both be financially protected without causing disruption and delay to the progress of the job. The owner is well advised to consult an attorney at the time of contract to be sure that these goals are met.

RESOURCES

- Connecticut General Statutes, Section 49-33, et seq.
- American Institute of Architects, A201 General Conditions of the Contract for Construction. www.aia.org

Construction

Guideline 3.13 • Retainage

ISSUE

Owners want protection against claims and defaults as the construction project nears completion and they want assurance that the contractor will finish the work. Retainage clauses in construction contracts provide mechanisms to hold back a percentage of earned contract funds until the work is successfully completed.

DISCUSSION

Contract documents on larger private and most public construction projects allow the owner to retain a portion of the monies earned by the contractor in the course of working on the project. The primary purpose of retainage is to serve as security against incomplete and defective work, claims and delays toward the end of the project. Typically, retainage is required on all non-residential work, whether bonded or not. Retainage of 5% to 10% of each requisition is customarily sought, although there are statutory limits in Connecticut, for DOT contracts (2.5%), municipal contracts (5%), private commercial contracts (5%) and DPW contracts (10%).

It is common for retainage to be reduced prior to completion, either at the mid-point or based on completed trade contractor work, with the remaining retainage held until final payment. In some cases, owners require that retainage be held after final payment as security against the potential of warranty call-backs. However, because retainage often represents a significant part of the contractors' profit, it can be a financial hardship to withhold retainage in the warranty period.

The release of retainage at the end of a project is often linked to the punch list. Upon reaching substantial completion, and the contractor, architect and owner agree on a punch list, a value of the work to be completed or corrected is assigned to the items on the list. The monetized punch list is often used as a substitute for, or as a supplement to, a reduced percentage of retainage. These remaining amounts are normally held until the architect's final inspection and contractor's submission of a final application for payment. (see Guideline 4.1)

There are statutes in Connecticut that must be considered in crafting retainage clauses for private, commercial construction contracts and subcontracts in excess of \$25,000. For these contracts, retainage cannot exceed 5.0% of each requisition, and the retained funds must be escrowed in a Connecticut bank. Moreover, the owner must provide monthly reporting on the account. Failure to create the escrow or release the retainage properly subjects an owner or contractor to penalties and attorney's fees.

RECOMMENDATIONS/BENEFITS

Reasonable retainage requirements in construction contracts can give an owner assurance and a contractor monetary incentive to complete the project according to the contract documents.

Construction

Guideline 3.13 • Retainage

RESOURCES

- American Institute of Architects, *The Architect's Handbook of Professional Practice, Volume 2, The Project*. www.aia.org
- *State of Connecticut Public Act 99-153, Fairness in Financing in the Construction Industry Act*. Hartford, CT: Joint Committee on Legislative Management. 1999.
- Connecticut General Statutes, Title 49, Chapter 847, Liens.
- Connecticut General Statutes, Title 42, Chapter 742 B, Commercial Construction Contracts.

• Post Construction •

- **4.1 Project Close-out** ... Final completion
- **4.2 Guaranty & Warranty** ... Securing specified quality for the owner



Post Construction

Guideline 4.1 • Project Close-Out

ISSUE

As the construction phase of a building project comes to an end, it is important to efficiently complete a series of procedures designed to achieve a satisfactory project conclusion.

DISCUSSION

All members of the project team are involved in these procedures, which involve owner occupancy and use, final completion of the construction work, completion of contractual obligations, and transfer of responsibility from contractor to owner. The contracts between the parties will typically define the closeout requirements for each party associated with the project and define who is to administer them. Project close-out encompasses three general phases: substantial completion, final completion, and final payment.

Substantial completion: This is generally defined as the date when the project or a portion thereof is sufficiently complete for the intended use or beneficial occupancy by the owner. This does not, however, mean that the owner must use or occupy the project for it to be deemed substantially complete. The contract between the parties will specify what will constitute substantial completion of the project or portion thereof. The date of substantial completion is generally initiated by the design professional in an AIA document called the "Certificate of Substantial Completion". Some of the more common requirements for substantial completion include a final certificate of occupancy issued by the local building official, and/or the transfer of insurance and equipment operation manuals to the owner. Additionally, the date of substantial completion commences all contractor warranty periods. However, an owner may set forth the requirements that will constitute substantial completion. Because there is no bright-line test for what must constitute substantial completion, it is important that the parties clearly establish these requirements in their contract. At the time of substantial completion, the remaining minor items of work not necessary for use of the project are commonly set forth in a document called "the punch list".

Final completion: This generally refers to the stage in the project when the responsibilities of all parties have been fulfilled: for example, all outstanding items on the punch list have been completed, all required warranties have been presented, and all "as-built" drawings and maintenance manuals have been delivered to the owner. Some contracts may require training of owner personnel in the operation of equipment. In some instances the contract will require consent of the surety company on a performance payment bond.

Final payment: This is the stage where the parties agree that all the contractual responsibilities associated with final payment have been satisfied. The party charged with the close-out administration will have concluded that all requirements have been met. Some of these requirements may include:

- Ensuring that lien waivers have been supplied by the contractor and the subcontractors
- Verification that the insurance bond has been updated to include all contract revisions, change orders and alternates

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Guideline 4.1 • Project Close-Out

- Completion of all items on the punch list
- Issuance of the final certificate of occupancy
- Completion of owner training in equipment by the contractor
- Furnishing of as-built drawings by the contractor
- Submission of all required warranties, attic stock, and other owner-stipulated provisions

RECOMMENDATIONS/BENEFITS

Although many participants are involved in the project and are anxious to complete it, careful attention should be given to project close-out. The contract between the parties should specifically define the various stages of project close-out and responsibilities for ensuring completion of all requirements. The contract should also establish time limits for submission of close-out documentation. With careful attention to applicable requirements, responsibilities and time limits established by the contract, project close-out can be effectively completed without undue delay or conflict.

RESOURCES

- American Institute of Architects, The Handbook of Professional Practice, General Conditions of The Contract for Construction. www.aia.org

Post Construction

Guideline 4.2 • Guaranty and Warranty

ISSUE

What are the expressed and/or implied promises regarding the quality of a product or service that is provided to another party in construction contracts?

DISCUSSION

A guaranty is a promise by a third party to perform the specified act or achieve the specified result if the principal fails to do so. For example, a bonding company guarantees to pay for or complete the work if the principal (the Contractor or Subcontractor) fails to do so.

A warranty is a promise that the product is of a certain quality, description, or performance standard. A warranty may be expressed in a contract document or implied by law. Most standard-form construction contracts, including the AIA forms, contain an express warranty by the contractor that the materials and equipment provided are of good quality and that the work will be performed according to the specifications and free of defects. Conversely, the owner generally warrants that the contract documents are adequate to complete the project.

Contractor Warranty

It is customary for contractors and subcontractors to provide a one-year warranty for their work. However, parties can contractually agree to a longer warranty. It is not uncommon to cover particular equipment or systems with a longer warranty; for example, roofing materials are often warranted for twenty years or more. Material warranties are customarily provided within the close out documents provided by the contractor to the owner at the conclusion of work and/or at the end of the project.

The warranty period commences upon completion of the work unless the parties otherwise agree. Generally, the contractor will memorialize the commencement of the warranty period with a letter specifically stating that the period has begun to run.

The applicable warranty period defines the time in which the contractor will be responsible for repairs within the scope of the warranty. This is not the time within which a party can commence an action to enforce the warranty. That time is defined by the applicable statute of limitations established by state statute.

Extended warranties may impose conditions such as periodic maintenance or the use of certified technicians. Failure to observe these conditions may invalidate the warranty.

Owner Warranty

The contractor has the obligation to build what is defined in the project documents (i.e. the contract, plans, specifications, reports, surveys, etc.). The owner implicitly warrants that the project documents are sufficient to build the project and that the contractor may rely on their sufficiency. If the project documents are not sufficient, the owner may be liable to the contractor for its additional costs, which may include lost efficiency and delay damages.

Post Construction

Guideline 4.2 • Guaranty and Warranty

In most instances, the owner's project documents are prepared by its design professional. An owner should be conscious of its obligations to the contractor when it defines its contractual relationship with the design professional.

RECOMMENDATIONS /BENEFITS

The selection of a material that will be incorporated into a project during the design process may have direct impact on the duration of the warranty that is provided with the specified material or manufacturer. This should be reviewed between the owner and design professional. For certain types of projects (generally consumer protection provisions applicable to residential construction), warranties may arise by statute. For example, New Home Warranties, Conn. Gen. Stat. § 47-116 et. seq.; Warranty arising by virtue of a certificate of occupancy on a single family dwelling, Conn. Gen Stat. §47-121; and Condominium Warranties, Conn. Gen. Stat. §47-274. The Uniform Commercial Code also contains warranties that may apply to material or equipment installed in the project: Conn. Gen. Stat. §§42a-2-313 et. seq.

RESOURCES

- Connecticut General Statutes, Section 4 7-116, et seq. Hartford, CT: Joint Committee on Legislative Management.
- Connecticut General Statutes, Section 42a-2 -313, et seq. Hartford, CT: Joint Committee on Legislative Management.
- Connecticut General Statutes, Section 4 7-211, et seq. Hartford, CT: Joint Committee on Legislative Management.
- Connecticut General Statutes, Section 47-274. Hartford, CT: Joint Committee on Legislative Management.
- American Institute of Architects, A201 General Conditions of the Contract for Construction, Section 3.5. Washington, DC: AIA Press.
- Cite to Consensus documents.



• Glossary of Construction Terms & Acronyms •

Aa-As • At-CI • Cm-Ej • En-Hv • Ib-Nv • Oc-Re • Rf-Tem • Ten-We

AAA: American Arbitration Association. One of the leading organizations of long standing that administers ADR procedures. (Guideline 1.8)

ACEC: American Council of Engineering Companies of Connecticut . The professional organization of engineers in Connecticut.

ACI: American Concrete Institute.

ADA: Americans with Disabilities Act. A federal statute establishing rules for building accessibility for the physically challenged. (Guideline 2.4)

AGC: Associated General Contractors. An association of general contractors in the United States. The organization publishes many construction documents.

AIA: American Institute of Architects. The association of architects in the United States. The organization publishes many of the commonly used construction documents. (Guideline 1.5)

AISC: American Institute of Steel Construction.

Alternate: A bid price requested by bidding documents for an alternate project component which may later be chosen by the owner in lieu of a first-specified component. (Guideline 2.9)

Alternate Dispute Resolution (ADR): A group of procedures for heading off and resolving construction disputes before they harden into litigious positions. In this phrase, the word “alternate” means an alternative to court litigation. (Guideline 1.8)

ANSI: American National Standards Institute. A national organization which establishes and publishes construction standards. (Guideline 2.5)

Apples and Apples: A construction slang term meaning that two different price quotes or materials are basically equivalent.

Apples and Oranges: A construction slang term meaning that two different price quotes or materials are not fairly compared with one another.

Approved Equal: A component of the project accepted by the design professional in lieu of a specified component. (Guideline 3.7)

Arbitration: A procedure often mandated in a construction agreement by which the parties agree to submit any disputes under the agreement to final decision by an arbitrator or arbitrators chosen by the parties. (Guideline 1.8)

As-Built: A term which refers to drawings prepared after construction to show the actual construction in place after incorporation of all changes from the original plans and specifications. (Guideline 4.1)

ASHRAE: American Society of Heating, Refrigeration & Air-Conditioning Engineers. An organization that promulgates standards for HVAC work. (Guideline 3.9)

ASTM: American Society for Testing and Materials. A national organization that establishes standards for testing of materials.

Glossary of Construction Terms & Acronyms

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Attic Stock: Spare parts, leftover quantities of finish and other materials turned over to the owner by the contractor at project close-out. (Guideline 4.1)

Bar Chart: Type of schedule to show the projected period of construction of various elements of the project. (Guideline 3.3)

Bearing: The area of direct vertical support under a structural member.

Bidding Set: The group of plans, specifications and other documents forming the basis for contractor bids. (Guideline 1.5)

BIM: Building Information Modeling. The use of three-dimensional, real-time, dynamic building modeling software to increase consistency and productivity in building design and construction. (Guideline 2.2)

Blocking: Filling in open spaces with solid material to secure structural members against shifting or twisting, or to strengthen a portion of the structure to allow for the future installation of hangers or supports for future items such as partitions, plumbing fixtures or bathroom accessories.

Bridging: Diagonal ties connecting top edges of structural members with the bottom edges of adjacent members. Also, a process whereby an independent architect employed by the owner oversees the work of a design/build contractor. (Guideline 1.3)

Builder's Risk: A standard type of insurance policy protecting the builder from certain risks. (Guideline 1.7)

Building Envelope: The complete roof and exterior walls of a building.

Business Objective: The goal of a project from the standpoint of the owner's business needs and purposes. (Guideline 1.2)

CADD: Computer-Aided Design and Drafting. Software that enables design professionals to design buildings on the computer. (Guideline 2.2)

CALS: Connecticut Association of Land Surveyors (Guideline 1.10).

Cast-in-Place: A term referring to ready-mix concrete which is placed directly into its final position while still in the fluid state.

CBC: Connecticut Building Congress. A Connecticut organization that promotes networking among all participants in the construction industry. These guidelines were prepared under its auspices.

Change Order: A contract amendment authorizing a change in the work, with associated changes, if any, in contract price and/or contract time. (Guideline 3.10)

Claims-Made Policy: A type of professional liability insurance policy which provides indemnity for claims made during the term of the policy. (Guideline 1.7)

Clerestory: A wall section high in a building with glass for admitting light into the interior.

Clerk of the Works: A full-time employee of the owner who monitors construction progress in detail on the job site.

Glossary of Construction Terms & Acronyms

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CMU: Concrete Masonry Units. A term referring to concrete blocks.

Commercial General Liability: A standard type of insurance coverage for owners and contractors. (Guideline 1.7)

Commissioning: A quality assurance process by which the installation and functioning of inter-related mechanical and electrical systems for a building are documented and optimized to meet the design intent of the architect and engineers and the operational needs of the owner. (Guideline 3.9)

Construction Administrator: A person or entity hired by the owner to oversee the design and construction process. (Guideline 1.4)

Construction Management: A system by which a construction manager organizes and oversees the construction for the owner. The roles of design professionals and contractors in this system vary depending upon the particular project delivery method chosen. (Guideline 1.4)

Construction Management Association of America: An organization dedicated exclusively to the interests of professional Construction and Program Management. The organization publishes standards of professional performance and many construction documents.

Critical Bolting/Welding: Vital points of attachment in steel construction.

CPM: Critical Path Method. A scheduling concept using the most important sequence of construction steps. (Guideline 3.3)

Critical Path: The most important sequence of inter-dependent construction steps. (Guideline 3.3)

Curtain Drain: A system of pipes and stone that provides positive drainage of water away from the perimeter of a building's foundation.

Design/Bid/Build: The traditional method of design and construction in which the project is first completely designed and put out to bid, and only after a successful bid has been accepted by the owner and a construction contract has been entered into does the project commence construction.

Design/Build: A form of construction process whereby a single entity is responsible for both design and construction. (Guideline 1.4)

Design Professional: An architect, engineer, landscape architect or land surveyor who undertakes responsibility to design all or part of the project.

Dispute Review Board: One of the ADR (Alternative Dispute Resolution) methods of dispute avoidance or resolution in which a panel of neutral experts hears controversies on the jobsite at their inception, so as to head off major disputes. (Guideline 1.8)

EIFS: Exterior Insulation Finishing System. A system in which rigid insulation board is applied to the exterior of a building and then sprayed with layers of a synthetic material having the appearance of stucco.

EJCDC: Engineers Joint Contract Documents Committee: An organization of engineering societies that promulgates standard construction documents. (Guideline 1.5)

Glossary of Construction Terms & Acronyms

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Energy Star: A voluntary program of the Environmental Protection Agency (EPA) that rates buildings for energy use intensity.

EPDM (Ethylene propylene diene monomer): A common type of single-ply roofing membrane.

Errors & Omissions: A type of insurance coverage for design professionals where the insurance company provides coverage for oversights. (Guideline 1.7)

Extras: Necessary project elements not included in the project documents which give rise to an increase in contract price or contract time. (Guideline 3.10)

Fairness in Financing: A Connecticut statute that establishes requirements and limits on retainage and lien waivers in non-residential construction. (Guideline 3.13)

Fast Track: A type of construction process involving condensing and overlapping project steps and speeding up of scheduled time frames. (Guideline 1.4)

Flange: The outer sections of steel beams and columns.

Flashing: As a verb this term refers to the process of weatherproofing various joints between building components; as a noun it refers to the materials used for the purpose.

Float: A term used to describe a period of flexibility in scheduling of construction steps. (Guideline 3.3) This term also denotes a type of tool used in leveling concrete, with the larger tool with handle extensions referred to as a “bull float”.

Forms, Formwork: Temporary structures that are pre-fabricated and brought to the jobsite and assembled there, or are specially constructed on the jobsite, in both cases to contain ready-mix concrete in a stable position during the hardening process.

General Contractor: A contractor who undertakes overall responsibility to build the project.

Lap: The amount of overlap at the joints of construction materials applied in strips.

GMP: Guaranteed Maximum Price. A method of establishing contract cost. (Guideline 1.4)

Grading: The process of smoothing out or leveling off the surface of the site to its designed level, separated into two steps of rough grading and finish grading. Also, rating the quality of a single type of construction material by a series of different quality grades.

Guaranty: Legal responsibility undertaken by a surety company to complete the work of a defaulting contractor or to pay its subcontractors and suppliers. (Guideline 4.2)

Hardpan: A very hard layer of subsoil composed of earth and flat rock.

HazMat: Hazardous Materials: Always a potential issue in property development and building rehabilitation. (Guidelines 1.10, 3.2)

Hidden Conditions: Unknown conditions underground or buried inside an existing structure which may give rise to extra contract costs or increased contract time. (Guideline 3.10)

HVAC: Heating, Ventilating and Air Conditioning. A term that describes these parts of the work or the contractor that performs them. (Guideline 3.9)

Glossary of Construction Terms & Acronyms

*Aa-As • At-CI • Cm-Ej • En-Hv • **Ib-Nv** • Oc-Re • Rf-Tem • Ten-We*

IBC: International Building Code: This set of codes has governed all aspects of building in Connecticut since 2003. (Guideline 2.4)

Jobsite Neutral: An unbiased construction expert who acts as an intermediary on the jobsite to resolve developing conflicts before they mature into full-fledged disputes. (Guideline 1.8)

Lally Column: A common type of support column consisting of a steel pipe filled with concrete.

Laminated Beams: Structural beams manufactured in a process by which very thin layers of wood are glued together to build a member of many layers with structural properties much greater than an equal total thickness of natural wood.

Life Cycle Costing: A system of calculating the cost of a project over its useful life rather than just its initial construction cost, thereby enabling an owner to evaluate the benefits of project elements such as energy-saving features and durable materials.

Lump Sum: A fixed price for construction work, as opposed to percentage formulas or other more flexible methods based on area, volume, time and/or materials. (Guidelines 1.4, 3.11)

LVL: Laminated veneer lumber. A type of structural member in which very thin strips of wood are glued together side by side to form a complete member having excellent load-bearing characteristics.

MCAC: Mechanical Contractors Association of Connecticut; also Mason Contractors Association of Connecticut.

Means and Methods: The standard term used to refer to the contractor's exclusive area of control and responsibility over the procedures used to accomplish construction of the project.

Mechanic's Lien: A statutory legal process which enables a contractor, subcontractor, materials supplier or design professional to file a lien on the real estate of the owner upon which a project is being constructed in order to secure unpaid amounts due to the person or entity filing the lien. (Guideline 3.12)

Mediation: A non-binding process for dispute resolution in which a neutral construction expert acts as an intermediary to attempt settlement of a matured construction dispute. (Guideline 1.8)

Microlam: A type of laminated structural member. See "LVL".

NFPA: National Fire Protection Association: An organization that publishes a fire safety code that is part of Connecticut's fire safety code. (Guideline 2.4)

Non-Destructive Testing: Method of testing construction elements on the jobsite which does not require reconstruction of completed work. (Guideline 3.8)

NVLAP: National Voluntary Laboratory Accreditation Program: A federal program which establishes standards for accreditation of testing laboratories. (Guideline 3.8)

Glossary of Construction Terms & Acronyms

*Aa-As • At-CI • Cm-Ej • En-Hv • Ib-Nv • **Oc-Re** • Rf-Tem • Ten-We*

Occurrence-Based Policy: A type of insurance policy that indemnifies the insured for errors and omissions which occurred during the term of the policy. See Claims-made Policy. (Guideline 1.7)

Open Web Joists: A common steel framing system using a type of steel truss made by welding steel angles to a steel reinforcing bar bent into a series of s-curves.

OSHA: Occupational Safety and Health Administration. An agency of the federal government which promulgates and enforces rules and regulations designed to advance health and safety on construction projects and completed facilities. (Guideline 2.4)

Partnering: A procedure for insuring a smoothly running project in which the participants commit at the outset to appoint a facilitator, meet regularly, and share information throughout the project. (Guideline 1.8)

Peer Review: A state building code requirement for review of structural design by a third party professional. (Guideline 2.5)

Piles, Piling: Foundation structural elements or systems which are driven into the ground with powerful hammering equipment to enable a structure to be supported over unstable soil or which retain embankments (sheet piling) so that activity can safely take place below.

Plate: A flat steel member.

Plies: Layers of the same construction material used as a sandwich, such as roofing felts or layers of thin wood sheets in plywood.

Pre-cast Concrete: Structural or architectural reinforced concrete building components produced at a plant in accordance with plans and specifications and then shipped to the building site for erection.

Professional Liability Insurance: Equivalent to “errors & omissions” insurance coverage for design professionals. See “Errors and Omissions Insurance” above. (Guideline 1.7)

Program Management: A type of project delivery system. (Guideline 1.4)

Project Delivery: The means by which a construction project is brought to fruition. (Guideline 1.4)

Project Manager: The individual employee of a design professional, contractor or subcontractor in executive charge of the project for his employer.

Punch List: The list of uncompleted items, or items needing correction, at the time of substantial completion, agreed to by the project participants. (Guideline 4.1)

QC/QA: Quality Control and Quality Assurance: The process for assuring that the construction work is performed in accordance with acceptable standards.

QBS: Qualifications-Based Selection: A system for selecting project participants on the basis of expertise, experience and integrity. (Guidelines 1.6, 2.6)

Renovate as New: The building is being renovated so as to be in the condition of a completely new building.

Glossary of Construction Terms & Acronyms

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RFI: Request for Information. A standard document by which contractors ask the design professional for clarification of information in the contract documents prepared by the design professional. (Guideline 3.5)

RFP: Request for Proposal. A formal document by which the owner or design professional requests a proposal from the contractor for a defined portion of the work.

RFQ: Request for Qualifications. A formal document by which the owner or design professional seeks to procure the services of a professional services firm based on a qualifications-based selection process.

Retainage: A percentage of contractor billings held back by the owner until certain later stages of the construction. (Guideline 3.13)

Sheet Piling: Piling systems to retain embankments so that activity can safely take place below.

Seated Connection: A type of connection in steel construction where one member rests on a specially prepared part of another member.

Seismic Code Requirements: This term refers to the earthquake protection requirements now contained in the building code. (Guideline 2.4)

Shear: One of the basic types of structural stress where one force operates in the opposite direction as an adjacent force.

Shop Drawings: Drawings of construction components prepared by the supplier and submitted to the design professional through the contractor responsible for installing the component. (Guideline 3.6)

Sick Building Syndrome: A term that refers to buildings with seriously deficient air quality constituting a threat to public health. (Guideline 3.9)

Special Inspector: An individual designated by the owner who inspects certain construction elements which are required by code. (Guideline 3.8)

Specifications: A comprehensive document in which all elements of the project are described in detail, to be read in connection with the contract drawings. (Guideline 2.1)

STC: Connecticut State Traffic Commission. (Guideline 1.10)

Submittals: Samples of project components submitted to the design professional in the same manner as shop drawings. (Guideline 3.6)

Substantial Completion: A point in time recognized in the construction industry in which the project is complete enough to be occupied, and which triggers the procedures of project closeout. (Guideline 4.1)

Substitutions: Elements of the project differing from those specified which are proposed by the contractor or designated by the design professional. (Guideline 3.7)

Temporary Job Utilities: The utilities on site that the general contractor must put in place in order to construct the project. (Guideline 3.4)

Glossary of Construction Terms & Acronyms

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Tenant Fit-Out: The category of construction steps required by the particular needs of a tenant for its portion of interior space.

Test Boring: The process of drilling deep holes into subsoil to determine its consistency; also the written record showing the results found by the process.

Threshold Buildings: Buildings above a statutory size limit for which a review of plans and specifications by a third-party structural engineer is required. (Guideline 2.5)

Title Block: An area on contract documents in which basic information about the project and the design professional is located. (Guideline 2.1)

Trim: A term which refers to the materials and labor by which finishing touches for various components of the project are put in place.

Turnkey: A type of project delivery in which all the steps from design up to the moment of occupancy are controlled by one entity. (Guideline 1.4)

Truss: A structural unit in a pre-engineered pattern made of wood members connected by steel plates or steel members welded together to form a structural element capable of spanning larger distances.

Unit Prices: Bid prices affixed to units of construction materials and/or labor by means of price per unit. (Guideline 2.9)

Vapor Barrier: A layer of material resistant to passage of water vapor which is used to keep parts of the building envelope from deteriorating as a result of water vapor coming from inside the building.

Vapor Retardation: Systems in the construction designed to inhibit the flow of moisture into the materials comprising the building envelope.

Warranty: A pledge of quality and length of service for construction materials provided by the manufacturer. (Guideline 4.2)

Weep Holes: Small holes deliberately placed in exterior building components to allow water which has penetrated into the wall to drip out.



• Resources •

- American Concrete Institute (ACI) International, 38800 Country Club Drive, PO Box 9094, Farmington Hills, MI 48333, Phone (248) 848-3700, Fax (248) 848-3701, www.aci-int.org
- American Arbitration Association (AAA), One Center Plaza, Suite 300, Boston, MA 02108, (617) 451-6600, www.adr.org
- American Council of Engineering Companies (ACEC), 1015 Fifteenth Street, NW, Washington, DC 20005, Phone (202) 347-7474, Fax (202) 898-0068, www.acec.org
- American Council of Engineering Companies of Connecticut (ACEC) 460 Smith Street, Suite K, Middletown, CT, 06457. Phone (860) 635-5522, Fax (866) 668-9858, www.ctengineers.org
- American Institute of Architects (AIA), 1735 New York Avenue, NW, Washington, DC 20006, Phone: (202) 626-7300, www.aia.org
- American Institute of Architects, Connecticut Chapter (AIA Connecticut), 370 James Street, New Haven, CT 06513, Phone (203)865-2195 Fax (203)562-5378, www.aiact.org
- American Institute of Steel Construction (AISC), One East Wacker Drive, Suite 3100, Chicago, IL 60601- 2001, Phone (312) 670-2400, Fax (312) 670-5403, www.aisc.org
- American Society of Heating, Refrigeration and Air-conditioning Engineers (ASHRAE), 1791 Tullie Circle, N.E., Atlanta, GA 30329-2305, Phone (404) 636-8400, Fax (404) 321-5478, www.ashrae.org
- American Society for Testing and Materials (ASTM), 100 Barr Harbor Drive, West Conshohocken, PA, 19428-2959, Phone (610) 832-9585 Fax (610) 832- 9555, www.astm.org
- American Welding Society, 550 NW LeJeune Road, Miami, FL 33126, Phone (800) 443-9353, Fax (305) 443-7559, www.aws.org
- APA—The Engineered Wood Association (American Plywood Association), P.O. Box 11700, Tacoma, WA 98411-0700, Phone (253) 565-6600, Fax (253) 565- 7265, www.apawood.org
- ARCOM Master Systems (MasterSpec), 332 East 500 South, Salt Lake City, UT 84111-3309, Phone (800) 424-5080 or (801) 521-9162, Fax (801) 521.9163, www.arcomnet.com
- Associated Builders and Contractors (ABC), 1300 N. Seventeenth St., Suite 800, Rosslyn, VA 22209, (703) 812-2000, www.abc.org
- Associated Builders and Contractors of Connecticut (ABC of Connecticut), 1800 Silas Deane Highway Suite 221, Rocky Hill, CT 06067, Phone (860) 529- 5886, Fax (860) 529-6778.

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- Associated General Contractors of America (AGC of America), 333 John Carlyle Street, Suite 200, Alexandria, VA 22314, Phone (703) 548-3118, Fax (703) 548- 3119, www.agc.org
- Associated General Contractors of Connecticut (AGC of CT), 912 Silas Deane Highway, Wethersfield, CT 06109, Phone (860) 529-6855, Fax (860) 563-0616, www.ctconstruction.com
- Building Officials and Code Administrators International (BOCA), 4051 W. Flossmoor Road, Country Club Hills, IL 60477-5795
- Canadian General Standards Board, Technical Information Unit. Ottawa, Canada KIA IG6, Phone (819) 956-0894, Fax (819) 956-1634, www.pwgsc.gc.ca/cgsb
- Central Connecticut State University (CCSU), Dr. Raymond Perrault, 1615 Stanley Street, New Britain, CT 06050 (CCSU offers construction management classes).
- Connecticut Building Congress, Inc. (CBC), P.O. Box 107, Rocky Hill, CT 06067-0107, (860) 228-0163, www.cbc-ct.org
- Connecticut Construction Industries Association (CCIA), 912 Silas Deane Highway, Wethersfield, CT 06109, Phone (860) 529-6855, Fax (860) 563-0616, www.ctconstruction.com
- Connecticut General Statutes, Connecticut General Assembly, Hartford, CT 06016, www.cga.ct.gov
- Connecticut QBS Council, 460 Smith Street, Suite K, Middletown, CT, 06457. Phone (860) 635-5522, Fax (866) 668-9858, www.ctengineers.org
- Construction Management Association of America, 7926 Jones Branch Drive, Suite 800, McLean, VA 22102-3303, www.cmaanet.org
- Construction Specifications Institute (CSI), 601 Madison Avenue, Alexandria, VA 22304, Phone (703) 684-0300, Fax (703) 684-0465, www.csinet.org
- Electric Power Research Institute (EPRI), 3412 Hillview Avenue, Palo Alto, CA 94304, Phone (800) 313-3774 or (650) 855-2000, www.epri.com
- Engineers Joint Contract Documents Committee (EJCDC), available from ACEC above.
- FM (Factory Mutual) Global Corporate Headquarters, PO Box 7500, Johnston, RI 02919, Phone (401) 275- 3000, Fax (401) 275-3029, www.fmglobal.com
- R. S. Means Company, Inc., 100 Construction Plaza, P.O. Box 800, Kingston, MA 023 64-0800, Phone (800) 334-3509, Fax (800) 632-6732, www.rsmeans.com

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- Mechanical Contractors Association of America (MCAA), 1385 Piccard Drive, Rockville, MD 20850, Phone (301) 869-5800, Fax (301)990-9690, www.mcaa.org
- Mechanical Contractors Association of Connecticut, Inc., 10 Broadway, Hamden, CT 06518, Phone (203) 281-0588, Fax (203) 248-3098.
- National Concrete Masonry Association, 2302 Horse Pen Road, P.O. Box 781, Hemdon, VA 22071-3406, Phone (703) 713-1900, Fax (703) 713-1910, www.ncma.org
- National Electrical Contractors Association (NECA), 3 Bethesda Metro Center, Suite 1100, Bethesda, MD 20814, Phone (301) 657-3110, Fax (301) 215-4500, ww.necanet.org
- National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02269, Phone (617) 770-3000, Fax (617) 770-0700, www.nfpa.org
- National Ready Mixed Concrete Association (NRMCA), 900 Spring Street, Silver Spring, MD 20910, Phone (301) 587-1400, Fax (301) 585-4219, www.nrmca.org
- National Roofing Contractors Association (NRCA), 10255 W. Higgins Road Suite 600, Rosemont, IL 60018, Phone (847) 299-9070, Fax (847) 299-1183, www.nrca.net
- North/East Roofing Contractors Association, 1400 Hancock Street, 7th floor, Quincy, MA 02169, Phone (617) 472-5590, Fax (617) 479-1478, www.nerca.org
- Occupational Health and Safety Administration (OSHA), U.S. Department of Labor, Directorate of Construction, Room S 1506, 200 Constitution Ave., N.W, Washington, DC 20210, Phone (202) 693-2020, www.osha.gov
- Portland Cement Association (PCA), 5420 Old Orchard Road, Skokie, Illinois 60077, Phone (847) 966-6200, Fax (847) 966-8389, www.portcement.org
- Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), 4201 Lafayette Center Drive, Chantilly, VA 20151-1209, Phone (703) 803-2980, Fax (703) 803-3732, www.smacna.org
- State of Connecticut Commission on Official Legal Publications (COLP), 111 Phoenix Avenue, Enfield, CT 06082-4453, Phone (860) 741-3027 Fax (860) 745-2178, www.jud.state.ct.us/colp/
- Steel Structures Technology Center, Inc. (SSTC), 42400 W. Nine Mile Road, Novi, MI 48375-4132, Phone (248) 344-2910, Fax (248) 344-2911, www.steelstructures.com
- Structural Engineers Coalition, American Council of Engineering Companies of CT (ACEC/CT), 460 Smith Street, Suite K, Middletown, CT, 06457. Phone (860) 635-5522, Fax (866) 668-9858, www.ct-sec.org
- Truss Plate Institute, 583 D'Onofrio Drive #200, Madison, WI 53719, Phone (608) 833-5900, Fax (608) 833-4360.

