Whose Design is it, Anyway?
The Benefits and Challenges of Delegated Design

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I. **What is Delegated Design and why does it matter?**

Delegated design is the transfer or delegation of design responsibility for an element or component of a project to a party other than the Design Professional of Record (*i.e.* Architect or Engineer of Record). In the authors’ opinion, if a project requires submittals stamped by a design professional, some degree of delegation of design responsibility has occurred. Delegation of design, just as the design of any project, is not a simple process. But for purposes of an example, in its simplest form, the delegation may occur between the Design Professional of Record and a specialty engineer for the design-builder of one component of the project, or the delegation may occur between an engineer and the manufacturer of a component piece of material.

Delegated design allows the component manufacturer or installer to design its component using specialist designers who are experts in the field. Many trades view delegated design as an opportunity for a sales advantage, as it seems logical to allow the specialist with the highest knowledge level to design a given component. Common examples of scopes of work that almost always involve delegated design include: structural steel, architectural and structural precast concrete, proprietary roofing systems, curtain wall systems, retaining wall systems, and some aspects of mechanical systems.

We first consider the elemental question: Why delegate design?

As in the law, design in construction is becoming a highly-specialized field. The generalist design professional is giving way to the focused practitioner who does the deep dive into one area of building or infrastructure or system design.

Construction materials, assembled systems, and methods for fabrication and installation of building systems are pushing for design delegation as well. For example, rather than have the Design Professional of Record try to study up on the newest truss methodology and design, that
scope of work can be delegated to the contractor and its specialty designer for the entire building truss system.

Similarly, the technology and complexity of building materials/systems lends itself toward delegated design – entrusting the complex means and methods to a design and build team.

Next, we consider why delegated design matters to the construction and design process – and to counsel for contractors and design professionals. Because a project involving multiple parties in collaboration is fraught with potential errors in communication and coordination, regardless of the reasons to delegate design, the process must be handled carefully. The Design Professional of Record, as well as the specialty designers, have the responsibility, and exposure to the risk, for protecting the health, safety, and welfare of the public, by ensuring that the delegated portions of design interface well with and meet the design intent of the overall project plans and specifications. Two critical steps to managing that risk are clear communication and coordination. The various levels of design professionals and contractors on a project team must communicate clearly through the contract documents and project documents to clearly outline the details related to design delegation and coordinate tasks and obligations to ensure details do not fall through the cracks.

Problems are more likely to arise when one or more parties take a “tunnel vision” approach or fail to coordinate the delegated design component with the rest of the project. Thus, delegated design is an opportunity for efficient and sound design, provided the parties properly execute the delegation of responsibility. If not, delegated design is a breeding ground for dispute and division.

Delegated design also matters because it may expose an unsuspecting subcontractor to risks it is not prepared to manage. For instance, delegated design may expose the sub to the risk of
professional liability, when the subcontractor is only insured for commercial general liability and its policy has a specific exclusion for professional services and professional negligence.

In the bigger picture, delegated design blurs the lines between designer and builder, which may also blur the lines for responsibility if quality/performance issues or delays arise due to problems with materials or systems that were the subject of delegated design. These issues require thoughtful consideration by the owner and Design Professionals of Record, as well as clear communication about expectations and requirements in the contract documents so that all contracting parties are aware of their obligations as well as their risks.

In recent years, various guidelines have been published regarding delegated design. All share the common theme that delegation should be clear and in writing. This paper will discuss some of these guidelines and regulations that, if followed, should result in successful delegation and reduction in risk.

II. State Regulations.

Some states have adopted regulations and guidelines specific to delegated design duties. Two examples are Florida and New York. There, the design professional to whom the design function has been delegated (the delegatee) shall design the component or system in accordance with the performance specifications. The delegatee should request any needed clarification in writing from the Design Professional of Record through the Contractor/Subcontractor.¹ Florida has regulations governing professional engineers that set forth the framework for delegation of design duties and actual transferring the title “EOR” to the delegated designer within the scope of the delegation.² Given the importance of delegated design on the project outcome, as well as on professional responsibility of the design professionals involved, best practices would include a due
diligence evaluation – before contracting or design begins – of any state rules/laws that may either guide or govern the delegation of design duties on a project.

Like the trade organization guidelines discussed below, the hallmark of a well-written rule is that the delegation should be clear so that all parties understand what party is designing what component.

III. Trade Organization/Industry Guidelines.

Most subcontractors would argue they have no design duties absent express delegation. But they would also be the first to tell you they know their business best and should have input on how systems are designed. Any subcontractor that submits drawings or product data is, arguably, undertaking design or design-related duties.

In general terms, a design duty is delegated to a subcontractor when the contract documents require the subcontractor to engage a licensed design professional to produce drawings or designs for any aspect of its work. Several of the more sophisticated industry groups have defined or addressed delegation of design. The American Council of Engineering Companies (ACEC) has publications issued by its Council of American Structural Engineers (CASE). CASE is the leading industry voice for structural engineer guidelines. CASE developed two publications on delegation and coordination of designs in response to specific requests from the American Institute of Steel Construction (“AISC”).3 Previously, CASE issued a publication borrowing from regulations in Florida regarding specialty engineers.4 Both publications address best or recommended practices. In more recent years, the specialty trades have published consistent and more precise guidelines on the delegation of design responsibility. Leading this effort is the AISC.
AISC publishes the following content in its Code of Standard Practice (2010), which provides a useful framework for defining a specialty designer’s (i.e. delegated designer’s) duties as follows (italics in original):

**1.5 Responsibility for Design**

1.5.1. When the owner’s designated representative for design provides the design, design drawings and specifications, the fabricator and the erector are not responsible for the suitability, adequacy or building-code conformance of the design.

1.5.2. When the owner enters into a direct contract with the fabricator to both design and fabricate an entire, completed steel structure, the fabricator shall be responsible for the suitability, adequacy, conformance with owner-established performance criteria, and building-code conformance of the structural steel design. The owner shall be responsible for the suitability, adequacy and building-code conformance of the non-structural steel elements and shall establish the performance criteria for the structural steel frame.

…

**3.1.2 [Connection Design Responsibility]**

The owner’s designated representative for design shall indicate one of the following options for each connection:

(1) The complete connection design shall be shown in the structural design drawings;

(2) In the structural design drawings or specifications, the connection shall be designated to be selected or completed by an experienced steel detailer; or,

(3) In the structural design drawings or specifications, the connection shall be designated to be designed by a licensed professional engineer working for the fabricator.

In all of the above options,

(a) The requirements of Section 3.1.1 shall apply; and,

(b) The approvals process in Section 4.4 shall be followed.
When option (2) above is specified, the experienced steel detailer shall utilize tables or schematic information provided in the structural design drawings in the selection or completion of the connections. When such information is not provided, tables in the AISC Steel Construction Manual, or other reference information as approved by the owner’s designated representative for design, shall be used.

When option (2) or (3) above is specified, the owner’s designated representative for design shall provide the following information in the structural design drawings and specifications:

(a) Any restrictions on the types of connections that are permitted;

(b) Data concerning the loads, including shears, moments, axial forces and transfer forces, that are to be resisted by the individual members and their connections, sufficient to allow the selection, completion, or design of the connection details while preparing the shop and erection drawings;

(c) Whether the data required in (b) is given at the service-load level or the factored-load level;

(d) Whether LRFD or ASD is to be used in the selection, completion, or design of connection details; and,

(e) What substantiating connection information, if any, is to be provided with the shop and erection drawings to the owner’s designated representative for design.

When option (3) above is specified:

(a) The fabricator shall submit in a timely manner representative samples of the required substantiating connection information to the owner’s designated representatives for design and construction. The owner’s designated representative for design shall confirm in writing in a timely manner that these representative samples are consistent with the requirements in the contract documents, or shall advise what modifications are required to bring the representative samples into compliance with the requirements in the contract documents. This initial submittal and review is in addition to the requirements in Section 4.4.

(b) The licensed professional engineer in responsible charge of the connection design shall review and confirm in writing as part of the substantiating connection information, that the shop and erection
drawings properly incorporate the connection designs. However, this review by the licensed professional engineer in responsible charge of the connection design does not replace the approval process of the shop and erection drawings by the owner’s designated representative for design in Section 4.4.

(c) The fabricator shall provide a means by which the substantiating connection information is referenced to the related connections on the shop and erection drawings for the purpose of review.  

Similarly, the Precast Prestressed Concrete Institute (PCI) provides a three-option matrix for delegation of design duties. Both the PCI and AISC guidelines are standards that are frequently referenced in steel and precast specifications, but are less frequently followed by the engineer of record.

Best practices: The take away from these industry guidelines is that the delegating designer needs to take the following steps:

a. Elect a scope of delegation.

b. Define any restrictions or limitations on the delegated designer.

c. Define the required deliverables (shop drawings, calculations, etc.) due from the delegated designer.

As more fully discussed below, these steps are best communicated through the drawings or specifications or both.

IV. Contract Language.

The recently published AIA A201 – 2017 document addresses delegation of design directly and requires a level of specificity as to design and performance criteria, but is vague when defining the boundaries of the delegation.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the
Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor’s responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional’s written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor’s design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

The AIA A201 2017 revision changed very little of these sections from the 2007 version, and the changes were not significantly substantive in nature.8 The AIA approach is good, but is too open to be effective without some further defining of delegation. This further definition is most sensibly contained in the Plans and Specifications, as discussed below.
Similar to Section 3.12.10 of the AIA A201-2017, which allows the owner and architect to rely on the adequacy, accuracy, and completeness of the contractor’s design services, provided that the owner and architect specified all performance and design criteria for the contractor, the Engineers Joint Contract Documents Committee’s (EJCDC) engineering and construction contract documents track very similar language in the EJCDC C-700 form document, Section 7.19, titled “Delegation of Professional Design Services.” That section states (emphasis added):

A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor’s responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable Laws and Regulations.

B. If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such service or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional’s written approval when submitted to Engineer.

C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.

D. Pursuant to this paragraph, Engineer’s review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer’s review and approval of Shop Drawings and other submittals (except design calculations and
design drawings) will be only for the purpose stated in Paragraph 7.16.D.1.

E. Contractor shall not be responsible for the adequacy of the performance or design criteria specified by Owner or Engineer.

As with the AIA, Section C of EJCDC C-700 expressly recognizing the owner and architect’s right to upon the adequacy, accuracy and completeness of the design professional’s work, provided the owner and engineer specified all the necessary performance and design criteria.

V. Plans and Specifications.

Common notes on structural drawings are often the only words in any contract document directly related to delegated design from the structural engineer of record. For example, the following notes on steel connections:

SHOP DRAWINGS/SUBMITTALS

1. THE STRUCTURAL SHOP DRAWING REVIEW IS INTENDED TO HELP THE ENGINEER VERIFY HIS DESIGN CONCEPT. IT IS THE CONTRACTOR’S RESPONSIBILITY TO CHECK HIS OWN SHOP DRAWINGS. SHOP DRAWINGS SHALL BE REVIEWED BY THE CONTRACTING OFFICER.

2. THE STRUCTURAL SHOP DRAWINGS WILL BE RETURNED FOR RESENDIMENT IF A CURSORY REVIEW SHOWS MAJOR ERRORS WHICH SHOULD HAVE BEEN FOUND BY THE CONTRACTOR’S CHECKING.

3. THE FOLLOWING SHOP DRAWINGS AND CALCULATIONS, WHEN APPLICABLE, ARE REQUIRED FOR SUBMITTAL FOR STRUCTURAL REVIEW IN ADDITION TO THAT REQUIRED PER THE SPECIFICATIONS.
   A) CONCRETE MIX DESIGN
   B) PRE-ENGINEERED STEEL JOIST
   C) REINFORCING STEEL
   D) STRUCTURAL STEEL AND DECK
   E) WELDING PROCEDURE SPECIFICATIONS
   F) MISCELLANEOUS STRUCTURAL STEEL SHOWN ON STRUCTURAL DRAWINGS
   G) EXTERIOR METAL STUDS
   H) CURTAIN WALLS
   I) CONSTRUCTION JOINT LOCATIONS
   J) POST TENSIONING
   K) MAUSERY

4. ANY SUBMITTAL OF A DETAIL SHEET WITH ADDED INFORMATION SHALL BE ACCOMPANIED BY LOCATION PLAN IDENTIFYING THE MEMBERS INVOLVED AND CLOUDING AROUND ADDED INFORMATION.

5. ANY ENGINEERING SUBMITTED FOR REVIEW SHALL BE APPROPRIATELY SEALED. FULL RESPONSIBILITY OF SUCH ENGINEERING RESTS WITH THE PERSON SEALING THE DESIGN.

The contract’s reliance solely on these general common notes in the plans presents problems related to the delegated scope of work, as well as the engineer of record’s scope of work. The lack of specific boundaries and detailed work items is problematic:

- Who sizes the steel members?
• Are the referenced calculations relating only to steel connections or to the entirety of the structure?

• Who is responsible for the calculations on the foundations into which the steel will transfer loads?

• Are there any loading limitations on the cast-in-place concrete footings or foundations? A good set of specifications should be clear about the requirements for the delegated designer as well as the Design Professional of Record.

Included as an appendix to this paper is a specification by a national architecture firm, used with permission. See Appendix A. This sample specification is both detailed and clear about the design delegation. It provides an example of clear communication, which will more likely result in effective delegation that is consistent with the industry guidelines. The sample specification is clear about the delegation of all design responsibility and provides very specific performance requirements. For instance, with regard to shop drawings, it provides 12 specific parameters that the delegated designer must meet. This form of specification would meet the goal of assisting the parties in communicating the delegation of responsibility for design between the professionals involved in the project.

VI. The Roles and Responsibilities Related to Delegated Design.

It is typical for members of the construction team to look to the Design Professional of Record for direction on the inner workings of the delegation of design. And that may be appropriate on some projects, if the Design Professional of Record was involved in that decision, or if owner made that decision from project inception. But that may not always be the case. In fact, the Design Professional of Record may not know much about the delegated design details IF, for example, the general contractor chose to break out a portion of its work on a design-build basis.
and give it to a subcontractor and its specialty designer to perform. Thus, the role and extent of the Design Professional of Record involvement in delegated design depends on when the decision for delegated design occurred. If involved from project inception, the Design Professional of Record has the opportunity to be the key communicator and coordinator of delegated design.

Design professionals have highly regulated roles and practices in the United States. To better understand the concept of design delegation, we must first understand the obligations of the design professional and any limits on their delegation power.

The U.S. has 55 licensing jurisdictions, each of which has a Licensing Board with the legal authority to determine the required qualifications to obtain licensure and practice in that jurisdiction. Each U.S. jurisdiction also has its own statutes and rules governing licensure, practice, and discipline. These statutes and rules impact, for instance, the requirements for initial licensure and continued good standing, when a license is required to practice, whether a design professional must be licensed in order to offer to practice in the state, what types of structures/systems require the involvement of a design professional, the code of professional conduct, and the process for discipline of licensees for violating the statutes and rules.

Many design professionals are licensed to practice in several states, which is a necessity based on client needs, project locations, business growth, etc. With every state having its own set of requirements for practice, multi-state practice is little more than a trap for the unwary. When working with specialty designers, a valid concern is their proper licensure in the jurisdiction of the project. Design professionals must do their due diligence on the requirements of any other jurisdiction before making an overture for work there, not to mention entering into a contract.

Design professionals must adhere to a number of rules, laws, and codes as they perform their professional duties on any given project, and are required by their respective licensing statutes
as well as their codes of ethics to practice within their area of competency and experience.\textsuperscript{13} The paramount ethical concern for design professionals is the protection of the public health, safety, and welfare.\textsuperscript{14} Design professionals are also obligated to perform within their applicable standard of care – which is generally defined as the ordinary and reasonable care usually that a member of the same profession would exercise, on the same type of project, at the same time and in the same place, under similar circumstances and conditions. Although perfection is not the standard, a design professional’s failure to meet the standard of care may constitute professional negligence, which may lead to exposure for professional liability claims.

Any U.S. jurisdiction may require the design professionals to comply with all applicable codes – which could include federal, state, local, and specialty codes. Thus, the design professional must first evaluate whether the applicable codes would allow delegated design in the specific areas anticipated. The International Building Code, for example, allows delegated design and defines “deferred submittals” as “portions of the design that are not submitted at the time of the (permit) application and that are to be submitted to the building official within a specific period.”\textsuperscript{15} Further, each U.S. jurisdiction will have its own requirements for how the design professional must sign, stamp, or seal the drawings before submittal to the local authority to obtain the necessary permits to proceed with construction. That signing/stamping/sealing process generally includes the design professional’s certification that the design meets all applicable codes and statutes.\textsuperscript{16}

The applicable licensing statutes, ethical rules, codes, and standard of care together create the design professional’s professional responsibility, which frames how any design professional – and its counsel – must view delegated design. For instance, even though design professionals may delegate portions of the project design between themselves, they each have an obligation to protect the public health safety and welfare (HSW) as part of their ethical duty, and to meet their own
applicable standard of care. When issues arise on a project, circumstances may require the various designers to parse out responsibility for their respective portions of the design, which often is no easy task.

Given that risk, and given that delegated design involves collaboration among professionals, communication is the critical element to the successful delegation of design and a successful project. Communication about delegated design must be “clear, concise, and non-compromising.” Those communications must also be consistent throughout the contract documents – in the description of the scope of work in the agreement, in the plans, the specifications, the addenda, and the shop drawing review. The key communicators about delegated design are the Design Professionals of Record on a project, *i.e.* those working with the owners on project concept and then developing the plans and specifications for the project.

The need for clear communication of the delegation requirements begs these three critical initial questions, which we will address in the following sections:

1. What is the project delivery method?
2. Who is making the decision to delegate design?
3. When is that decision made vis-à-vis the development of the contract documents?

1. **Impact of Project Delivery on Delegated Design**

   (a) **Traditional Design-Bid-Build Delivery Method**

   Project delivery and delegated design are two separate functions that intersect. In the traditional design-bid-build delivery method, the design process is linear and ordered. The design is complete before the project is let and constructed. The owner and its design team work together to develop a design to meet the owner’s project concept. They move from schematic design, to design development, to construction drawings, with the owner and design team obtaining owner
approval of each step of design along the way. At some point, the owner may discern that a portion of the design would be better delegated to a specialty designer rather than the Design Professional of Record. The design professional may assist in determining what portions of the design might make the best sense for delegation. In that case, the contract between the owner and design professional should clearly articulate the scope of services for the Design Professional of Record, so as to demonstrate their agreement on what portions of the project the Design Professional of Record will design for the owner and which will be delegated to another specialty professional.

The timing for the decision and discussion of the delegation of design is critical. For instance, if the owner made the decision to delegate design prior to the initial retention of the Design Professional of Record, then that professional will be tasked with drafting the plans and specifications to accommodate the details about the delegation. The burden of effective and clear communication about the delegation will fall on that designer’s shoulders. The contracts, plans, and project manual will work together to communicate the requirements for the bidding contractors. In that context, the prudent subcontractor with a scope that includes delegated design will study the contract documents for instructions on (a) how its portion of the project will be delegated, and (b) how the specialty designer and the Design Professional of Record will work together to ensure the design meets the project criteria and design intent.

If, however, the decision to delegate design comes from the general contractor after the contract has been let, then the party making the decision about the delegation of design may not have enough facts to be able to evaluate the full impact of that decision – or the complexity of the necessary coordination of the design among the design professionals. In this scenario, the party proposing delegated design may be driven by cost and efficiency. Unfortunately, in a design-bid-build delivery method, if the delegation was not anticipated from the outset, neither the Design
Professional of Record nor the spec writers nor the plan drafters may have included standard language in the specs or the plans to address design delegation. As a result, the project is at risk that neither the specifications nor the plans contain the necessary communication to address delegation, which may lead to confusion, coordination problems, and errors.

\textit{(b) Design Build Delivery Method}

By contrast, in a design-build delivery method, the parties are likely already in a collaborative mindset from the initial conception of the project. The combined design and construction team invites delegated design. The main risk here, however, is that parties may proceed too informally with the collaboration and not define their respective responsibilities with coordinating the delegated design into the main design. It is important to remember that a design-build project will still have the same concerns, addressed above, for clear communication about process, boundaries, and details for the delegation.

2. \textit{Who makes the decision to delegate design?}

The following parties may decide on delegated design of a portion of the project:

- The owner, as it is planning out its project, or down the road, in response to a technical challenge that would appear best handled by a specialty sub with its own designer;

- The Design Professional of Record, as it is working with the owner in the programming phase, and identifies an area that warrants delegation; or

- The general contractor or design-builder who elects to take a portion of its scope of work, convert it to design-build, and delegate it to a sub and its specialty designer.

3. \textit{When is the decision to delegate made a propos of the contract documents?}
This decision-making question is critical, regardless of the project delivery method or who made the decision to delegate a portion of the design. If the decision to delegate design is made after the design team has developed the contract documents, the project is very likely to encounter issues with coordination/gaps in design. This is not to say that delegation post-contract documents is impossible; rather, it will present exponentially more challenges for both the Design Professional of Record and the delegated designer, and those challenges may impact the prosecution of work on the site, as well as the project schedule. Site disruption and delays ensure three things: additional project time, additional project cost, and litigation. Consequently, this panel of authors makes the following observation:

Given that a process as elemental to construction as shop drawing review constitutes delegated design, and given that projects are simultaneously becoming more complex and abbreviated, the panel recommends the development of an industry standard whereby every contract would provide specifications and special notes on the plans for delegated design. The specifications should contain a specific and detailed protocol for delegated design, in the event it were to occur, with the requirement that the protocol be further developed and memorialized as an A/E Supplemental Instruction to the contract if delegated design is, in fact, employed.

**VII. Risks Associated with Delegated Design.**

One of the initial, if not the first question that owners, design professionals, contractors, and their counsel should consider before delegating and/or accepting design responsibilities on a project are the potential pitfalls and risks associated with such a decision. Understanding who will be responsible for preparing and approving shop drawings, how shop drawings relate to the overall delivery of the design, and what design responsibility is allocated to those preparing shop drawings
are necessary questions that need to be scrutinized prior to becoming involved in a delegated or shared design project delivery system.

Having an understanding of the answers to these questions prior to execution of the contract or subcontract will also likely go a long way towards a fabricator, contractor, or subcontractor avoiding exposure beyond the construction of its scope of work. Additionally, the manner in which risk is allocated between the owner and design-builder will impact allocation of risk between the design-builder and the design professional subcontractor. As a general proposition, if risk is unfairly or inappropriately allocated in the prime agreement between the owner and the design-builder, it is probable that the design professional will – by virtue of “flow down” or incorporation by reference provisions – be subjected to a similarly unfair or inappropriate risk allocation burden. When that occurs, there is a significantly increased probability of professional liability exposure for the design professional, whoever that may be.18

It is incumbent on parties and counsel drafting agreements to provide clarity and focus to the contract documents and clearly delineate the nature of the project specifications. Of particular import is the distinction between performance and design/technical specifications. Performance specs define the requirements a particular product, material, or piece of equipment must fulfill, whereas design or technical specs identify the characteristics that a system must have to function. An example of a performance spec would be the requirement that a wastewater system have the capacity to move X thousand gallons per minute through a pumping station. By contrast, a design/technical spec for the same system would outline the type, size, strength, operating characteristics, and rating of the equipment needed.

Indeed, two of the leading scholars on delegated design have concluded that “[t]he proper delegation of design services from the structural engineer of record to specialty design
professionals or contractors requires an express statement of the intent of the parties to delegate these components. The delegation of design components must be done through the contractual language, specifications, and in compliance with local regulations.\textsuperscript{19}

This section analyzes liability from the preparation and review of shop drawings and submittals in the typical delegated design process system, discusses and illustrates how industry form documents have reacted to the wave of delegated design projects, and touches on the growth of Building Information Modeling (BIM) and legal issues to consider associated with BIM.

A. \textit{Shop Drawings and Contractor’s Liability}

Shop Drawings are one of the most basic forms of delegated design. As the industry has evolved, shop drawings have come to serve as a fundamental instrument of nearly all construction projects because design professionals simply cannot design every component and detail of a project to that level of required detail. Although shop drawings can have various purposes and levels of detail depending on the project, they are generally prepared in the chain of command of contractors, subcontractors and suppliers and are used to illustrate how a contractor intends to implement an architect’s design. On large projects, it is typical that the number of shop drawings will outnumber the contract drawings prepared by the principal Designer of Record. While the adoption of the shop drawing process created tension in the industry as to who should bear responsibility for reviewing and approving shop drawings, the construction community has worked to develop defined procedures laying out the respective roles on the construction participants in the shop drawing process.

The AIA Standard Form of Agreement Between Owner and Architect (2017 ed.) defines “Shop Drawings” to include:
drawings, diagrams, schedules, and other data specifically prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.\textsuperscript{20}

While the AIA provides separate definitions for “Product Data” and “Samples”, both terms have been interpreted to be subsumed within the definition of “Shop Drawings.”\textsuperscript{21} Notably, the AIA is clear that Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Rather, their purpose is to “demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals.”\textsuperscript{22}

Under the traditional design-bid-build project (design is not delegated), the AIA places the primary responsibility of reviewing shop drawings on the contractor, not the architect.\textsuperscript{23} In fact, the contractor’s approval and submittal of Shop Drawings acts as an affirmative representation to the Owner and Architect that the Shop Drawings conform to the requirements of the Contract Documents.\textsuperscript{24} These provisions are consistent with the Federal Acquisition Regulations\textsuperscript{25} and the ConsensusDOCS Standard Form of Agreement Between Contractor and Subcontractor.\textsuperscript{26} In the delegated design context, however, where design input should intersect at the shop drawing process between the different design professionals and trade contractors, it is not surprising that liability is not always as clear due to the shared nature of the shop drawing process.\textsuperscript{27}

\textbf{B. Delegated Design Provisions in Form Agreements}

With the increasingly complex nature of construction projects, design professionals retained by an owner are increasingly becoming more collaborative with other specialty trade contractors with more experience and with greater knowledge of the components to be provided on large construction projects. The complex nature of the projects consisting of various sub-components and variables has made it less feasible than ever for one builder to assume general
responsibility for the entire project. Moreover, by delegating the work to other trade contractors, design professionals of record are given greater flexibility to focus on the project as a whole. However, with the greater level of involvement by non-traditional design professionals in the shop drawing process comes increased exposure to liability for a faulty design or delays on the project.

1. AIA

Both the 2007 and 2017 editions of the AIA General Conditions for the Construction Contract form, consistent with industry practice, explicitly recognize and approved the practice of design delegation. Section 3.12.10 of the AIA A201-2007 and 2017 forms require the owner and architect to “specify all performance and design criteria” that the contractor must specify, with the intent being to require the owner and architect to be more explicit and detailed in the specification process. As a result, where the owner and architect have specified such criteria, the owner and architect are entitled to rely on the adequacy, accuracy, and completeness of the contractor’s design services. In that instance, the architect is given specific protection and the architect takes on the role of review and approving the contractor submittals only for the limited purpose of checking their conformity to the information given and the “design concept” expressed in the contract documents.

Importantly, under the revised Section 3.12.10 of the AIA A201-2017 form, the Contractor is now entitled “to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents.” However, in the A201-2017 form edition the AIA struck language from Section 3.12.10.1 that previously held the “the Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.” Therefore, while the 2017 addition appears to reduce the Contractor’s liability for issues with criteria specified by the Owner and/or Architect, the deletion suggests the Contractor now is
responsible for ensuring the criterion specified by others is accurate and that the Contractor may have a role in design criteria of the contract documents. These changes to Section 3.12.10.1 suggest the AIA attempted to strike a balance between the Owner/Architect and the Contractor.

Accordingly, while AIA contractual language treats the Design Professional of Record as a reviewer as opposed to the Design Professional of Record, the designer of record is likely required to provide some or all of the following services in the design delegation context:

(i) Developing and specifying the conceptual basis of the delegated design (e.g., design criteria or performance standards);

(ii) Defining the qualifications of the specialty designer;

(iii) Reviewing (and, in some instances, approving) the design development submissions of the specialty designer;

(iv) Coordinating the delegated design with the overall project design;

(v) Reviewing shop drawings or other construction contractor submittals regarding the delegated design; and

(vi) Observing construction, reviewing and certifying payment applications, and making recommendations regarding acceptance of completed construction work relating to the delegated design.28

The delegation framework set out in the AIA General Conditions document (as well as the other standard contracting forms) gives rise to a number of important issues they remain uncertain, even after the changes between the 2007 and 2017 AIA General Conditions documents:

- To what extent does the architect remain responsible for the delegated design?
- To what extent, if at all, must the architect specify and verify the qualifications and experience of the party performing the delegated design?
• What is the scope of the architect's review of the delegated design submittals? In other words, what does it mean to say that the architect's review is “for the limited purpose of checking for conformance with the information given and the design concept expressed in the Contract Documents”?
• Who is responsible for the coordination and compatibility of the non-delegated design with the delegated design?
• Should both the architect and the party responsible for the delegated design review the contractor's shop drawings regarding the delegated design? Again, for what purpose is this review undertaken?
• Are there limitations on what is delegable due to either professional registration criteria or licensure requirements?29

Importantly, the Design Professional of Record should also require certification from this second design professional to establish that the work designed by this other professional complies with the design intent of his project documents.30 Additionally, certifications related to codes and standards, structural capabilities, etc., should also be considered.31

2. **EJCDC**

Just as in AIA Document A201, the EJCDC C-700 form (quoted, *supra*) provides that the contractor taking on the design must have such service or certifications to be provided by a properly licensed professional,32 and for all Shop Drawings and other submittals related to the Work designed or certified by such professional to bear such professional’s written approval. Under this section, the Design Professional of Record is likely required to provide some or all of the following services that the architect would be required to provide, as referenced above in the
context of Section 3.12.10 of the AIA document, again with the limited purpose of checking for conformance with the design concept and criteria.

3. **ConsensusDocs**

Finally, and consistent with the AIA and the EJCDC form documents, the ConsensusDOCS Standard Form of Agreement between Contractor and Subcontractor contains several similar requirements as the AIA General Conditions, as set forth in Article 3.8 entitled “Design Delegation”:

If the Subcontract Documents (1) specifically require the Subcontractor to procure design services and (2) specify all design and performance criteria, the Subcontractor shall provide those design services necessary to satisfactorily complete the Subcontract Work. Design Services provided by the Subcontractor shall be procured from licensed design professionals retained by the Subcontractor as permitted by law of the place where the Project is located (the Designer). The Designer’s signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals related to the Subcontract Work designed or certified by the Designer, if prepared by others, shall bear the Subcontractor’s and the Designer’s written approvals when submitted to the Contractor. The Contractor shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by the Designer.

Notably, the ConsensusDOCS expressly deals with the increased design responsibility of a subcontractor, requiring it to use licensed design professionals with the designer’s signature seal appearing on the applicable design documents. However, Section 3.8 of the ConsensusDOCS does not discuss holding the subcontractor responsible for the adequacy of the performance or design criteria required by the subcontract documents. And in fact, Section 3.8.2 of the ConsensusDOCS goes even further than the AIA General Conditions in prohibiting the subcontractor from agreeing to any limitation of liability with the design professional it uses except to the extent consequential damages are waived pursuant to the contractor-subcontractor agreement.33
C. **Improvements Needed for Form Agreements**

The use of performance specifications by design professionals to transfer design responsibility to the construction team is not a new development. The consensus in the industry appears to be that form contracts need to do a better job of addressing shop drawings in a true delegated design project delivery system. Although shared input is recognized in the shop drawing process, scholars have criticized the AIA form contracts for still adhering to the structure whereby the subcontractor provides the contractor shop drawings and submittals to review and approve prior to submitting to the architect, with what “probably amounts to a warranty that they accurately reflect what is required by the contract documents; while the architect reviews them merely for the limited purpose of noting compliance with general design concepts.”

As one commentator characterized the state of the law discussing design delegation:

> Although specialty design-build practices have yet to produce many reported decisions, these cases show that any shared design process may blur conventional liability boundaries. Even in the relatively rare instance in which the circumstances or the contracts clearly delineate the distinct responsibilities relating to the specialty work, it may be difficult to categorize each step in the process as exclusively within one scope or the other. Often, the project A/E, the prime contractor, and the specialty designer (and perhaps others) will have overlapping responsibility for interdependent aspects of the process by which the specialty design is developed, approved, coordinated and integrated into the project. All of these factors will tend to distribute to several participants some risk of liability associated with specialty design.

D. **Identifying Deviations in Shop Drawings**

The industry standard requires contractors to identify specifically any deviations in shop drawings and submittals from the Contract Documents. The majority of courts have held that where a contract contains a provision that places responsibility for finding errors or calling out discrepancies in shop drawings from the contract requirements on the contractor, a contractor’s
claims for damages arising from approval of non-compliant shop drawings are barred, notwithstanding approval of those drawings or submittals.\textsuperscript{37} For example Section 3.12.8 of the AIA General Conditions of the Contract for Construction (2017 ed.) provides similar language to that effect:

Work shall be in accordance with the approved submittals except that the Contractor shall not be relived of responsibility for deviations from the requirements of the Contract Documents by the Architect’s approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation.

Similarly, the ConsensusDOCS and Federal Acquisition Regulations require the contractor to expressly identify in writing all changes, deviations or substitutions from the requirements of the contract documents. For example, the FAR provides that:

(f) If shop drawings show variations from the contract requirements, the Contractor shall describe such variations in writing, separate from the drawings at the time of submissions. If the Contracting Office approves any such variation, the Contracting Officer shall issue an appropriate contract modification, except that, if the variation is minor or does not involve a change in price or in time of performance, a modification need not be issued.\textsuperscript{38}

Accordingly, if a design delegation contract sets forth requirements for identifying discrepancies in shop drawings, a contractor’s claims for damages arising from approval of non-compliant shop drawings will likely be barred.\textsuperscript{39} For example in \textit{McDevitt Mech. Contractors, Inc. v. United States}, 21 Cl. Ct. 616, 619 (Ct. Cl. 1990), the contract provided that the contractor was to “layout the work, establish grades and elevations, and be responsible for dimension and elevation” and that approval of the shop drawings “shall not relieve the Contractor from responsibility for any errors or omissions in [shop] drawings, nor from responsibility for
complying with the requirements of this contract."\textsuperscript{40} The contractor claimed that because the owner approved its shop drawings, the owner was responsible for damages caused in its installation by defects in its shop drawings.\textsuperscript{41} The court found that the contract unambiguously provided that the contractor was responsible for any errors in the shop drawings, and in light of this provision, the government had disclaimed responsibility for verifying the installed dimensions.\textsuperscript{42}

E. \textit{Statutory Violations}

Finally, it is important to consider that the delegation by one design professional to another of a certain aspect of a project generally will not relieve the delegating individual from liability pursuant to a statutory or code violation. For example, in \textit{Johnson v. Salem Title Co.}, 425 P.2d 519 (Or. 1967), a pedestrian injured by a collapsed masonry wall sued the architect, who had assumed overall responsibility for the design but had retained a structural engineer to perform the design at issue. The court held that the architect had a non-delegable duty to meet applicable building code design provisions, including structural engineering requirements. Because the wall was constructed in violation of the building code, the architect was vicariously liable for the engineer's negligent design. The court also held that the architect was not relieved of liability because the city building inspectors had approved the design.\textsuperscript{43}

F. \textit{Building Information Modeling (BIM)}

Building Information Modeling (BIM) involves the use of modeling, often through computer representations, to present objects and attributes in conjunction. BIM typically uses three-dimensional, real-time, dynamic building modeling software to increase productivity in building design and construction. From a design perspective, AIA defines BIM as the digital representation of the physical and functional characteristics of a project, and that BIM refers to the process and technologies used to create a Building Information Model.\textsuperscript{44} However, there are
various other definitions of BIM used in the industry such as the Associated General Contractors of America’s more narrow definition as “the development and use of a computer software model to simulate the construction and operation of a facility” and the more descriptive National Institute of Building Sciences’ definition that “Building Information Model or BIM utilizes cutting edge digital technology to establish a computable representation of all the physical and functional characteristics of a facility and its related project/life-cycle information, and it is intended to be a repository of information for the facility owner/operator to use and maintain throughout the life-cycle of a facility.”

Despite the advantages of BIM and growth in the construction industry, there are numerous legal issues associated with it such as ownership of the BIM model and data, professional design responsibility, standard of care, Spearin doctrine, and confidentiality concerns. For example:

- Will an owner believe they are entitled to own the model?
- How can it be ensured that licensed design professionals will always be in charge of the creation and changes of the data that forms a digital model?
- Will different parties have the ability to change the design created by another party?
- Who should hold liability if the building fails to comply with the recent or latest construction codes?
- As a result of the collaborative nature of the BIM process during the design phase, will the contractor be deprived from the protection of design errors provided by the Spearin doctrine?
- Will confidentiality rights be compromised as a result of inadvertent sharing of proprietary information and trade secrets?
Given the lack of case decisions addressing these questions and applying BIM contract language, however, it remains unclear exactly how courts will answers these questions going forward.

CONCLUSION

The challenge in design and construction in modern times is to keep up with progress without being trampled by it. Delegated design is one method, one tool, for the design and construction team to use to maximize specialized knowledge for the benefit of the project. But it is also a tool that is very complicated and therefore very dangerous. The key safety guard to that risk is communication through the contract documents to the design and construction team – clear, concise, timely, and thorough communication of the details, requirements, methods for coordination/integration of the delegated design with the main project design. Every prudent owner, design professional, and contractor/subcontractor needs to understand the nature of delegated design – what it is; what the roles and responsibilities of the delegated designer, the contractor who hired them, and the designer of record; and what risks are associated with it. Only then can they adequately manage their risk and maximize the benefit of delegated design.


3 See CASE 962-D – A Guideline Addressing Coordination and Completeness of Structural Construction Documents.

4 See CASE 962-B -National Practice Guidelines for Specialty Structural Engineers.


7 See CASE Guidelines Committee, Delegated Design: It is all about Communication, Structure (Sept. 2013).
The 2017 version breaks the 2007 paragraph 3.10 into three sections, the last of which is new and requires a certification from the delegated designer if required by the Contract Documents.

U.S. licensing jurisdictions include all 50 states, Wash. D.C., Guam, Marian Islands, Puerto Rico, and Virgin Islands.


See id.

See id.


See, e.g., id. at p. 12, Model Rule 240.15 (“Licensees shall be cognizant that their first and foremost responsibility is to safeguard the health, safety, and welfare of the public when performing services for clients and employers.”)

IBC § 107.3.4.2 (2015).


CASE Guidelines Committee, Delegated Design: It is All about Communication, Structure (Sept. 2013).


AIA General Conditions of the Contract for Construction § 3.12.1 (2017 ed.).

“Product Data is defined as “illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.” AIA A201 General Conditions of the Contract for Construction § 3.12.2 (2017 ed.). “Samples” is defined by AIA as “physical examples that illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.” AIA A201 General Conditions of the Contract for Construction § 3.12.3 (2017 ed.).

AIA A201 General Conditions of the Contract for Construction § 3.12.4 (2017 ed.).
“[T]he Contractor shall not be relieved from responsibility for errors or omissions in the Shop Drawings, Product Data, Samples, or similar submittals, by the Architect’s approval thereof.” AIA A201 General Conditions of the Contract for Construction § 3.12.8 (2017 ed.).

“By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so and (3) checked and coordinated the information contained within such submittals with the requirements of the Work of the Contract Documents.” AIA A201 General Conditions of the Contract for Construction § 3.12.6 (2017 ed.).

“If this contract requires shop drawings, the Contractor shall coordinate all such drawings, and review them for accuracy, completeness, and compliance with contract requirements and shall indicate its approval thereon as evidence of such coordination and review.” 48 C.F.R. § 52.236-21(e) (2007).

Contractor shall “submit to the Owner, and if directed, to its Architect/Engineer, for review and approval of all shop drawings, samples, product data and similar submittals required by the Contract Documents.” ConsensusDOCS Standard Form of Agreement Between Contractor and Subcontractor, § 3.14.1. This form agreement also states that “Contractor shall be responsible to the Owner for the accuracy and conformity of its submittal to the Contract Documents. Id.

Examples where the constructor was found liable for delegated design damages include: Waggoner v. W&W Steel Co., 657 P.2d 147, 151 (Okl. 1982) (Because the contractor, not the architect, was required under the contract to supervise the job and employ all reasonable safety precautions, the architects cannot be held liable for injuries sustained as a result of an unsafe construction procedure); D.C. McClain, Inc. v. Arlington County, 452 S.E.2d 659 (Va. 1995) (county's approval of shop drawings did not relieve contractor of errors that existed in shop drawings as the contract documents clearly stated that general contractor remained responsible for any errors that might exist in those drawings); Appeal of Mercury Const. Corp., 80-2 B.C.A. (CCH) 14668, 1980 WL 2708 (Armed Serv. B.C.A. 1980) (finding the contractor could and should have concluded that the fiberglass ducts as originally installed did not conform to the specifications, and contractor did not construe them reasonably in asserting that they did); Johnson v. Salem Title Co., 425 P.2d 519 (Or. 1967) (although engineer employed by architect actually did negligent work which did not comport with building code and which caused wall to collapse in windstorm, architect was liable to pedestrian who was injured by wall as due to meet minimum safety standards of the building code are non-delegable). Examples where the DPR was found liable for delegated design damages: Toombs & Co., Inc. v. U.S., 4 Cl. Ct. 535, 31 Cont. Cas. Fed. (CCH) 72149 (1984) aff’d, 770 F.2d 183 (Fed. Cir. 1985) (contractor entitled to equitable adjustment for additional time and costs incurred as approved shop drawings held to incorporate shop drawing details into owner’s implied warranty of design adequacy); Henningson Durham & Richardson v. Swift Bros. Constr. Co., 739 F.2d 1341 (8th Cir. 1984) (architect's claim for contractual indemnity from general contractor was barred by contract provision that contractor's obligations did not extend to architect's liability arising out of approval of drawings and by South Dakota statute).


As noted above, Section 3.12.10.2 of the AIA A201-2017 form was recently added by the AIA requiring that “[i]f the Contract Documents require the Contractor’s design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.”


“Under the design professional licensing statutes in most states, which are enacted for the safety and protection of the public, contract documents on large projects (usually anything more than simple single story construction) are required by law to be prepared by or under the direct supervision of design professionals licensed in that jurisdiction, who, as designers "of record," must certify their responsibility by physically signing and placing their professional seal upon the documents.” Bruner and O’Connor on Construction Law, *Risk Management: Identifying, Allocating and Mitigating Construction Risks* § 7.137.

See, e.g., Dennis J. Powers, *Shared Design* (Ch. 8), *Traditional Shop Drawing Liability and Liability That Arises From Shared or Delegated Design* (2011).


Dennis J. Powers, *Traditional Shop Drawing Liability and Liability That Arises From Shared or Delegated Design* (Ch. 8, Shared Design).


See fn. 39, infra.


See, e.g., *Acmat Corp. v. Rhode*, 132 F.3d 51 (Fed. Cir. 1997) (customer approval of asbestos plan did not relieve contractor of responsibility to perform work in accordance with OSHA requirements referenced in contract, as deviations from OSHA requirements were not clearly indicated on submittal); *B-W Construction Co. v. United States*, 104 Ct. Cl. 608 (Ct. Cl. 1945).
(contractor not able to recover for work performed under approved, but defective shop drawings); 
*U.S. for Use & Ben. of A. Hollow Metal Warehouse, Inc. v. U.S. Fid. & Guar. Co.*, 700 F. Supp. 410, 412 (N.D. Ill. 1988) (upon discovery of deviations from specifications, rejection of products justified where Navy’s previous acceptance was of submittals that did not disclose the extent to which the submittals deviated from specifications); see also *In Re Duran Const. Co.*, 00-1 B.C.A. ¶ 30758 (Jan. 13, 2000) (“By not providing notice of the deviation, the contractor acted contrary to the terms of the contract . . . such that the Government’s approval of the plans does not relieve the contractor from complying with the contract.”). However, an exception to the contractor's responsibility for variations is where the contractor has in writing called the professional's attention to such variation and has received the professional's written approval of the variation or deviation.

40 *McDevitt*, 21 Cl. Ct. at 620.

41 *Id.*

42 *Id.*

43 *Id.*


47 For a more thorough discussion of these questions see Lonny Simonian, *Legal Considerations Associated with Building Information Modeling*, [http://www.caed.calpoly.edu/content/pdci/research-projects/simonian-10](http://www.caed.calpoly.edu/content/pdci/research-projects/simonian-10).
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APPENDIX

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide precast architectural concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated:

1. Dead Loads: Panel dead loads plus dead loads superimposed on the panels.

2. Wind Loads: The precast architectural concrete units shall be designed, fabricated, and installed to withstand the maximum inward and outward wind pressures required by the ICC International Building Code, 2009 Edition.
   a. Basic Wind Speed: 90 mph (3-Second Gust).
   b. Importance Factor: 1.15.
c. Exposure Category: Exposure B.

   a. Spectral Accelerations for Short Periods ($S_s$): 13.4% g.
   b. Spectral Accelerations for a 1-Second Period ($S_1$): 5.2% g.
   c. Importance Factor: 1.25.
   d. Site Class Soil Profile: C.
   e. Seismic Design Category: A.
   f. Provide miscellaneous steel framing not shown on drawings which is required to satisfy seismic criteria.

4. Thermal Movement: Design, fabricate, and install precast assemblies to withstand expansion and contraction forces resulting from material surface temperature range of -50°F to +150°F, minus unit casting/curing temperature.
   a. Dimensions shown on Drawings are based on an assumed design temperature of 70°F. Fabrication and erection procedures shall take into account the material surface temperature range at the time of panel erection.

5. Concrete Tension Stresses: The concrete tension stresses at working design loads shall not exceed the following:
   a. At exterior face of element: 4.5 times the square root of $f_{c}$.
   b. At interior face of element: 7.5 times the square root of $f_{c}$.

6. Deflections: Base the calculations for deflections upon all loads superimposed on the panels, including walls and other adjacent materials if applicable, building structural frame movements, erection tolerances, thermal stresses, and the following.
   a. Design, fabricate, and install assemblies, including anchorage, for deflections not to exceed 1/1000 times span parallel to wall at full design loading. Span is defined as the distance between anchor centerlines; for cantilevers, span is defined as the distance between anchor centerline and the end of the cantilever.
   b. Design, fabricate, and install assemblies, including anchorage, for deflections not to exceed 1/500 times span perpendicular to the wall at full design loading. Span is defined as the distance between anchor centerlines; for cantilevers, span is defined as the distance between anchor centerline and the end of the cantilever.
7. Building Movement: Design, fabricate, and install precast architectural concrete panels to withstand building movements including thermal movements, loading deflections, shrinkage, creep and similar movements. Thermal movements shall be as specified herein. Building frame deflections, shrinkage, creep and other movements are available from the structural engineer.

8. Safety Factor for Inserts and Embedments: The minimum factor of safety for any inserts or embeddings cast into the precast architectural concrete panels shall be 2.5.

9. Leakage of Air and Water: Design, fabricate, and install all precast architectural work, including joints between precast and metals, to effectively prevent leakage of either water or air into the building, under any combination of the foregoing performance requirements when any type or amount of precipitation occurs. Leakage of water is defined as the appearance of uncontrolled water, through any portion of the precast assembly including all sealed joints to the interior plane of precast work. Leakage of air is defined as air infiltration at a rate exceeding 0.06 cfm per square foot per panel assembly per bay of precast assemblies including piece to piece and assembly to assembly joints when tested in accordance with ASTM E283 at a static air pressure difference of 6.25 psf.

10. Exterior Maintenance Loads: The precast architectural concrete units shall be designed, fabricated, and installed to withstand the loads caused by exterior maintenance equipment.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixes: For each concrete mix as required under Article “Concrete Testing”.

C. Shop Drawings: Detail fabrication and installation of precast architectural concrete units. Indicate member locations, plans, elevations, dimensions, shapes, cross sections, limits of each finish, and types of reinforcement, including special reinforcement.

1. Indicate separate face and backup mix locations and thicknesses.

2. Indicate locations and extent and treatment of dry joints if two-stage casting is proposed.

3. Indicate welded connections by AWS standard symbols. Detail loose and cast-in hardware, inserts, connections, and joints, including accessories.

4. Indicate locations, details, and dimensional tolerances of anchorage devices to be embedded in or attached to structure or other construction.

5. Reinforcement, joint and connection details. Indicate method of field adjustment for all proposed connections.


7. Other items cast into panels.
8. Handling procedures, plans and elevations showing panel location and sequence of erection.

9. Relationship of precast architectural concrete units to adjacent materials.

10. Show location of unit by same identification mark placed on panel.

11. Loads: Show the location, type, magnitude and direction of all loads from the precast architectural concrete units to the building structural frame. The shop drawings shall show each unit and each location.

12. Indicate location and anchorage of intermittent stabilization anchors.

D. Samples: Match the Architect’s samples. Submit samples prior to fabrication of precast and construction of mock-up, using same design mix as proposed for the finished work. Sample acceptance will be for color, appearance and configuration of aggregate, aggregate distribution and depth of exposure only. Compliance with other requirements is the responsibility of the Contractor.

1. Sample Size: Submit a minimum of one set of three 12 by 12 by 1 inch thick samples, each finish required.

E. LEED Submittals:

1. Credit MR 4.1 and Credit MR 4.2: Product Data indicating percentages by weight of postconsumer and preconsumer recycled content for precast architectural concrete and reinforcing materials.
   a. Include statement indicating costs for each product having recycled content.

2. Credit MR 5.1 and Credit 5.2: Product Data indicating percentages by weight of precast architectural concrete materials that have been extracted and manufactured within 500 miles of the project site.
   a. Include statement indicating costs for each material extracted and manufactured within 500 miles of the project site.

F. Welding Certificates: Copies of certificates for welding procedures and personnel.

G. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

H. Material Test Reports: From a qualified testing agency indicating and interpreting test results of all testing and inspection reports required within this specification section.

I. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
1. Concrete materials.

2. Reinforcing materials.

3. Admixtures.

4. Shims.

5. Water-absorption test reports.

J. Design Calculations: Submit prior to casting operations, for review and comment only, structural design calculations for the fabrication, reinforcement and erection of all precast architectural concrete work. All shop drawings and supporting calculations prepared and submitted herein shall bear the seal and signature of a licensed Professional Engineer registered in the State of West Virginia who is experienced in the design of precast concrete panel products.

K. Design Modifications:

1. Submit design modifications necessary to meet the performance requirements and field coordination.

2. Variations in details or materials shall not adversely affect the appearance, durability or strength of units.

3. Maintain the general design concept without altering size of members, profiles and alignment.

L. Submit cutting lists, order sheets, material bills, shipping bills and mill test reports.