The architect’s changing role in the design of buildings in the U.S.A

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Abstract

The increasing complexity of building systems has challenged the traditional design roles and responsibilities in the construction industry. Rapid improvements in building technology and materials have surpassed the technical abilities of many architectural and engineering firms resulting in an increased design fragmentation and specialization. To overcome this knowledge gap, architects and engineers have traditionally relied on the expertise of contractors and manufactures. However, this reliance was considered only for the means and method of construction. Evidence indicates that this dependence is not limited only to the means and methods but there is an increasing number of building performance engineering tasks that are being designed by entities associated with construction. This design input, generated through shop drawings and mockups, has not been timely recognized as a design activity by the American Institute of Architects (AIA). The position of AIA is discussed by analyzing the content of its standard form of contractual agreements for design and construction services namely B101 and A201 for the last seventy years. Contrary to what is suggested in these documents, the industry practice shows that the design is not a finite activity but a continuum throughout the construction process. The increasing use of design delegation to parties traditionally not involved in the architectural profession poses the need for reconsidering and redefining the central role and services of architectural designer in the making of buildings.

Keywords: Design delegation, Contractors, Shop drawings, Design Services, AIA contracts
1. Introduction

Traditionally design and construction activities have been treated as independent activities. Design was perceived as an activity that was completed at the submission of contract documents for bidding. It was assumed to be little interaction between the designer and the contractor after the submission of construction documents. Construction, on the other hand, was seen as performed by specialists, namely the contractor and subcontractors, who were experts in the means and methods of constructability. This view has been largely supported by construction management books as well as in the agreements for professional services. Based on these documents, the architect maintains a presence during construction by administering the contract between the owner and the contractor.

The increased complexity of building systems and the abundance of new technologies available, especially after WWII, have shifted the design knowledge largely to manufacturers and specialty contractors. It is therefore convenient for a design professional to rely on the expertise of manufacturers and contractors for designing/engineering building systems based on quality and performance specifications.

In turn, this design activity is provided by the contractor, subcontractors or manufacturers during construction in the form of shop drawings. These documents are not properly categorized as performance engineering design nor are they recognized as part of contractual documents. In contractual agreements they are presented simply as the demonstration of understanding the design intents and as the reflection of means and methods to be employed during construction activities. Historically they have been interpreted as necessary only to accomplish the work in terms of construction means and methods and not of design.

This paper presents a review of the standard contracts for design and construction services as they were promulgated by the American Institute of Architects (AIA) in the past 100 years. The analysis of AIA B101 (agreement between owner and architect) and AIA A201 (general conditions of the contract between the owner and contractor) over the years show that the design contribution by contractor, generated through shop drawings and mockups, has not been timely recognized as a design activity.

Differently to what has been suggested in these documents, the industry practice has shows that the design is not a finite activity with the completion of working drawings, but a continuum throughout the construction process. The increasing use of design delegation to parties traditionally not involved in the design profession poses the need for reconsidering and redefining the central role and services of architectural designer in the making of buildings. Only recently, did the AIA include provisions to recognize the design input from the parties that execute construction activities.
2. Technological Complexity

Contemporary buildings still serve the same principles of purpose as their centuries old predecessors. However, they have evolved considerably by becoming synonymous with complex machines. Building systems and their constituents have grown increasingly complex by providing a secure and environmentally controlled space.

Ford (1990) explained that modern building design is characterized as a passage from conceptually “monolithic” to a “layered” system of construction. The first type denotes a technological framework where the same building system meets multiple functional and aesthetic requirements, and it is implemented through a series of construction activities that involve a limited number of trades. The latter, by contrast, indicates a system that results from the assembly of different materials and autonomously produced components. It is a reflection of both the increasing specialization of design knowledge and the fragmentation of design and construction activities.

Natural materials, such as stone and wood, were the main building elements used in the early-nineteenth century construction. The application of these materials required skilled labor and considerable on-site activities. This method of construction started to change during the Industrial Revolution where new manmade materials were introduced. The use of structural steel and reinforced concrete caused a fundamental shift in the structural design process by transforming external walls from load bearing to non-bearing walls thus allowing for increased flexibility in the arrangement of internal space (Purdy 1896). These new technologies along with the use of elevators facilitated the vertical expansion of buildings. The use of electricity for lighting and other purposes, together with the developments of mechanical air ventilation and cooling/heating between the two great wars, added new means for achieving environmental comfort. Moreover, building codes and regulations unceasingly mandated improvements in regards to safety, pollution control, and increased security. More recently, energy conservation concerns, emphasis in the use and preservation of natural resources, and computer and communications applications have added additional technological content in buildings. Solutions of complex aesthetic and structural problems by means of modeling software have escalated dramatically in the last twenty years resulting in very complex architectural forms such as those of Frank Gehry and Zaha Hadid.

The increasing technological complexity of buildings is reflected in the shifting cost distribution of their parts over the years. The average historical cost data reported by R.S. Means (RSMeans Company 1983, 2011) for 1983 to 2011 show the growing relative economic importance of the mechanical, electrical and plumbing systems (MEP), particularly in regard to structural systems. In 1983 the percentage cost of the MEP systems in hospitals and college laboratories represented 27% and 36% of the total building cost. In 2011 these percentages had reached 45% and 50% respectively. A similar trend can be seen in less technology intensive buildings such as hotels, where MEP accounted for 37% in 1983 and for 46% in 2011.

These data indicate that some types of buildings are characterized more by machinery than bricks and mortar. The architect is called to coordinate and integrate a growing amount of specialized design data into his architectural representation quite often changing the form to accommodate the function.
Hence, the increasing demand for specialized technology and the necessity for a faster adaptation of new technologies woven together with the abundance of new materials and building products have expanded the traditional scope of services performed by the architect. The knowledge gap is filled by design consultants and specialty trade contractors. Actually, there is a specialist for every aspect of the building, from the foundation to skin selection (Liebing 2008). The increasing dependence on consultants, manufacturers, and specialty trade contractors has added complexity to the relationships among the project participants.

3. The increase of off-site production

Given the increasing technological complexity of buildings and the need for satisfying cost and time schedule constraints, construction activities have been relying on the use of off-site manufactured parts. Labor intensive activities requiring the assembly of discrete components have been replaced with pre-manufactured assemblies that are delivered and installed according to schedule. Reducing on-site labor activities, lowering construction costs and time, increasing quality control coupled with environmental concerns and waste reduction have accelerated the use of prefabricated and preassembled building parts.

The use of steel in buildings marked the start of off-site manufacturing to some specific requirements and delivered ready for assembly in the late XIX century. Advances in building technology along with improved manufacturing capabilities increased the use of prefabricated elements. In addition to steel, a sizeable part of elevators, HVAC, MEP, curtain wall systems, not to mention fixtures and infill elements, currently are manufactured off-site. The design expertise for these systems does not rest with the architect. Instead it is concentrated on the manufacturers and installers (and their consultants) of such components. Consequently, the use of prefabricated components has amplified the practice of shop drawings generated by manufacturers and subcontractors to satisfy specific performance requirements.

Traditionally, shop drawings have been developed on the basis of the architect’s working drawings to illustrate the way building components are fabricated, assembled together and installed onsite. The reason behind this practice was simply because manufacturers needed to make the drawing suitable for their own shop production methods. Conventionally these documents have been associated only with the means and methods of construction. However, there is evidence, that an increasing number of building performance engineering tasks is being designed through the use of shop drawings alone.

Hallowell and Toole (2009) in analyzing twenty $5-$45M design-bid-built construction projects found that 35 performance engineering tasks were required by project specifications to be performed by entities associated with construction. Performance engineering tasks impact the overall functionality of a building and, if not completed efficiently, have negative consequences on the safety and health of its occupants. The collapse of L’Ambiance Plaza that killed 16 workers in 1989 was attributed to deficiencies in performance engineering tasks (Heger 1990). Pietroforte (1995), showed that the design of a thin veneer curtail wall is a long engineering design process whose functional performance is eventually verified with a physical mockup testing.
For some very complex buildings the use of performance specifications is of course a necessity in order to take advantage of the design knowledge of specialty trade contractors and manufacturers. This approach, developed in the UK after the second war, was introduced in the US during early 1960’s to smooth the transition between working drawing and shop drawings. Performance based specifications indicate that there is much design being executed after the architect’s issuance of final design documents.

The above mentioned technological complexity and use of prefabricated components raises several considerations regarding the design role of the architect in the building delivery process. Technological complexity suggests that over the years the design has evolved from a single source into the coordination of many specialist contributions and that its meaning has been enriched with new types of functional dimensions. Differently, off site production suggests the use of performance specifications and shop drawing, that is, the execution of additional design engineering activities by entities not necessarily linked with the design professional. This last observation suggests that design activities span across the conventional design and construction phases of a building project. The following notes illustrate how the US architectural profession institution has addressed the above raised issues over the years.

4. AIA Contractual Agreements

During the building process, the architect offers both design and construction contract administration services to the owner. The scope and the extent of these services are described in two well recognized contractual documents published by the American Institute of Architects (AIA), namely The Standard Form of Agreement between the Owner and Architect AIA-B101 and the General Conditions of the Contract for Construction AIA-A201. The first contract between owner and contractor was published in 1888, followed by the first edition of the General Conditions in 1911. The first agreement between architect and owner was released in 1917 (Dundin 1988). Since then, these documents have been revised and coordinated regularly to integrate evolving construction practices and react to court cases. With its 125 years history and with more than one hundred forms and construction contracts, the AIA plays a dominant role in the construction industry of the United States. AIA documents are widely recognized as construction industry standards and in themselves can be seen as mounting to “private legislation” (Sweet 1991).

The consideration of the above mentioned types of contracts is broken down according to two periods: before 1997 and after 1997. That year, in fact, marked a major shift in the documents, especially in the A-201. New provisions dealt openly with the issues of delegation of design responsibilities to the contractor, via performance and design specifications.
4.1 Standard form of agreement between the owner and architect 1917 – 1987

As stated before, the first owner-architect agreement was published in 1917 (AIA 1917a, b) and consisted of two versions: Percentage based and fee-plus-cost forms of payments. In the first version, the services provided by the architect are described in a single article, Article 1, with professional services consisting of “...the necessary conferences, the preparation of preliminary studies, working drawings, specifications, large scale and full size detail drawings; the drafting of forms of proposals and contracts; the issuance of certificates of payment; the keeping of accounts, the general administration of the business and supervision of the work. This version offers a generic description of the architect services. Little information is given about the role of design consultants. The review of shop drawings are embedded in the fee-plus-cost version under Article 3, the Architect’s Costs that includes:

“The sums paid for drafting, including verification of shop drawings, for specification writing and for supervision of the work.”

"The sums paid to structural, mechanical, electrical, sanitary or other engineers.”

However, no further details are given to define neither the scope of services provided by these consultants nor the scope of architect’s services during construction, other than to “endeavor to guard the Owner against defects and deficiencies in the work of contractors, but he does not guarantee the performance of their contracts”.

Design continued to be described in general terms until the 1951 edition, when the following is added to the architect’s services to include work not usually performed by the architect:

“...large scale and full size drawings, for architectural, structural, plumbing, heating, electrical, and other mechanical work;…” (AIA 1951a).

This addition implies the reliance and the role of design consultants during the design phase. Nonetheless, these services listed under the umbrella of architect’s services did not clearly convey to the owner that the design was provided also by entities outside of the architect’s office.

The 1958 edition, AIA B-311 presents a departure from all prior editions. Under this document, the provided design services flow through three distinct phases listed as the schematic design, design development, and construction documentation. In addition, the role of the architect during construction is clearly stated as a separate activity. Thus, for the first time, there is a clear separation of duties of the architect. His role as a designer is considered concluded with the completion of construction documentation phase. It is only under the construction phase that the architect “reviews the shop drawings for compliance with design” and “provides general administration of the contract”, a term used to replace the troublesome “supervision” (AIA 1951b, I.4). A possible explanation for the observed changes may be attributed to the challenges the architectural profession was experiencing in the late fifties. New types of project delivery, then known as “package service”, were introduced with
a combination of design and construction services (Bannister 1954). Producers were delivering building parts of larger sizes and the trend toward prefabrication was affecting architectural practice.

With the addition of the bidding and negotiation phase in the 1967 edition, AIA B131, the description of the basic services of the architect remained the same. The drawings and specifications developed during the construction document phase, described in details the necessary requirements for construction of the entire project. (AIA 1967b, 1.1.6) Architects provided a descriptive set of instructions or requirements for the final size and character of the buildings. This practice continued for some twenty years. The 1987 edition recognizes for the first time the input of architect’s consultants as part of the architect’s basic services. Until that year, by concentrating solely on the owner-architect relationship, the agreement gives the impression that the architect was the sole designer who provided a complete and constructible package prior to bidding and negotiation phase. Design input via shop drawings is considered only during the construction phase of the project, but only for “the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents” (AIA 1987a, 2.6.12).

The various editions of the “handbook of architectural practice” offer additional information about the architect’s role during the examined period, although they are not contractual documents. First introduced in 1920, the handbook (AIA 1920) outlines the architect services offered during the design phase in more detail. The following quotations resemble the duties prescribed in the architectural agreements almost 40 years later,

a. Making preliminary studies of the problem, the results being expressed in a report or more frequently in the form of a sketch or sketches for a design;

b. The preparation of working drawings, specifications and detail drawings;

c. Drafting forms of proposals and contracts, issuing certificates of payment, keeping accounts and carrying on the business administration incident to the conduct of the work.

d. The supervision of the work as it is executed.

The input and dependence on consultants was duly noted in the architectural practice since the turn of twentieth century. Increasing technological complex systems, such as heating and ventilation, electricity, and plumbing, required for successful application to depend on “professional specialists who could give the entire time in studying of these systems” (AIA 1920, p. 16). The architect, therefore, progressively became a coordinator of specialized design services, although this issue is not addressed in the owner/architect agreements. According to the 1953 edition (AIA 1953), shop drawings are defined as a “necessary step between architects’ working drawings and actual construction”. Regardless of how careful the working drawings and the amount of details placed on them, the architect could not make them acceptable to the trades and to all the shops in which the work was to be made.
4.2 A201 – General Conditions of the Contract for Construction 1915 - 1987

The best-known and widely used owner-contractor document is A201, General Conditions of the Contract for Construction that is coordinated with B101. Originating in 1888 and currently in its sixteenth edition (A201-2007), it is used for projects where the design and construction are contracted separately. It is also known as the design-bid-build contract delivery. It reflects the entire and integrated agreement between the owner, architect and the general contractor. It also describes the duties, responsibilities, and relationship among these parties.

The document often refers to the required work of the contractor. In the second edition (AIA 1915) of the contract the term “work” was limited to supplied labor and material and remained unchanged until 1967. In 1915, the contractor was required to furnish all the samples for approval as per Article 8 (AIA 1915). In 1958, the contractor, in addition to labor and materials, was required to provide satisfactory evidence on the quality of the materials as per Article 9 (AIA 1958b). In 1967 the term work included “all the labor necessary to produce the construction required by the Construction Documents”, as per subparagraph 1.1.3 (AIA 1967a). In the context of the first half of the century the contractor is presented as a “producer” and all the information generated via shop drawings is considered as part of production. These drawings and other calculations are integrated in terms of construction means and methods only and not as engineering design tasks. The 1987 edition included a provision that touched upon the issue of design delegation. The scope of contractor’s work, in addition to providing materials, labor and equipment necessary to fulfill its obligations, was updated to include “services” as required by contract documents. Subparagraph 1.2.3 of the 1987 edition (AIA 1987b) required the contractor to produce the results “intended” through the contract documents defined as the drawings, specifications, and addenda. This provision, therefore, required the contractor to participate in a design entity by analyzing and interpreting the design professional’s intentions. The issue of design delegation is briefly addressed in subparagraph 3.12.11 that states:

“When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, the Architect shall be entitled to rely on the accuracy and completeness of such certifications” (AIA 1987b).

Although design delegation has taken place for many years, prior to 1987 there was little AIA contractual guidance as to delegation of design to the contractor. Parties were left to draft their own delegation or rely on informal agreements (Potter 1998). The court’s decision on the structural failure of the Kansas City Hyatt Regency hotel in 1981 prompted the AIA to clarify on the issue of design delegation.

4.3 B101 – Standard form of agreement between the owner and architect 1997 - 2007

The B141-1997 edition of the owner-architect agreement represented a “fundamental departure” from the earlier editions (AIA 1997c). To accommodate increasing specialization within the architectural
profession, B141 was divided into two parts separately addressing agreement terms and scope of architectural services. Past practice of grouping the architect’ services into phases applied to a linear model of delivery. The intent of this separation was to create a more flexible platform for the rendering of architectural services that were no longer grouped into phases. Instead, the services were grouped into six primary categories that included administration, planning and evaluation, design, construction procurement, contract administration and facility operation. The extent of services in general approximated those outlined in the 1987 edition with one exception regarding the information included in construction documents.

Differently from the previous editions, design engineering services could be delegated to the contractor through performance and design specifications by outlining the quality level of materials and systems. Subparagraph 2.4.4.1, among others, reads:

“The Construction Documents shall include Drawings and Specifications that establish in detail the quality level of materials and systems required for the Project.”

Subparagraph 2.6.4.3, pertaining to submittals that is, the information provided by the contractor after contract execution, indicates:

“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 Architect shall specify appropriate performance and design criteria that such services must satisfy. Shop drawings and other submittals related to the Work designed or certified by the design professional retained by the Contractor shall bear such professional’s written approval when submitted to the Architect. The Architect shall be entitled to rely upon the adequacy and accuracy and completeness of the services certifications or approvals performed by such design professionals”.

There is clearly a shift on the design responsibilities placed upon entities associated with construction. Until 1997, according the AIA documents, contractors’ design responsibilities were related only to means and methods. After 1997 their contribution became an integral part of the overall engineering and performance of a building.

The flagship of owner-architect agreements B141 was discontinued in 2007. The B141-1997 had “created undue complexity for the architect providing traditional architectural services” and for the architects who did not provide design and construction services (AIA 1997c). Therefore, B101 returned to the services provided by the architect during the five phases, as they existed prior to the 1997 edition.

B101-2007 acknowledges that, during construction phase, in order to construct the work, the contractor will provide additional information such as shop drawings and other submittals (AIA 2007a, 3.4.1). This statement leads into the assumption that shop drawings related to the engineering performance tasks are still part of the means and methods of construction. Differently, the work as defined in A201, in addition to materials and equipment, includes services in which the contractor must satisfy performance and design criteria set forth by the architect.
The history of AIA standard contractual agreements indicates that the design as performed by the architect ends with the issuing of contract documents. The design input by contractor and manufacturer is not appropriately acknowledged until 1997.

The use of performance specifications in contractual agreements and the expected additional information by contractors in terms of shop drawings, indicate that these documents do not only describe the means and methods of construction as in the past, but they are in fact a complement that details the design intent of the architect.

4.4 A201 – General Conditions of the Contract for Construction 1997 - 2007

The issue of design delegation plays the center stage of the A201, 1997 edition. Under this agreement, the contractor is expected to provide design engineering services based on performance specifications outlined by the architect or the owner (AIA 2007b, 3.12.11). But, because the contractor is not a licensed professional, the A201 requires that such services be provided by a properly licensed professional who must certify all the shop drawings, calculations, and all other required submittals. Once the shop drawings are developed based on the required performance specifications, these drawings can no longer be regarded as just documenting the means and methods of construction only. Since they provide engineering calculations, these shop drawings are in essence engineering design tasks.

The issue of design delegation resonated through construction industry generating considerable opposition. The substantial risk shift to contractors prompted the Association of General Contractors of America (AGC) to reluctantly endorse this document. The 2007 edition of the contract was not endorsed by AGC for the first time in fifty years (Alitz 2008).

Shop drawings are used to materialize the design intent as given via performance specifications notwithstanding, they are not considered part of contract documents (AIA 2007b, 3.12.4). “…the purpose of the submittals is to illustrate how the contractor intends to implement the architect’s design. Because the owner may not have the opportunity to agree with changes incorporated into shop drawings product date or samples, the submittals from the contractor to the architect cannot represent the mutual agreement of the parties to the same degree as the contract documents.” (AIA 2007c, 3.12.4)

The statement that the design can be delegated to and generated by the contractor during the construction phase breaks the linearity of project delivery as described in both B101 and A201 documents. As the design intent of working drawings is refined and sometimes changed after their submittals, contracts documents do not envision a collaborative design undertaking with specialty trade contractors, manufacturers and their professional consultants. Their inputs are considered only after the completion of the construction contract documents by the architect.
5. Conclusions:

The increasing technological complexity of building systems followed an escalation of prefabricated assemblies after the WWII has altered the design process from that presented in general literature or in the AIA contractual documents namely A201 and B101. Design is considered as a finite activity completed at the end of the design phase. On the other hand, construction has been understood as a subsequent activity that strictly implements the instructions given in the drawings and specifications. Contrary to this assumption, design continues well onto construction phase of the project. This part of design process has been considered as pertaining to the means and methods of construction only, and not as an activity contributing to the overall performance of the building. Shop drawings not only refine the architect’s intent but they also have a more profound role in the design and functionality of the building. Only recently has the architectural profession duly recognized and accepted these design inputs.

The technological progress has weakened the ability of the architect to maintain her historical role as the only depositary of design knowledge. Unable to fully cope with the growing number of innovations, the architect has resolved by shifting certain specialized design responsibilities to consultants and specialty trade contractors by means of performance specifications. The shifting of design liabilities has altered the role that manufacturers and specialty trade contractors play on the fulfillment of the design. The design input by entities traditionally associated with construction was finally recognized by the architectural profession. The architect is no longer the only designer but rather the coordinator and integrator of different design contributions. The contractor and manufacturer, on the other hand, have become extensively involved in design activities related to the engineering performance on the building.

The increase use of design delegation to parties traditionally not involved in the architectural profession poses the need for reconsidering and redefining the central role and services of architectural designer in the creation of the buildings. New professional agreements should clearly recognize that modern building design/engineering is not an individual activity but the coordination and integration process of multidisciplinary inputs that span across the traditionally separated phases of designing and constructing a building. The shifting roles of architect and contractors also should be recognized in the educational programs by developing coordination and integration capabilities in architectural schools and applied building design/engineering capabilities in construction oriented schools.

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