HARVARD DESIGN SCHOOL

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Shepley Bulfinch Richardson Abbott: 4 Projects

Understanding Changes in Architectural Practice,
Documentation Processes, Professional Relationships, and Risk Management

Executive Summary

This case study analyzes the evolving role of the architect in the construction process through the lens of four projects designed by Shepley Bulfinch Richardson Abbott during the last 125 years. It also addresses the changes in the working relationship of architects with contractors and owners, the quantity and quality of construction documentation architects produce, and the risks to which architects are exposed.

Shepley Bulfinch Richardson and Abbott (SBRA) has its origins in the architectural firm founded in 1874 by architect Henry Hobson Richardson. It is one of the oldest continuously operating architectural firms in the United States and has survived the full range of ownership transitions and changes in forms of practice, from sole practitioner, to partnership, and a century later, to corporation in 1972. It weathered the loss of its founder and subsequent family owner-practitioners, to become today one of the nation's largest and most successful architectural firms.

The four projects are:

- Sever Hall at Harvard University, a classroom building completed in 1880.
- Eliot House at Harvard University, a residence hall completed during the Great Depression.
- Mather House, at Harvard University, a residence hall completed in the 1970s, and
- Hotung International Law Center Building at Georgetown University, a law center and fitness facility completed in 2004.

The number of sheets of working drawings in the above projects range from a few to many. The number of pages of specifications varies from a few typed pages to entire manuals. The role of the architect varied from deep involvement in the construction process to periodic observations of the progress of the work. The architect's relationship with the contractor also varied from a near-partnership arrangement to a formal professional relationship.

This case was prepared by Richard W. Jennings. MDesS'05 and Professor Spiro N. Pollalis with the assistance of Research Associate Brian Kenet, and Katerina Tryfonidou, MDesS'06, Harvard University Graduate School of Design, as the basis for class discussion rather than to illustrate effective or ineffective management of an administrative situation, a design process, or a design itself.

The authors would like to thank the many architects of Shepley Bulfinch Richardson and Abbott, who were interviewed, reviewed the case study and provided comments, as well as Robert J. Roche, Archivist of SBRA, and Harvard University who generously supplied documents and information from the SBRA company's and the University's archives for this case study.

This research serves as a catalyst for discussions on two issues. First, does the complexity of today's buildings require more documentation than for the buildings in the past? Second, if the architect has distanced himself from construction, manifested as a trend to over-document buildings, is it to facilitate construction, or is it a risk management reaction to the increased litigious environment in the construction industry?

Discussion Questions

1. Are today's architects and engineers producing more documentation than necessary for buildings, and by so doing, do they inhibit potential innovation and more economical solutions that might result from a different approach? What could be done if this is true?
2. How could architects and contractors build at the end of the 19th century with fewer drawings and less detailed specifications? What has changed?
3. Are there more efficient ways to communicate a designer's intent to a contractor? In what ways could information technology be used to more effectively communicate with the contractor and/or subcontractors? What are the legal implications of communicating differently than in 2D drawings?
4. If architects and contractors worked more closely together from the beginning of the design process, would fewer drawings and specifications be required?
5. How has the role of the architect during construction changed from the past? Has the architect distanced himself/ herself from the construction process over time, leaving more decisions to the contractor today or, through more documentation the architect has more control?
6. Does today's litigious environment hinder changes in the quantity and level of detail of documentation that architects and engineers produce to communicate their designs to a contractor? Is this necessary, or is the threat of litigation an unrealistic fear?

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Four Projects by Shepley Bulfinch Richardson Abbott

Understanding Changes in Architectural Practice, Documentation Processes, Professional Relationships, and Risk Management

Carole Wedge, President of Shepley Bulfinch Richardson and Abbott (SBRA), was in the process of reviewing a set of construction documents containing hundreds of drawings. She was amazed at the large number of sheets and the level of detail. Each drawing was heavily noted and seemingly well-dimensioned. Certainly, it was no small task to coordinate so many drawings and dimensions According to the AIA General Conditions of the Contract for Construction, AIA Document A201-1997 Edition, the architect's construction drawings are intended to convey the design intent, not to provide all of the information needed to actually construct the building.

At the same time, Wedge was skeptical if the large number of drawings and documentation her firm produces, made possible by today's computers, were really necessary to build a building. She even wondered if the large number of documents increase the construction costs, and if they inhibit innovation. Wedge, reflecting on the legacy of the firm, questioned how the firm's founder, the renowned architect H. H. Richardson, managed to get buildings such as Harvard University's Sever Hall, completed in 1880, by producing less than a dozen sheets of architectural drawings, and what that meant for his relations to the owner and the contractor. What has changed over the last 125 years that requires architects today to produce so many drawings and tomes of specifications?

Wedge knows she has to balance what is required by the client, what the project needs, and her professional duty, against the economic realities of private architectural practice. The key question, however, is whether the firm should change its approach to construction documents, and whether a change is even possible given the current professional standards of practice in America's litigious environment.

How much documentation is needed?

Wedge had learned that the working drawings[1] her firm had recently prepared for a major project under construction contained a number of errors resulting from conflicts of information in different drawings. A large-scale dimensioned drawing of a stair enclosure did not match the dimensions shown on the foundation plan prepared by the structural engineering consultant. In addition, the dimensions shown on the small-scale floor plan did not agree with the dimensions shown on the detailed drawing of the stair enclosure. As a result, the contractor had submitted a change order for modifying the foundation wall under the stair enclosure.

The AIA General Conditions require the contractor to verify and coordinate the dimensions of the various components of the work, and upon discovery of discrepancies, has a duty to request clarifications from the architect. However, it was problematic that SBRA had produced a set of drawings with different dimensions for the same elements, although common in the two-dimensional world of construction drawings.

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[1] "Working Drawings" are the drawings prepared by the architects and engineers for the contractor to use to construct the building. "Contract Documents" refers to the architect's construction drawings and specifications, the general conditions, the Owner-Contractor Agreement, and all other documents that make up the contract for construction. The terms "Construction Drawing" and "Working Drawing" are interchangeable. "Shop Drawings" are the drawings made by contractors, subcontractors, vendors or suppliers to use in the fabrication of their portions of the construction. "RFI" refers to "Request for Information" and is the term applied to contractor requests for additional information from the architect.

Wedge decided to investigate further the subject of over-documentation and what is the right level of information and documentation for describing a building for construction. She decided to look at the construction documentation of past projects, going all the way to the 19th century. As one of the oldest architectural firm in the USA, she had a plethora of projects to look at.

Analysis of the 4 SBRA projects

The Projects

In her pursuit to analyze past projects, Wedge asked the firm's archivist, Robert Roche, to give her a list of working drawings produced on the firm's early commissions. Among the most impressive in the list was Sever Hall at Harvard University, designed by the firm's founder, Henry Hobson Richardson and completed in 1880. Sever Hall had been built with only 11 sheets of working drawings.

The selection of the projects was based on having one Richardson building, on having projects equally spaced in time, and on having as similar projects as possible so comparisons could be drawn. A decision was made to have Harvard buildings, given the proximity to the researchers and the access to Harvard archives. However, the last project was chosen to be in Georgetown, as there was no suitable Harvard project in the last 2 years. As the owner of each project is an institution, the relationship between the architect and the contractor becomes more transparent. In every one of the projects the methodology and the process of the documentation varies. The selected four projects designed by SBRA and its predecessor firms, each having been completed at very different eras in the history of design and construction in the United States, are:

a. **Sever Hall** at Harvard University, completed in 1880 (Appendix A),

b. **Eliot House** at Harvard University, completed in 1931 (Appendix B),

c. **Mather House** at Harvard University, completed in 1972 (Appendix C), and

d. **Hotung International Law Center** at Georgetown University, completed in 2004 (Appendix D).

Sever Hall was completed with very few drawings, and there is an unusual, based on today's standards, partnership between the architect and the contractor. Eliot House was completed during the Depression and the amount of drawings produced is significantly large. For the Mather House project, a new system of construction documentation, tried in the 1970s, was used, where the quantity of information on construction documents was reduced to avoid conflicts and reduce drafting time. Finally, Hotung International Law Center was completed very recently with the use of CAD generated drawings for the documentation. The general contractor was working as Construction Manager along with the architect since the design phase of the project.

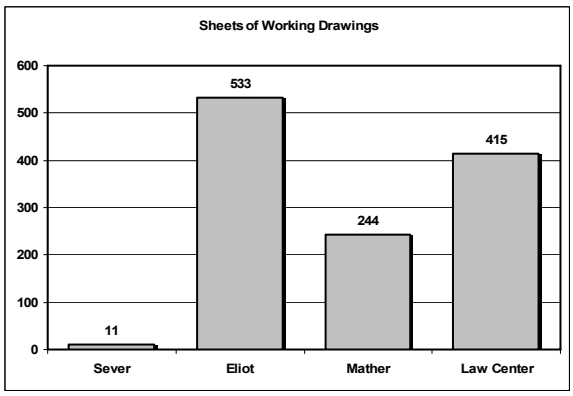
The four projects are individually presented in Appendices A-D. A quick comparison of the 4 projects is shown in Table 1. Some data of Table 1 are also shown in charts (Fig. 1), for a visual comparison.

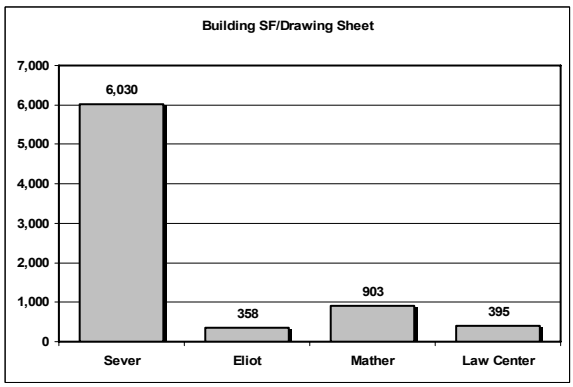
Table 1. *Data of the 4 selected projects*

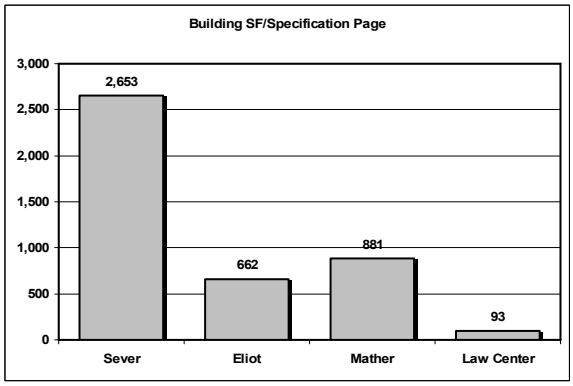
Note: 273 sheets of Eliot House working drawings were mostly large or full-size details

Documentation Tabulation	Sever	Eliot	Mather	Law Center
Year Completed	1880	1931	1972	2004
Building Area (SF)	66,335	190,711	220,356	164,000
Construction Cost	$110,000	$2,780,162	$8,732,088	$45,482,516
Construction Cost - Constant $	$2,218,700	$35,669,478	$42,088,664	$46,846,991
Construction Cost/SF	$1.66	$14.58	$39.63	$277.33
Construction Cost/SF - Constant $	$33.45	$187.03	$191.00	$285.65
Sheets of Working Drawings	11	533	244	415
Pages of Specifications	25	288	250	1768
Sheets of Architectural Working Drawings	11	533	95	209
Construction Cost/Specification Page	$4,400	$9,653	$34,928	$25,725
Construction Cost/Specification Page - Constant $	$88,748	$123,852	$168,355	$26,497
Building SF/Drawing Sheet	6,030	358	903	395
Building SF/Specification Page	2,653	662	881	93
Construction Cost/Drawing Sheet	$10,000	$5,216	$35,787	$109,596
Construction Cost/Drawing Sheet - Constant $	$201,700	$66,922	$172,495	$112,884
Gross Architectural Fee	$7,700	$181,043	$500,000	$5,108,040
Net Architectural Fee	$7,700	$165,948	$347,000	$3,278,300
Gross Architectural Fee - Constant $	$155,309	$2,322,782	$2,410,000	$5,261,281
Net Architectural Fee - Constant $	$155,309	$2,129,113	$1,672,540	$3,376,649
Net Architectural Fee/SF - Constant $	$2.34	$11.16	$7.59	$20.59
Net Architectural Fee/Construction Cost - Constant $	7.0%	6.0%	4.0%	7.2%
Net Architectural Fee/Arch. Drawing Sheet - Constant $	$14,119	$3,995	$17,606	$16,156
Net Architectural Fee/Specification Page - Constant $	$6,212	$7,393	$6,690	$1,910
Constant $ Factor as of 2005 CPI (Federal Reserve)	20.17	12.83	4.67	1.03
Index for Year	29	45.6	125.3	565.8
2005 Index	584.9	584.9	584.9	584.9
2005 Price = $1 x (2005 CPI / Subject Year CPI)	20.17	12.83	4.67	1.03

Source: Federal Reserve Bank of Minn. <http://minneapolisfed.org/Research/data/us/calc/hist1800.cfm>







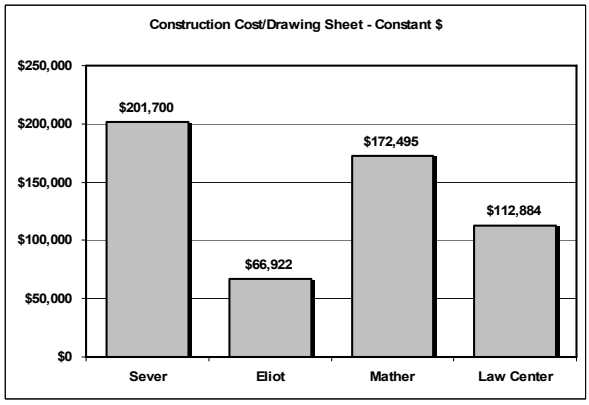
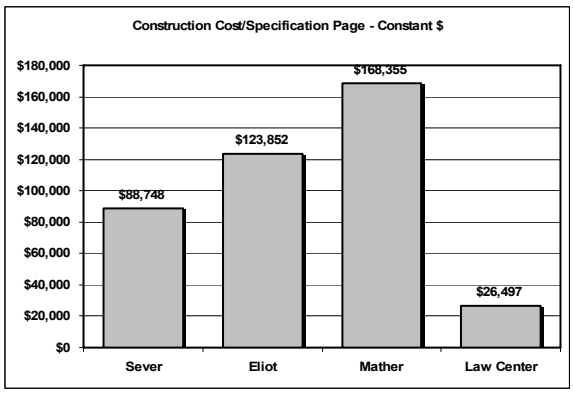
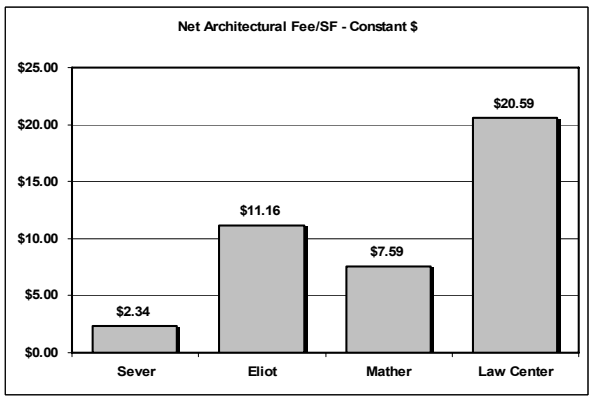
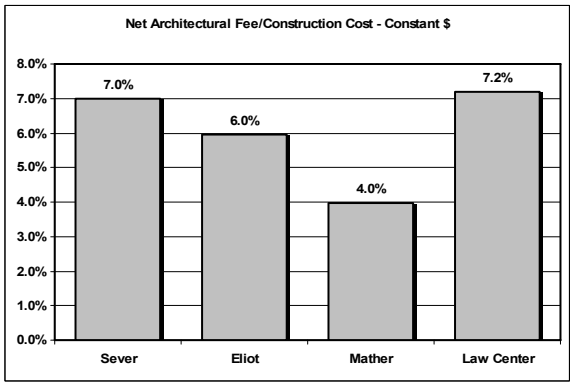


Fig. 1. Comparisons of the 4 projects.







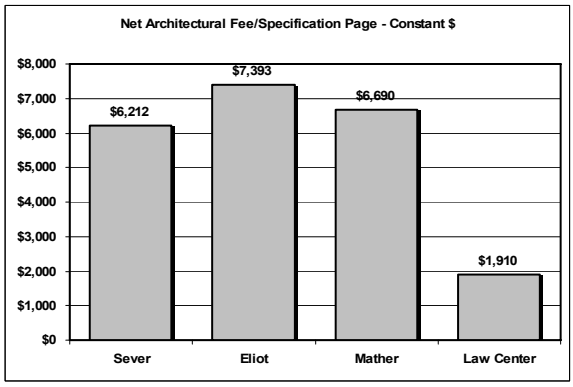


Fig. 1. Comparisons of the 4 projects (continued)

1. Documentation of the four projects

As Wedge reviewed the projects and the data, she noticed that the ratio of building area to the number of sheets of working drawings varied considerably. She also noticed a similar variation in the ratio of construction cost per working drawing sheet.

i. Sever Hall

Sever Hall could not have been built in today's professional environment with only the 11 "contract drawings" provided by H. H. Richardson. The contractor, Norcross Brothers, known for having its own architectural draftsmen, must have produced additional drawings to guide the tradesmen, or the tradesmen must have known from experience what was needed. However, this is just an assumption, since we did not find any additional drawings, beyond the 11 by Richardson. We have information though that H. H. Richardson personally visited the construction site frequently, and was known to make on-site changes and issued directives to improve his designs.

ii.Eliot House

An unusual number of working drawings were produced for Eliot House, and the other Harkness Houses as well. However, more than 50% of these drawings are full-size details, drawings that conveyed information that would today probably be accomplished through shop drawings. Also, this project was designed and built during the Depression. It seems possible, although no evidence was apparent, that the architect chose to keep its draftsmen busy rather than lay them off during this time, and therefore more drawings were produced than were actually needed to build the building. On the other hand, Elliott House is a large project, with many rooms and partitions. Also, the architectural style of Eliot House would have required many details to communicate the design intent.

iii.Mother House

The Mather House drawings appear normal for its time. Using a method for the production of less documents, the dimensions of various components were shown only once in the entire set of drawings, horizontal dimensions were shown on plans, vertical dimensions on sections and elevations, and dimensions did not appear twice anywhere in the drawings. Using this system, the stair enclosure dimensions would not have conflicted with the small-scale floor plans because they would have been shown only once. In addition, using this system, notes and descriptions of materials were made only once on a sheet so that if a change were made, fewer notes would have to be found and revised. This system eliminated the repetitious and seemingly endless repeating of information that the contractor would already know, such as noting the same material on each wall section on the same sheet of drawings. Further, using this system, the old method of indicating materials by symbols and hatching replaced the need to add elaborate notes indicating the same information. All drawings were drawn by hand and appear to convey adequately the information needed to construct the building. The number and type of shop drawings were also probably normal for its time.

iv. Hotung International Law Center

The working drawings of the 4th project, the Law Center, contain the greatest amount of information and the most number of pages of specifications. Although not as many sheets of drawings were produced as for Eliot House, the information is dense. The drawings are heavily notated, and many details are included. The floor plans are heavily dimensioned and much information is contained on each drawing. This information density has been facilitated by the use of CAD, which makes it easier to copy and enlarge portions of the drawings to use as details, and one wonders whether the same level of density would have been produced had the drawings been produced by hand. It is also worth questioning whether the drawings would conform to the ideal working drawing content expressed in the 1927 Edition of the Handbook of Architectural Practice referenced above in the discussion on the Eliot House documentation.

The 4 projects offer a continuum through the years of an increase in the quantity and preciseness of the documentation by the architect. Nevertheless, the one project that stands out in terms of maximum documentation is the Eliot House, but that can be justified by the economic situation during the Great Depression.

Was It Possible to Build Sever Hall with only the Contract Drawings?

In an attempt to explain the small amount of drawings, Fasano of SBRA says: “In Richardson’s era, the systems which were being used were probably not so different of those being used hundreds of years before. The tradesmen were probably much more knowledgeable of their materials than they are today, and they would require less information to construct the buildings.”

However, other SBRA architects argue that it was not possible to build Sever Hall using only the contract drawings provided by the architect. These drawings do not include sufficient information to the tradesmen and contractors. It seems that a number of supplementary drawings were produced for construction. The question is if and who provided these drawings? Was it the architect or the contractor? The following elements of Sever Hall would have needed additional documentation:

Entrance

The entrance of Sever Hall is an arched opening, a design element used by Richardson in many of his Romanesque style of architecture. However, with only a small scale exterior elevation drawing available, it would have been impossible to communicate the dimensions, radii, and proportions of the arched opening, entrance and door details. Additional drawings, either full-size drawings made by the architect's staff, or additional drawings made by the contractor, would have been required to actually form and place the brickwork and stone in the desired configuration.

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Window Details

The windows are an important element in the design of Sever Hall. And windows in that day were mostly custom made. Additional drawings would have been required to fabricate, install, and trim the windows. In addition, the ornamentation below certain windows would have required additional drawings. The original contract drawings do not provide any information regarding the windows or the ornamentation.

Brick Patterns

Sever Hall contains more than 60 different sizes and shapes of brick. The building ornamentation required that these bricks would have had to be made according to some pattern, or if available as standard shapes in that day, additional drawings would have been required to instruct the masons in their work. Whether Richardson's office provided this instruction on site, by additional drawings that did not survived, or whether Norcross provided additional drawings is not known.

Stair Details

No evidence of the drawings that would have been needed to construct the interior stairs survives. Nothing is shown on the "Contract Drawings" issued by Richardson's office. But the size and shapes of the treads and risers, landings, handrails, and other details would have required additional drawings to communicate the architect's design intent to the tradesmen.

Framing & Structure

Additional drawings would have been required to frame the building's structure. The layout and sizing of the joists and rafters, construction of the dormer windows, and other framing elements should have been communicated to the tradesmen to accomplish the work. In addition, no information was provided for construction of the foundation or basement, which would have been required. Either Richardson's office provided this information in supplemental drawings, or so did Norcross, as part of engineering of the building.

In summary, additional drawings and documents were required to build Sever Hall. As Wadgy Anis, principal and director of Technical Resources at SBRA notices, "There is no way a building with ornamentation as complex as Sever could have been built without detail drawings." Whether those drawings were provided by the architect or the contractor, or both, is not known.

Comparison of Sever Hall with other buildings of its time

The small quantity of contract drawings produced for Sever Hall poses the question whether this was normal for the times. Compared to later projects, very few drawings were issued to the contractor. A comparison with other projects constructed about the same time is instructive.

Christ Church

In 1846 Architect Richard Upjohn produced only 10 sheets of working drawings, comprised of plans, elevations, sections, and details, for the construction of Christ Church in Raleigh, North Carolina.[2]

Woburn Library

The Woburn Library is the first of Richardson's public libraries. Charles Bowers Winn, a prominent leather merchant, willed funds for a building to honor his father, founder of the Woburn Public Library. In 1876, a design competition was held among prominent New York and Boston architects, including Gambrill and Richardson. Richardson was still in partnership with Charles Gambrill when he submitted the winning design. The library building committee accepted Richardson's design on January 16, 1877 and the library opened on May 1, 1879.

The library contains four levels: basement, first floor, second floor, and attic and contains approximately 18,000 square feet of enclosed area. The total cost of the library was $95,305.24, which included the cost of the building construction, heating and ventilation system, interior furniture and fixtures, and architectural fees. Norcross Brothers was the general contractor.

The Houghton Library Richardson Collection contains 41 drawings of the Woburn Library. Of those, only 10 drawings are listed as “working drawings/contract drawings,” and bear the signatures of the members of the Woburn Library building committee. Seven of the 41 drawings are listed as “presentation drawings” and some are duplicates of the contract drawings, such as floor plans and exterior elevations. Six of the working drawings are details and sections that might have been used by the contractor in constructing the building.

Austin Hall

In 1881 Richardson submitted a design for Austin Hall, the first Law School building at Harvard. Construction began the following spring and was complete in 1884. Norcross Brothers was the contractor and the building today remains a part of Harvard Law School. The Houghton Library Richardson Collection contains 250 drawings related to this building. However, the large majority of these drawings are sketches and presentation drawings. Only 33 of the drawings are listed as “working drawings,” and of those, only 11 are “design drawings.” A number the working drawings are early versions of the contract drawings

Table 2. *Data of the buildings compared to the Sever Hall.*

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[2] Elliott, Cecil D. *The American Architect from the Colonial Era to the Present.* McFarland Company. Jefferson, North Carolina, 2003. p. 105.

Building	Year	Total Drawings	Working Sheets
Christ Church, Raleigh, NC	1846	10	10
Woburn Library, Woburn, MA	1877	41	16
Sever Hall, Harvard	1878	33	11
Austin Hall, Harvard	1882	250	10-16
Union Station, St. Louis	1894	165	N/A
Univ. of Penn. Law School	1898	347	26

Union Station

In 1894, German-born architect Theodore C. Link produced a total of 165 drawings for the Union Station building in St. Louis. However, these drawings included presentation drawings, perspectives, working drawings, and details, most of which were drawn in ink on tracing linen. The railway terminal building cost $6.5 million to build at that time. [3]

University of Pennsylvania Law School

In 1898, Architects Cope & Stewardson produced only 26 sheets of working drawings for the construction of the University of Pennsylvania Law School Building. However, during construction, the architects produced 321 additional drawings, most of which were full-size details, to supplement the original working drawings. [4]

2. The Profession of the Architect[5]

According to Mary N. Woods, Associate Professor of Architecture at Cornell University, Benjamin Henry Latrobe claims for himself the distinction of being America's first professional architect. In an 1806 letter to a former student, Latrobe defined his role in the English tradition, which he brought with him when he immigrated to the United States in 1796. Latrobe relates that architecture in America had been in the hands of "gentlemen" who learned architectural theory from books and travel, and "mechanics" who knew of construction but nothing of the theory. Latrobe set the stage for the professional architect in early America by maintaining that not only does the professional architect combine theoretical knowledge with practical understanding of building, he is separate from the client and the builder.

Woods explains further that architecture as a true profession came into existence in the United States only about 150 years ago, between about 1820 and 1860, during the antebellum period. It is during this period that the conventions and institutions as well as the values and identities of the architectural profession as it exists today, have their roots.[6]

In the United States, architecture as an organized and regulated endeavor is of relatively recent origin. For most of the 1800's, anyone could call themselves an architect. There were no standards of education, training, or qualifications until the late-1800's. The first school of architecture in the United States opened at the Massachusetts Institute of Technology (MIT) in 1868. Cornell opened an

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3 Elliott, Cecil D. *The American Architect from the Colonial Era to the Present*. McFarland Company. Jefferson, North Carolina, 2003. p. 105.

4 Elliott, Cecil D. *The American Architect from the Colonial Era to the Present.* McFarland Company. Jefferson, North Carolina, 2003. p. 105.

5 Certain material in this section taken from Richard Jennings, The Architect Diminished, Master of Architecture Thesis, 2004.

6 Woods, Mary N. From Craft to Profession: The Practice of Architecture in Nineteenth-Century America. University of California Press, 1999.

architectural program in 1871, and the University of Illinois followed in 1873. The first architectural registration law was enacted in Illinois in 1897.[7]

The architect in America in the early part of the 20th century was responsible for coordinating the building process and architectural practices were organized to respond to this responsibility. The late architectural historian Spiro Kostof, Professor of Architecture at the University of California writing in The Architect: Chapters in the History of the Profession, offers an insight into the strong coordinative role of the architect in the 1930's. Projects such as Rockefeller Center and the Empire State Building required the talents of large numbers of professionals in various fields and the activities of these specialists, including architects, structural and mechanical engineers, construction companies, and material suppliers, had to be coordinated in "ways both precise and all-encompassing." This responsibility was assumed by the architect. Very detailed organization diagrams were developed, architects' offices were organized by specialized functions and responsibility, and decision-making was separated from the other architectural tasks. Selected individuals were assigned responsibility for the coordination of separate areas of the work. This division of labor concept became a standard for the large architectural office doing large projects.[8]

Professionalism

"One change that I can confidently describe is the denigration of the professions." - Carl Sapers[9]

Professions in general, including the architectural profession, are today viewed with greater skepticism of their value and worth. Thomas Fisher argues the architect has faced a period of "anti-professional sentiment" since the 1980s, caused largely by society's market orientation. This perception is reflected in the increase in fee bidding, litigation, and criticisms of the architectural profession as elitist and inefficient. Fisher argues this skepticism has influenced legal and government actions, and has resulted in antitrust rulings against the professions. The United States Justice Department has pursued anti-trust action against the architectural profession to eliminate standard fee schedules and other activities once considered an integral part of being a professional. [10]

The American Institute of Architects has been the target of vigorous antitrust litigation which resulted in changes to the AIA Code of Ethics and the institute's attitude toward how its member architects can establish fees, supplant an existing architect, advertise, and compete with each other. This litigation includes such cases as United States v. American Institute of Architects and Mardirosian v. American Institute of Architects, 474 F. Supp. 628 (D.D.C. 1979). In Mardirosian, the court held that the AIA Code of Ethics, which prohibited architects from seeking another architect's commission without first determining that the existing architect had been terminated, suppressed competition because it did not allow clients to negotiate with more than one architect simultaneously. Antitrust litigation also eliminated the bans on advertising and prohibited the use of recommended fee schedules. This federal antitrust litigation changed forever the professional manner in which architects act and undermined some of the most basic, once sacrosanct, tenets of professionalism.[11]

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7 Boyle at Kostof, Spiro. Ed. and Dana Cuff (Epilogue) The Architect: Chapters in the History of the Profession. University of California Press; Reprint edition , 2000.

8 Kostof, Spiro. Ed. and Dana Cuff (Epilogue) *The Architect: Chapters in the History of the Profession.* University of California Press; Reprint edition , 2000.

9 Sapers, Carl. *Reflections on Architectural Practices in the Nineties.* William Saunders, Ed. Princeton Architectural Press. New York, 1996. P. 86.

10 Fisher, Thomas. *Speech to AIA National Board*. Lincolnville, Maine. September 20, 2002.

11 Malin, Martin H. "Judicial Restraints on Professional Self-Regulation." *Perspectives on the Professions*. Vol. 1, No. 1, March 1981. p. 1-2.

Litigation Risk

America has become increasingly litigious over the past thirty-five years. Philip K. Howard, writing in The Collapse of the Common Good, summarizes today's legal environment:

> "Any dealings in public – whether in hospitals, schools, offices, or in the ebb and flow of daily life – are fraught with legal anxiety. An undertow pulls at us constantly, drawing us away from choices that we believe are reasonable. Legal fear has become a defining feature of our culture.[12]

The current legal environment in America has reduced most architects' ability and interest in leading the building process. Increased litigation in the nineteen sixties and nineteen seventies created a defensive attitude by architects, and many avoided certain services and additional responsibilities, and acceptance of new technologies and new products simply out of the fear of litigation.[13]

Claims against architects continue to rise. According to Steve Mauck, XL Design Professional Insurance Company's Chief Claims Officer:

> " the design industry has evolved in ways that make architects more vulnerable to disputes and claims. The growth in available projects far outpaced growth in the number of firms and number of experienced professionals. As resources were stretched by increased workloads, inexperienced staff was assigned to tougher challenges and details were missed. Our Risk Driver study showed that problems with non-technical factors such as project team capabilities, communications, client selection and contract negotiations contributed to 70 percent of claims."[14]

According to XL Insurance, architects are at "above average" risk compared to other professionals insured by the company. In a study of claims covering the period 1996-2000, XL Insurance found that the 3,796 claims paid on behalf of architects in the period, $176.2 million, represented 44% of all claims paid on behalf of all professionals insured by the company. In contrast, architects received only 39.6% of the total fees generated by all insured policyholders. In the previous study conducted by XL Insurance covering the period 1989-1996, only 35% of the claims paid were on behalf of architects who generated 37% of the total professional fees, indicating at that time architects were a lower than average risk to the insurance company. An average risk is defined when parity exists between claims paid and fees generated. Claims against architects have increased and, even if not always the cause of the claim, architects must defend themselves against those claims, often at great expense of time and effort.[15]

Increased litigation has also increased the participation of the professional liability insurance underwriters in the activities of the professional practice of architecture. Today, architect's professional liability insurance companies are active participants in the preparation of the AIA standard documents and they limit the services that architects can provide and still maintain insurance coverage. The actions of the insurance companies, in an attempt to minimize their risk of loss, can be seen as a limiting factor in the architect's willingness to assume leadership in projects beyond design.

Architects are highly aware of the exposure that accompanies their services. Successful litigation against the architect, combined with practice restrictions by professional liability insurance underwriters, has caused many architects to be less than enthusiastic about assuming more responsibility in the building process.

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[12] Howard, Philip K. *The Collapse of the Common Good*. New York: Ballantine Publishing Group, 2001. p. 11.

[13] DeHaviland, ed. *The Architect's Handbook of Professional Practice.* The American Institute of Architects. John Wiley & Sons; 12th edition, 1994, p. 8.

[14] "Claims Against Architects on the Rise." *Architect's Loss Prevention Library. XL Design Professional Insurance, 2003*. <http://www.xldp.com/architects/claims.html>

[15] "Thinking Like a Client." Adapted from *The Client Experience, 2002*. The American Institute of Architects. 2003.

Disconnect from Construction

According to the AIA survey of clients, The Client Experience 2002, the construction phase is the greatest "disconnect" between the architect and client perceptions of the architect's role. Clients do not think architects are as involved as they should be during construction of a building."[16] Colin Davies, architectural critic and Professor at the University of North London, UK, maintains that the architectural profession's estrangement from construction has been continuous over the last 30 years. Davies also suggests that architects are more connected to the field of art and are disconnected from the construction process.

> "A common sense view is that the architecture field was much closer to the construction field than the art field. But this does not seem to be the case. In fact, looked at culturally rather than professionally, architecture and construction have very little in common. Architects and builders may be able to rub along together on a professional level, but culturally they are worlds apart. They speak different languages, have different names and different tastes, are educated differently and have different histories." [17]

Roger Lewis argues the construction phase is at best difficult for architects and there is an "uneasy relationship" between the architect and the contractor. Many disputes with the contractor arise over deficiencies in the construction drawings, substitution of materials, and delays. Further, most architects find the task of checking shop drawings and other contractor submittals boring, tedious and sometimes overwhelming. In a large commercial project for example, literally hundreds of submittals must be checked by the architect, not always thought of as a pleasant task. [18]

It is true however that the role of the architect during the construction phase is not clearly defined, and a lot of space for contractors to innovate exists. Fasano of SBRA believes that it depends on the architect's commitment to the project: "I feel architects have as much control as they care to exercise during the construction phase. Perhaps the problem might be that many architects don't really care to; but prefer to mitigate these more tedious and mundane tasks to less experienced and qualified staff members." Nevertheless , although the contractor's opportunity for innovation during construction appears to be less today than at earlier times, Buddy Mear, SBRA project manager, suggests that is not the case for the architect, citing SBRA's attitude of promoting innovative thinking and creative solutions. Further, contractors are often involved from the beginning of a project, such as was the case at the Law Center project, where they do actually have opportunities to influence the design and promote innovative solutions.

When referring to competitively bid projects, the situation is different: in this case, the risk on having contractors involved during the design process is significant. But even in the competitively bid projects, Fasano believes that "the architect is the ultimate responsible for the design and performance of the building. Allowing contractors to "innovate" may provide some short term savings to the owner, but could also compromise the quality of the building." The focus of both the architect and the contractor on the quality of construction is the main interest that many of the SBRA principals – Fasano, Smith, Zwart- agree in.

The Rise of the General Contractor

The method of contracting for construction was one aspect of the building process that affected the quantity of working drawings and documentation produced by architects in the late 19th and early 20th centuries. In 1891, Holabird and Roche, set one of the early precedents of a change in the contracting system by awarding the construction of the Pontiac Building in Chicago to a general contractor, much to the distain of the architectural community. For most of this period, contracts were awarded to what would

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17 Davies, Colin. "Who needs architecture?" *World architecture 2001* Feb., n.93, p. 38-39.

18 Lewis, Roger K. *Architect? A Candid Guide to the Profession*. MIT Press, Revised edition, 1998. p. 182.

today be considered as subcontractors, and the architect was responsible for coordinating their activities on behalf of the owner. Even a simple house might have as many as ten to twenty different contracts. As late as 1909, the American Institute of Architects strongly condemned the general contracting process while acknowledging that the system had been in use by a number of architectural firms for several decades. The AIA argued that a general contractor would intrude on the architect's relationship with his client and distance the architect from the artisans and tradesmen who were to carry out the design. Before the advent of the general contractor system, most architects prepared an initial set of contract drawings, and then continued to issue supplemental drawings as construction progressed. Many of these drawings were not returned to the architect nor accounted for in the final tally of the drawings required to build a building. However, as general contracting became the norm, architects were required to increase the number of drawings issued to the contractor, organized into formal sets of numbered working drawings and detailed specifications, and fewer drawings were issued after the start of construction. [19]

The appearance of these general contractors challenged the architect supervisory role. Some architects felt contractors intruded on their owner-architect relationship. In addition, the general contractors had only the client's interest to deal with, unlike architects, who were required to balance professional ethics, duty to client, and duty to the public. However, architects who did not provide construction administration services risked becoming detached from the process and becoming picture makers. [20]

General contractors provided full-time supervision of an increasingly complex process, unlike architects' superintendents who inspected the project only periodically. The architect's superintendents inspected only to insure that construction conformed to the architect's drawings, not innovate, advise the client, or manage and coordinate the trades. Unlike architects, general contractors provided the entire range of manage early administrative services required by the client, services the architects unable, or unwilling, to provide. [21]

3. Relationships between Architect and Contractor

The four SBRA Projects

In all four of the projects, the contractor's role varied from being solely responsible for the construction, or being at the project from the start as a construction manager for the design phase. As the roles of the architect and the contractor evolved, the relationships and dependencies between them were constantly redefined from project to project. By examining the four projects one can observe the degree and importance of changes both in the two professions but also in the entire process of building. Have there been profound changes or has the nature of both the architect and the contractor stayed the same, influenced by more general changes in technology, the economy, and society?

i. The Sever Hall

Among the four SBRA projects Sever Hall is the one that stands out as belonging to a very different era in terms of the socio-economic conditions. At that time, the profession of the architect was very vaguely defined, and the distinction between the responsibilities of the architect, the engineer and the contractor were not at all clear. There was no discrimination between design drawings and construction drawings, and it was up to the architect to decide the degree of detail he would generate on the drawings. Neither was it clear whether there was an engineer who would produce separate structural drawings, as well as specific drawings for the heating and ventilation systems.

In this vaguely defined scenery, the Sever Hall project stands as an almost ideal condition between the architect and the contractor. The architect is SBRA's founder, H.H. Richardson, and he chose to

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[19] Ibid. p. 118.
[20] Ibid. p. 158.
[21] Woods, Mary N. From Craft to Profession: *The Practice of Architecture in Nineteenth-Century America*. University of California Press. Los Angeles, CA, 1999. p. 155.

collaborate with the contractor W. Norcross. Norcross Brothers and George Fuller were two of a number of large general contracting companies that appeared after the 1850s, and Richardson had worked with them on several projects. At that time, some of these general contractors had their own design and engineering staff and architects often outsourced expensive drafting and engineering work to the contractor. Consequently, it was not unusual that the contractors charged higher fees than the architects.

The dynamic partnership-like relationship that existed between H. H. Richardson and his contractor, O. W. Norcross, is central to understanding the Sever Hall project. "The relationship of Richardson and Norcross was more of a design/build partnership in which Richardson could essentially create a schematic design and Norcross could complete the engineering and documentation necessary to complete the building" comments John Fasano, SBRA Associate. Indeed, the 11 sheets of working drawings that have been saved prove that for the communication between the contractor and the architect, very little information needed to be documented. However, there might have been more schematic drawings produced during construction which are now lost, or the architect might have been closely supervising the masons and guiding them.

Whichever the case might be, everyone can agree on the impact of the 'partnership-like' relationship that the architect and the contractor shared. The very strong foundations of trust and respect between the two parties defined the amount of responsibility each one of them had on the project. Throughout his career, H. H. Richardson relied heavily on Norcross for advice and counsel on structural systems, material selections, and methods of construction.

Norcross was essentially an extension of Richardson's office and thus provided much opportunity to innovate and influence. Responsibilities that are now undoubtedly attributed to the architect, such as the production of detail drawings, where 'passed' to the contractor in a very similar way of the later on 'design/build' process.

iii. The Mather House

In May 1971, the construction of Mather House at Harvard was nearing completion, albeit off schedule, due to "the complexity of the project and two strikes by the ironworkers and the carpenters during 1968 and 1969." Jean Paul Carlhian of SBRA, design architect of SBRA, for the Mather House, requested additional compensation for SBRA for its construction supervisory role, as a result of the delays.

On June 3, 1971, R.J. Candela from the Department of Buildings and Grounds of Harvard responded: "In reply to your letter of May 25th 1971, regarding compensation for architectural services, we do not believe additional compensation for alleged extended supervision during construction period is justified." Going through the correspondence during construction, one notices that it was not an isolated incident; many letters from the owner that referred to construction related issues were addressed to SBRA. A closer look at the relationships among the owner, the architect,[22] and the contractor during the Mather House project could lead to some interesting conclusions about how the role of the architect was different at that time from what it is today.

In the Mather House project, Harvard started looking for the contractor early in the design phase. With SBRA's recommendation, Harvard chose and negotiated with Turner Construction to construct the student dormitory. SBRA had made it clear that they wanted a construction firm that would be reliable and whom the architect could count on for the quality of their work. These suggestions matched the way Harvard was approaching construction at that time. Bob Tacconi, project architect from SBRA, recalls, "We always knew that Turner or another reputable Boston contractor among the few that we knew and we had worked with successfully in the past would be there," thus indicating the dependence of the architect on the quality of the contractor. Mason Smith, assistant project architect,[23] comments on the role of SBRA at that time: "The architect was still as was cited in the standard owner-contractor, the representative of the owner in dealings with the contractor." It is also evident that SBRA (who had

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[22] "Architect" refers to the SBRA team working on the project, both in the design and the construction phases. "Contractor" refers to Turner Construction.

[23] Mather House was the first project at SBRA of the then young Smith.

designed all of the Harvard Houses as well as other University buildings) was very committed to the project and to Harvard, and that the firm's responsibilities exceeded the typical architect's duties during design and construction today.

Turner Construction suited the profile both Harvard and SBRA had defined. As one of Boston's bigger and most prestigious construction firms at that time, they had a number of successful projects in their past work.[24] Because both Harvard and SBRA focused on the quality of the construction from the beginning, Turner was not selected through a low bidding process, but as a construction manager at risk, with a guaranteed maximum price (GMP). "The good contractor makes me [the architect] look good, and makes the owner look good," says Tacconi, commenting on the fact that SBRA was not interested in collaborating with the contractor that would offer the cheapest bid, but they were focusing on quality. Gerrit Zwart, from SBRA, rounded up SBRA's philosophy: "If something leaks, they [the owner] will never forget it. If it costs a little bit more, they will get over it."

The choice of Turner offered another big advantage. "In the 70s we used to work with people we knew," Tacconi adds. Indeed, SBRA had worked with Turner Construction in several projects in the past, and each knew the way the other worked. Due to their previous collaboration, a common "vocabulary" had been formed between the architect and the contractor. This was useful especially in the early estimating since the contractor's could anticipate the architect's intentions despite the incomplete information inherent in schematic design documentation, as they were familiar with some of the techniques or elements from previous projects. As a result, there could be less documentation, especially in terms of the construction detail drawings. The past experience of collaboration led to an economy on documentation but also to a better communication between the architect and the contractor, based on a mutual understanding. Thus, instead of leading to change orders and price increases, Turner based the GMP on the intention of the architect, following specific questions, after they studied the drawings. Furthermore, few explanation drawings and requests for information (RFIs) were needed during construction. The chosen project delivery method was a catalyst in achieving this mutual understanding that allowed the contractor to be "honest" in the process and not take advantage of missing information in the construction documents.

The architect considered itself part of the construction. As Zwart says "at that time, the architect designed and was responsible to have the design built." In the Mather House project, the architect considered good construction as his responsibility, reflecting the way the owner faced the architect as his representative. It was SBRA that would justify changes or delays, even if they had mainly to do with the contractor's part of the job. As seen clearly in the correspondence, Harvard was closer to SBRA than to Turner, which means that they took SBRA's commitment as a given, an expected part of the architect's fiduciary role.

Some similarities can be seen to the Richardson-Norcross partnership in the way Tacconi, Smith, and Zwart portray the relationship of the architect with the contractor in the Mather House project. As all three agreed, it was a case where the architect and the contractor together formed a team with common objectives, with a relationship that was far from adversarial. Of course, as in every project, there were problems and change orders; however, the problems were almost always resolved between the two parties and often Harvard did not know about them. Tacconi says: "If you are smart, you don't want the owner to get in these conversations."

However, one gets the complete picture when one looks at the owner. When a new project was planned at that time, Harvard approached its own architect, and SBRA enjoyed that position. Similarly, it approached the few contractors it was working with and negotiated construction management contracts. The teams were not based on low cost bidding but rather on relationships, past performance, and expectations of quality. As Smith points out "The close relationship between the architect and the builder was paralleled by a close relationship between the owner and the architect. The latter assuring the contractor that the architect could speak for the owner and the former assuring the owner that the architect could speak for the contractor and thus assure the quality and costs of the project."

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[24] Turner today is the biggest contractor for buildings in the USA, having 2% of the market. Turner was a pioneer of the construction management project delivery method and was bought in 2001 by the German firm Hochtief.

Looking at the same architectural firm, the same contractor, and the same owner 35 years later, one can observe the changes in relationships, both between the owner and the architect and also between the contractor and the architect. Putting the relationship between the owner and the contractor on a different ground than at the Mather House case, together with, and the gradual marginalization of the architect, seem to be the leading sources of issues. When Zwart was asked to comment on the impact of these changes, he chose to address the strong presence of litigation risks and the diminishing role of craftsmanship: “I hate the lawyers and I miss the carpenters,” he laconically pointed out.

ii. the Hotung International Law Center

The Hotung International Law Center Building, a law center and fitness facility, was the first building complex that SBRA worked for the Georgetown University in Washington DC. Although the University is known to be “faithful” to firms that they had successfully collaborated in the past, as Buddy Mear, SBRA’s project manager on the Law Center states, it chose to make a shift on this project and look for an architectural firm they had not worked together before. The University interviewed a series of architects based on qualifications, before making the decision to select SBRA. The University also chose from the beginning Whiting-Turner as construction manager. Whiting -Turner had completed several projects in the past for Georgetown University. In addition, the University wanted SBRA to work with a local architect, Ellerbe Architects, with whom the owner had also worked in the past. SBRA and Ellerbe would share the production of the documents, with SBRA being the leading architect. The fee for the project was negotiated after SBRA got the job.

SBRA produced the architectural drawings with attention on precision and detail. Ellerbe produced the structural engineering and MEP drawings, as well as certain details based on schematic drawings provided by SBRA. As for the quantity of documentation, Mear states that the documentation provided by the architect was very detailed, quite different than both the Sever Hall and even the Mather House. Mear believes that producing fewer drawings means leaving design decisions to someone else. He spires to James Stirling’s philosophy, with whom he had worked in the past, which is to draw all visible surfaces.

As Mear recollects, the relationship with Whiting Turner was based on mutual respect. Both firms acknowledged and approved the working strategy of the other, and the relationship was based on professionalism: the responsibilities of each party were clearly defined, and the information about the process during the design phase was communicated in the meetings. The construction manager was part of the project team from inception, and provided continuous input on design, materials, and systems throughout the design process.

At the end of the design phase, the cost estimation done by the construction manager revealed the project was 10% above budget. In collaboration with the construction manager, SBRA made slight modifications to the design to meet the budget. Whiting Turner’s contract was converted to be the construction managers at risk. The relationship of respect was tested when problems arose at the construction site. Such an instance was the product of incomplete technical documentation. Clear definition of everybody’s duties was essential for the successful outcome.

Mear observes that “it is in SBRA’s culture to take the lead during of the project and provide high quality service to the owner.” When the University’s project manager withdrew because of health problems, more work was required by the SBRA project management team. SBRA for this project wanted to establish a good relationship with the owner and the contractor, and that was an additional incentive to provide more services than the ones originally agreed.

Mear characterizes the Georgetown Law Center as a “typical project in terms of the relationship with the client and the contractor.” After the completion of the project, a trustful relationship was formed with the client, similar to the one SBRA used to have with Harvard. Comparing the former SBRA projects that the company did for Harvard, Mear notices that nowadays the risk of liability is different than it used to be in the ‘70s or earlier. According to him, changes in the profession and the relationships between the architect, contractor and owner have not been dramatic at SBRA, because the firm keeps the profile it used to have almost since the beginning of the firm’s formation: that is, a respectable firm that pays much attention to its partners and its collaborations, that always wants to provide very good services to the client.

4. Conclusions

The analysis of the four projects is quite insightful in the evolution of the relationships among architects, contractors and owners. However, this evolution is not quite linear among the 4 projects, especially between Sever Hall and Eliot House. Sever Hall stands apart with very different relations and documentation processes, while the other 3 projects follow a continuum of a gradual development with expected variations as opposed to dramatic changes. Unfortunately the lack of archival information for the Eliot House project does not allow a thorough analysis as the ones performed for the other three projects.

i. Architectural Practice

It is evident in the four projects that the profession of the architect has undergone significant changes. In the first three cases, the architect was very committed to the project during the construction phase and maintained a constant dialogue and collaboration with the contractor. In the Georgetown project, however, the role of each group – architect and contractor- is more clearly defined and the interaction is more formal. The interests of the two sides have gone apart. At the Sever Hall and Mather Hall cases, we see the architect and contractor form one team with the same goals. In contemporary projects, the architect differentiates clearly his position from the contractor. Gradually the architect distances himself and his role in the project during construction and focuses more at the design phase.

ii. Professional Relationships

Looking at the relationship of the architect with the contractor and the owner, from the '60s till now, Smith observes that until the Mather project, we can see a close relationship between the owner and the architect and between the architect and the contractor. The architect, as is obvious in the Mather project, is the 'representative' of the owner and also has the role of the 'connective bond' between the contractor and the owner. The close relationship between the contractor and the architect assured the quality of the project.

At cross-roads of increased construction costs and the more than ever separation of the architect from the contractor, as well as increased litigation, cases like the partnership at the Sever Hall project can make us think about how such a situation can be achieved nowadays. Steve Erwin, principal of SBRA, notices: "Today's landmark buildings are most often highly integrated constructions that are a result of a thoroughly collaborated enterprise. The current pendulum swing is recognizing the value in a seamless integration of owner, architect and builder interests." The proper use of computers for the documentation and the new ways of circulating information could be the hint for a redefinition of the relationship between the architect and the contractor.

Thinking about the relationships between the people involved in the four projects, each leads to interesting observations. Sever Hall could be used as a case study to reconsider relationships, as *Construction Management at Risk* or *Bridging* may be the closest we know today to the Richardson-Norcross ad-hoc partnership. Eliot, Mather and the Law School could be used to consider how such relationships could have worked. Mather House shows that a collaboration between two trustful firms, SBRA and Turner that had worked together in the past, could lead to a relationship relevant to the Richardson and Norcross partnership. At the end of the day, good collaborations always reflect on the projects, either as cost benefits or as a better quality for the project.

iii. Risk Management

The atmosphere of trust, collaboration, and appreciation that existed in projects such as in the Sever and Mather Hall, do not seem to be as strong in more recent projects, such as in the Georgetown case. Smith observes an attitude of lack of trust in recent projects that derives from the fact that the owner is uncertain about the ability of the architect and the contractor to meet the construction budget. Smith continues to say that a close relationship between the architect and the contractor is not at all welcome by the owner, who may see it with suspicion. He then concludes that in his attempt to better manage the costs and schedules of the work, the owner begins to form a closer relationship with the contractor.

"The litigious atmosphere and the increasingly litigious concerns tend to dilute and legally eliminate the responsibilities of the architect", notices Smith, bringing up the subject of liability issues and insurance. When one views all these issues from a risk management viewpoint, he or she should at least be skeptical to where the profession is heading. For sure, litigation and insurance is not a means to mitigate risks. There is an old Chinese proverb where one emperor made the whole litigation process so hard, cumbersome and time-consuming, so as to prevent people from going to courts for every single dispute. Moreover, insurance's main role is to protect against "acts of God", events one cannot prevent or handle. Insuring construction costs overrides and technical errors protection isn't, or at least was not in the past the primary role of insurance firms in the building industry. A basic concept in the risk management framework is that risks should be attributed to the party most capable in managing them.

Looking back at the four case studies examined, the evolving and changing nature of risks in the profession is evident. Risk is not simply viewed as a natural catastrophe, but is also hidden in the inter-dynamics of the delivery process. Conflicting interests, changing technology, declining operating margins and a risk-averse and over-protective attitude signaled by tomes of documentation could well be some of the major reasons for the everyday problems encountered in the once noble profession delegated to the formation of the environment we live in.

iv. Computer Aided Design as a changing factor of Documentation

Fasano comments on the bridging of the design and construction process and suggests new digital tools as the changing factor. He mentions "There is a great interest in the 'interoperability' of the design and construction process. Owners are realizing that they are paying twice for the production of the design and construction drawings. The axiom 'measure once, cut twice' should apply to the use of CAD as more and more building components are fabricated using digital information."

The way digital technology should be used is the critical issue that will affect both the relationships of the people involved but also the design and construction process per se. Computers today are used to produce 2D drawings faster and, as a result, in large quantities. However, one should question the basics and re-deploy computers to solve the problem of over-documentation as opposed to use them for multiplying the existing spill-out of information. Gerrit W. Zart, former partner and currently a consultant in SBRA, is skeptical about the efficiency of today's representational methods and tools: "The biggest change has been the method of producing documents: word processing for specifications and CAD for drawings. There has not been a big change in the content of the architectural drawings produced. However, there has been a significant quantity of added documents. This has mostly been in the form of repetition on and of the same information at different scales, often just because such drawings can be reproduced with very little incremental effort. This added information can have the unforeseen drawback of diluting and making it more difficult to focus on, or find the most important drawing information."

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Appendix A
Sever Hall: An Early Project

Sever Hall

Sever Hall at Harvard University is the first of more than 120 building projects designed by the firm for Harvard University. Robert Venturi says: "Sever Hall at Harvard by H.H. Richardson is my favorite building in America."[25] Completed in 1880, Sever Hall (pronounced to rhyme with beaver) is an undergraduate classroom building with flexible classrooms, a 300-seat lecture hall, exhibition galleries, and a large examination room, which later became a fine arts museum and studio. Containing approximately 66,000 sqft in 3½ floors, Sever Hall is located in Harvard Yard and is a designated National Historic Landmark. The building was given the Louis Sullivan Award by the American Institute of Architects in 1977.

James Warren Sever (1798-1871) left a bequest of $120,000 to Harvard for the building and library, and another $20,000 unrestricted bequest, all of which was conveyed by his widow in 1878. On April 29, 1878, Harvard appointed a building committee which included Edward W. Hooper and John Quincy Adams, the grandson of US President John Quincy Adams, to build Sever Hall, and selected H. H. Richardson as architect.[26]

Constructed of red brick with Longmeadow sandstone details on the facade and a red tile roof, the building has relatively simple ornamentation. However, by some estimates, the cut and molded brick detailing incorporates as many as 60 different shapes of brick. The low arch of the main entrance is a Richardson signature design element. Interestingly, this arched opening functions as a "whispering gallery." When a person whispers toward one side of the arch, the sound will be audible to someone listening on the other side.

Construction Time and Cost

Richardson received the commission to design Sever Hall in October 1878 and construction began in May 1879. The building was completed in the Fall of 1880.

The cost of the construction was $110,000, not including expenditures for furniture and equipment.

Architect

Sever Hall was the first of more than 120 buildings, additions and renovations H. H. Richardson completed for Harvard. Richardson was 36 years old when he received the commission from Harvard. He had no partners and his architectural practice has been compared to the ateliers of the Beaux-Arts, " not an office in the present sense, but an atelier where one lived and thought and the hours did not count." Richardson designed the buildings and supervised construction, leaving the office management to his head draftsmen. Richardson had a succession of head draftsmen who produced working drawings and managed the office, among them Charles McKim and Stanford White, later cofounders of the New York architectural firm of McKim Mead and White.[27]

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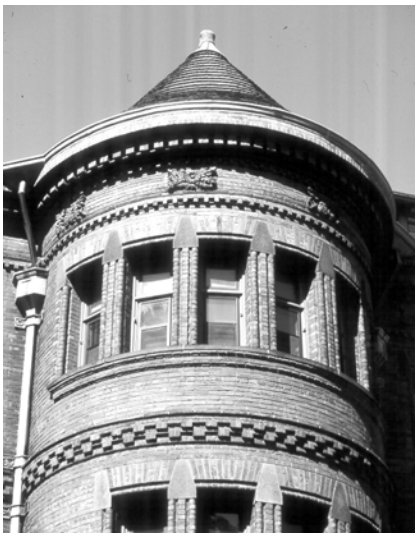
25 Robert Venturi, *Architecture as Signs and Systems for a Mannerist Time*.

26 Jefferey Karl Ochsner. *H. H. Richardson Complete Architectural Works*. Massachusetts Institute of Technology, Cambridge, MA. 1982. p. 196.

27 Mary N. Woods. *From Craft to Profession: The Practice of Architecture in Nineteenth-Century America*. University of California Press. Los Angeles, 1999. p. 106.

Richardson participated in every aspect of his practice. He was personally involved in all facets of his architecture - design, construction, and led the firm. He encouraged his assistants to do likewise. The emphasis in the office was that of collaboration. The team approach to projects characterized Richardson's office, and the atelier was the heart of his practice. Richardson's practice was that of a generalist - one man led the firm and made most of the decisions.[28]

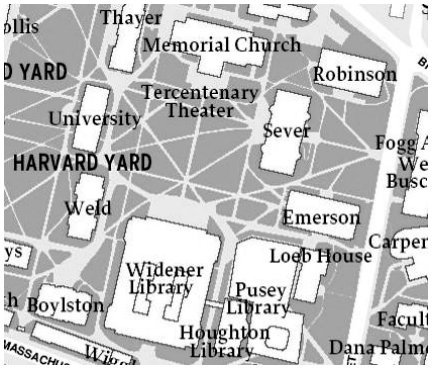
Richardson was the leading architect in the country at the time of his death in 1886. However, in his last year, " he hardly touched a pencil." After Richardson's death in 1886, the atelier approach was replaced with a more functional organizational structure. Design was taken over by G. Shepley, Charles Rutan became the firm's engineer, and Charles Coolidge assumed the management duties of the office.[29]



Sever Hall

Richardson's office was located in his home in Brookline, Massachusetts, a suburb of Boston. It was not a large office, probably never exceeding about 20 employees. An 1886 photograph of Richardson's office shows 18 members of "the staff." The office contained 9 "alcoves" for draftsmen, an exhibition room, a room for special projects, and Richardson's personal office and library. [30]

Although no record was found of the fee paid for designing Sever Hall, Richardson was known to have normally charged from 6% to 8% of the construction cost, compared to the 5% fees charged by most architects at the time. No record was found of the owner-architect agreement, the contract for construction, or the original specifications, if they existed. However, the 25 page specifications, contract, and conditions for Trinity Church have survived, and it is assumed Richardson would have used similar documents for Sever Hall. Charles Rutan, later promoted to chief engineer, may have provided the engineering work on the project. No information was found regarding any other engineer or consultant that might have been employed by Richardson for this project.



Sever Hall Site

Richardson was personally involved in the construction phase of his projects. Supervision of construction was a normal part of his basic services. He made monthly trips to visit construction sites that were out of town, and he frequently made changes to his design during construction. Richardson thought of his buildings more like sculptures stated, "An architect's revisions should never end until his building is in stone and beyond recover."[31] However, Richardson was not particularly interested in the technical aspects of construction. "He left problems of construction to his builder, Norcross Brothers, or Rutan, who trained himself as the engineer of the office."[32]

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[28] Illustrative of the transition to be found in later practices, SOM was a firm of specialists, a firm that made the transition from collaboration to division of labor.

[29] Spiro Kostof, Ed. *The Architect: Chapters in the History of the Profession*. University of California Press. Berkeley, CA, 1977. p. 312, 316

[30] Heskel, Julia. *Shepley Bulfinch Richardson and Abbott: Past to Present*. Published by the firm. Boston, 1999. p.14.

[31] Van Resselaer, Marina Griswold. *Henry Hobson Richardson and His Works*. Reprint Edition. Dover Publications. New York, 1969. p.119.

[32] Hitchcock, Henry-Russell. *The Architecture of H. H. Richardson and His Times*. Archon Books. Hamden, CT, 1961. p. 17.

Contractor

O.W. Norcross

The contractor was Norcross Brothers of Worcester, Massachusetts, a firm that subsequently became one of the largest and most successful general contractors in the United States. The names of the subcontractors are not known. Norcross Brothers was headed by Orlando Whitney Norcross. Trained as a carpenter, O.W. Norcross headed the firm and was chiefly responsible for cost estimates and supervision.. His brother James Norcross was the office manager and handled the firm's finances.

O.W. Norcross built most of H. H. Richardson's buildings. They shared similar ideas and developed a symbiotic relationship – Richardson the designer and artist, Norcross the builder, self-taught engineer and innovator. Before founding his company with his brother, O.W. Norcross had gained important experience working on large-scale bridges and roads for the Union army. He was also an inventor, eventually obtaining patents for new fireproofing materials and reinforced concrete slabs. Richardson relied heavily on Norcross. O.W. Norcross consulted with Richardson on materials selections, structural systems, cost and finances, and methods of construction. Their relationship began with Trinity Church with Norcross, a 33 year old practical-minded, self-taught engineer, and Richardson, a 30 year old Harvard educated rising young architect. Their close working relationship continued until Richardson's death in 1888.

Unlike many contractors, the Norcross brothers provided both materials and labor on their projects, and the brothers owned their own brickworks, timber mills, iron foundries, and stone quarries from Maine to Georgia.

Norcross Brothers was much more than a contractor as we know them today. The firm was an active participant in both the design and construction processes, which probably explains why Richardson produced so few construction drawings to build Sever Hall. Norcross Brothers may have supplemented Richardson's drawings with those made by its own draftsmen. Glenn Brown, who worked for Norcross, described the contractor's role on another Richardson project as "a working branch" of Richardson's office. Brown commented that Richardson ignored the more practical aspects of construction in favor of his artistic goals, and suggested that Norcross Brothers acted as Richardson's "collaborator," responsible for translating " Richardson's ideas into reality." Norcross employed draftsmen to prepare the working drawings needed to supplement the architect's drawings.[33] It seems certain that Norcross filled the gap between Richardson's design ideas and the practicality of construction on Sever Hall by providing additional working drawings, which reduced the number of construction drawings Richardson was needed to produce.

Documentation

The original construction drawings are housed in the H. H. Richardson collection at Houghton Library on the Harvard campus. A total of 30 drawings are in the Collection, 11 of which are designated "working drawing - contract documents" and are signed by the contractor and members of the building committee. (Appendix A.) These working drawings were made by hand using pen and ink on paper, with watercolor washes added to illustrate the various building materials. Unlike working drawings of today, the Sever Hall working drawings are devoid of all but the most sparse notation. The floor plans contain major dimensions and some notes. The elevations and sections have neither dimensions nor notes regarding materials.

Blueprinting had not become widely used at the time Sever was designed. Copies of architect's drawings were usually made by photolithography or by tracing the original drawings. The originals were either kept in the architect's "contractor room" or given to the contractor, with the architect keeping the traced copies. The original colored drawings were mounted on linen and kept in the architect's office during the

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[33] Mary N. Woods. *From Craft to Profession: The Practice of Architecture in Nineteenth-Century America*. University of California Press. Los Angeles, 1999.

construction process. This appears to be the case with the Sever Hall working drawings. It should be noted that three other Richardson projects commissioned shortly after Sever Hall had more drawings. Richardson produced 148 drawings for the Cincinnati Chamber of Commerce Building, possible 96 of them used to construct the building. For the Austin Hall project at Harvard, 250 drawings were produced. Of these, about 64 may have been working drawings.

As projects became more complex in the last half of the 19th century, more working drawings were required to construct them. In 1846, architect Richard Upjohn produced just 10 sheets of drawings to build Christ Church in Raleigh, NC. These drawings included plans, elevations, sections, and full-size details. In 1894, the architect of Union Station in St. Louis produced 165 sheets of working drawings for that building. The architect of the University of Pennsylvania Law School produced an initial set of 26 sheets of working drawings, and then subsequently produced 321 additional sheets of drawings to construct the building, many of which were full-size details.

Working drawings sheet sizes varied during this period. For example, for the Denver Post Office and Court Building, designed in 1900, the architect used 48" x 60" sheets. For the Missouri State Capitol building, completed in 1914, the architect produced the working drawings on sheets that measured 60" x 84" which, according to accounts, were so large that they had to be transported in wheel barrows and tradesmen tore off pieces of the drawings they needed for their work.[34] There was no standard approach to the production of the documents for construction in the turn of the 19th century.

Summary Information of Sever Hall

Sever Hall[35]		**Remarks**
Completion Date	1880	Often erroneously reported as 1878
Approximate Building Area	66,335 sqft	
Construction Cost	$110,000	
Cost Per Square Foot	$1.66	
Number of floors	3.5	
Sheets of Construction Drawings	11[36]	
Contractor	Norcross Brothers	

Sever Hall Drawings

No.+	Title	Type	Method/Media/Size	Scale
SH D3	Sketch for roof and dormers	design drawing	Ink on tracing paper	
SH D1	Sketch for roof and dormers	design drawing	Ink on tracing paper	
SH D2	Sketch for roof and dormers	design drawing	Ink on tracing paper	
SH E1	Stair balusters	design drawing	Graphite on tracing paper	
SH E2	Stair balusters	design drawing	Graphite on tracing paper	

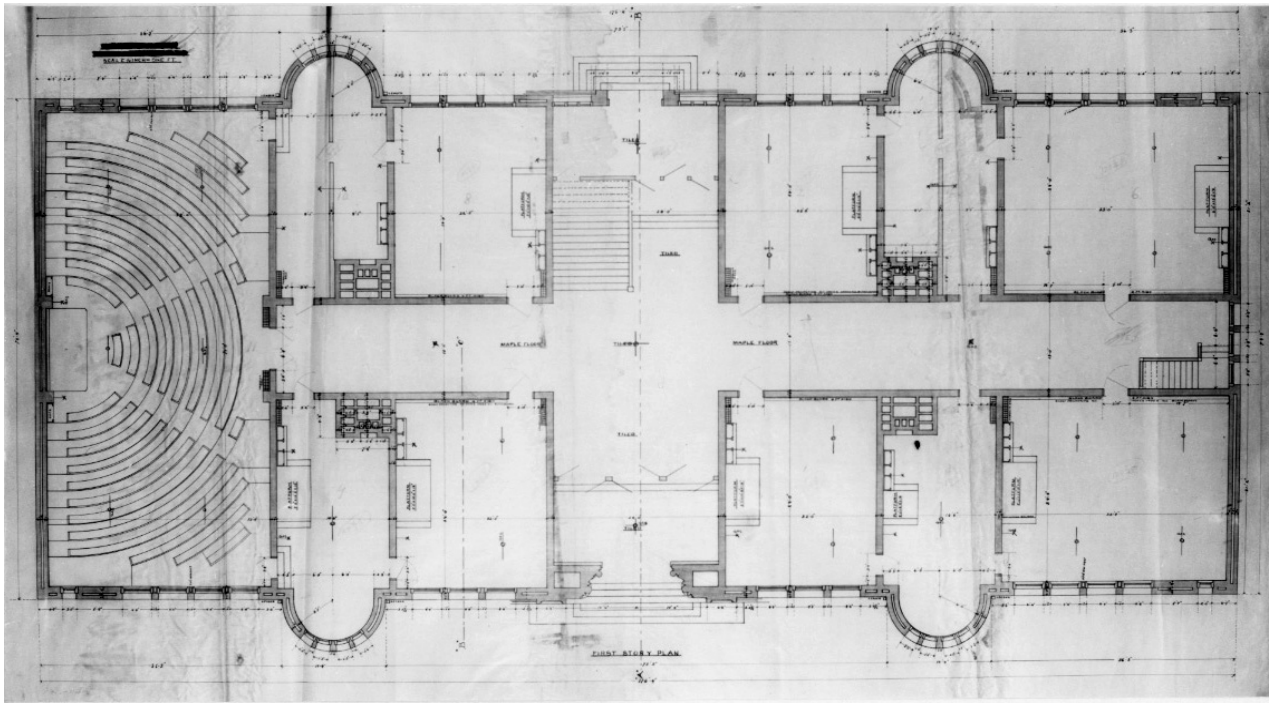
[34] Elliott, Cecil D. *The American Architect from the Colonial Era to the Present*. McFarland Company. Jefferson, North Carolina, 2003. p. 105.

[35] Some of the above figures were taken from a typewritten data card found in the H. H. Richardson files at SBRA, 2005.

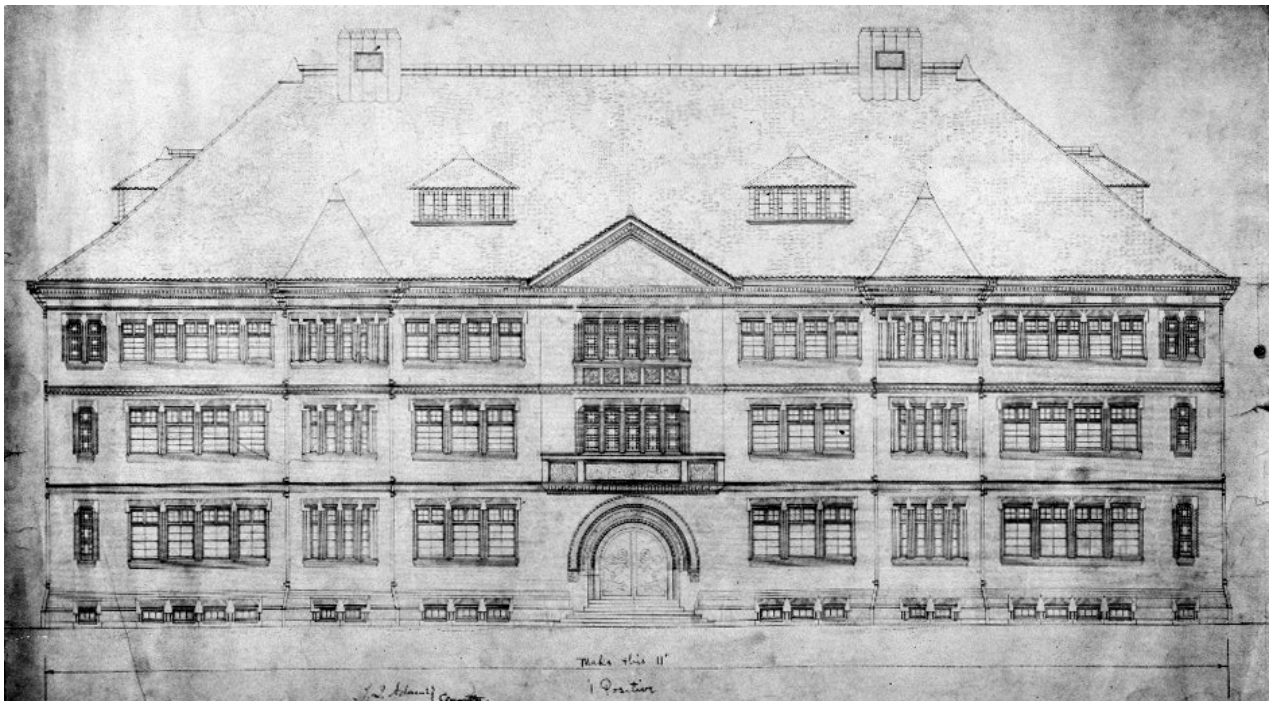
[36] A total of 30 drawings of Sever Hall are housed in the Richardson Collection of Houghton Library at Harvard University. Of those drawings, only 11 appear to be construction drawings, each being signed by the contractor and the Harvard Building Committee. The remaining drawings are preliminary sketches or presentation design drawings.

No.+	Title	Type	Method/Media/Size	Scale
SH B1	West elevation (design not carried out)	working drawing	Ink, colored ink on paper mounted on linen	1/4" = 1'-0"
SH B2	West elevation (as carried out)*	working drawing / contract drawing	Ink, colored ink, crayon on paper mounted on linen	1/4" = 1'-0"
SH B9	Principal elevation	working drawing	Ink on tracing cloth	1/4" = 1'-0"
SH B3	North elevation*	working drawing / contract drawing	Colored ink, ink, graphite on paper mounted on linen	1/4" = 1'-0"
SH B6	North elevation	working drawing	Ink on tracing cloth	1/4" = 1'-0"
SH B4	East elevation*	working drawing / contract drawing	Ink, colored ink, crayon, graphite on paper mounted on linen	1/4" = 1'-0"
SH B8	East elevation	working drawing	Ink on tracing cloth	1/4" = 1'-0"
SH B5	South elevation*	working drawing / contract drawing	Ink, colored ink, crayon on paper mounted on linen	1/4" = 1'-0"
SH B7	South elevation	working drawing	Ink on tracing cloth	1/4" = 1'-0"
SH C1	Longitudinal section*	working drawing / contract drawing	Ink, watercolor, colored ink on paper mounted on linen	1/4" = 1'-0"
SH C2	Section*	working drawing / contract drawing	Ink, watercolor, colored ink on paper mounted on linen	1/4" = 1'-0"
SH C3	Longitudinal section	working drawing	Ink, colored ink, watercolor on tracing cloth	1/4" = 1'-0"
SH C4	Transverse Section	working drawing	Ink, colored ink, watercolor on tracing cloth	1/4" = 1'-0"
SH A1	Cellar plan*	working drawing / contract drawing	Ink, colored ink, watercolor, graphite on paper on linen	1/4" = 1'-0"
SH A6	Cellar plan	working drawing	Ink, colored ink, watercolor on tracing cloth	1/4" = 1'-0"
SH A2	First floor plan*	working drawing / contract drawing	Ink, colored ink, watercolor, graphite on paper on linen	1/4" = 1'-0"
SH A7	First floor plan	working drawing	Ink, colored ink, watercolor on tracing cloth	1/4" = 1'-0"
SH A3	Second floor plan*	working drawing / contract drawing	Ink, colored ink, watercolor, graphite on paper mounted on linen	1/4" = 1'-0"
SH A8	Second floor plan	working drawing	Ink, colored ink, watercolor on tracing cloth	1/4" = 1'-0"
SH A4	Third floor plan*	working drawing / contract drawing	Ink, red ink, watercolor on paper mounted on linen	1/4" = 1'-0"
SH A9	Third floor plan	working drawing	Ink, colored ink, watercolor on tracing cloth	1/4" = 1'-0"
SH A5	Attic plan*	working drawing / contract drawing	Ink, colored ink, watercolor on paper mounted on linen	1/4" = 1'-0"
SH A10	Attic plan	working drawing	Ink, colored ink, watercolor on tracing cloth	1/4" = 1'-0"
SH E3	Section through chimney	working drawing	Watercolor, ink, colored ink, graphite on paper mounted on linen	1/4" = 1'-0"

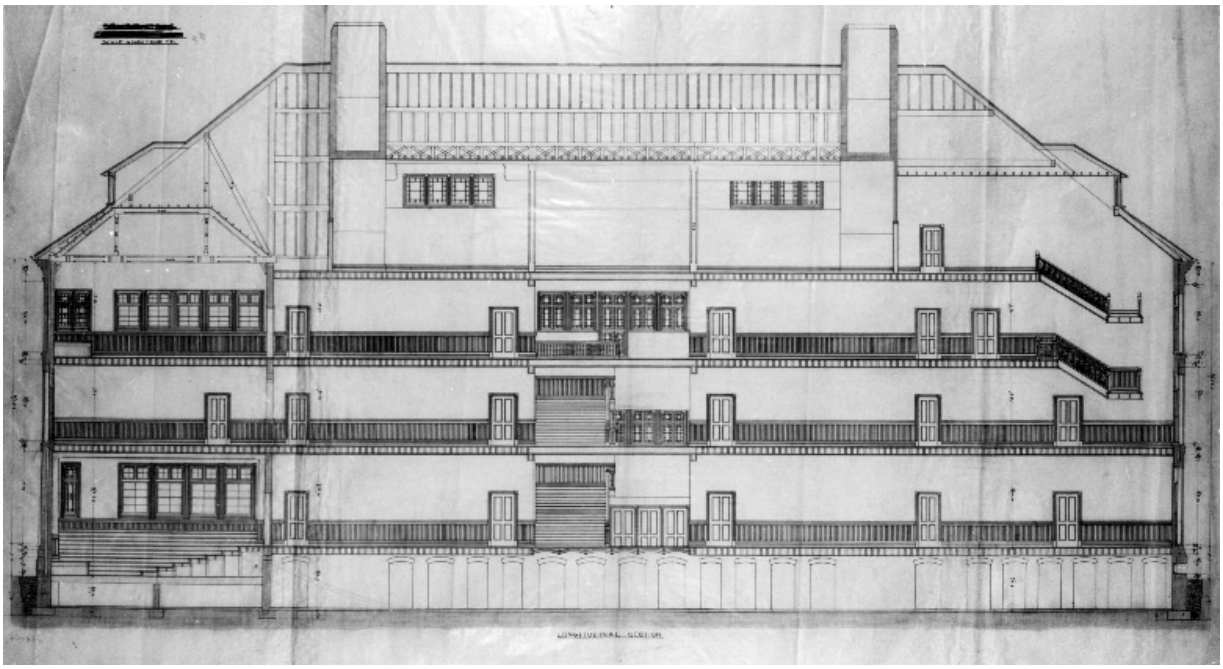
* Indicates construction drawings signed by Building Committee and Contractor.
+ Drawing numbers assigned by Richardson Collection archivists.



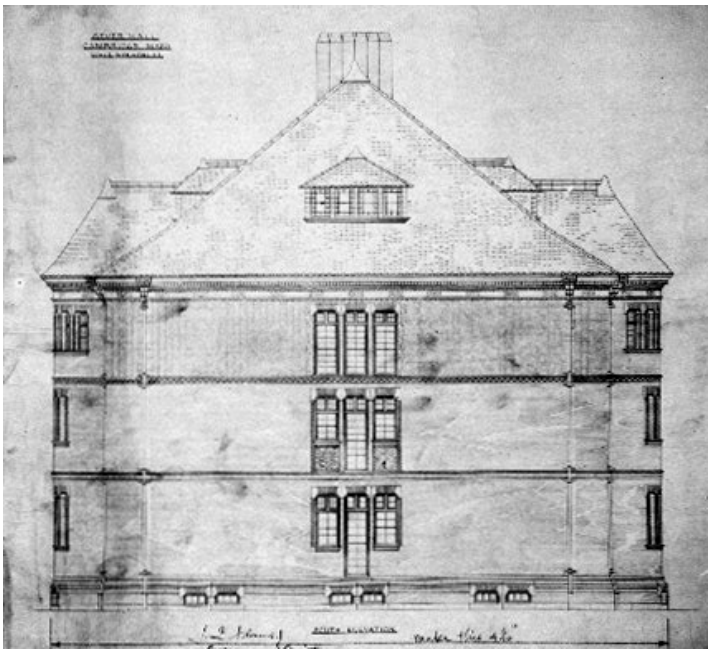
Sever Hall First Floor Plan



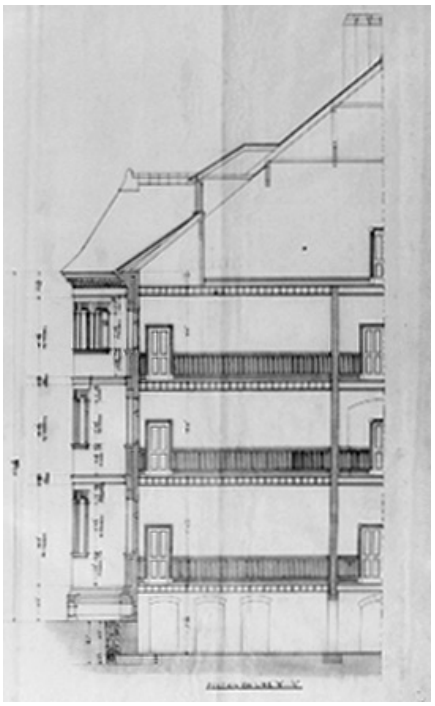
Sever Hall Elevation



Sever Hall Longitudinal Section



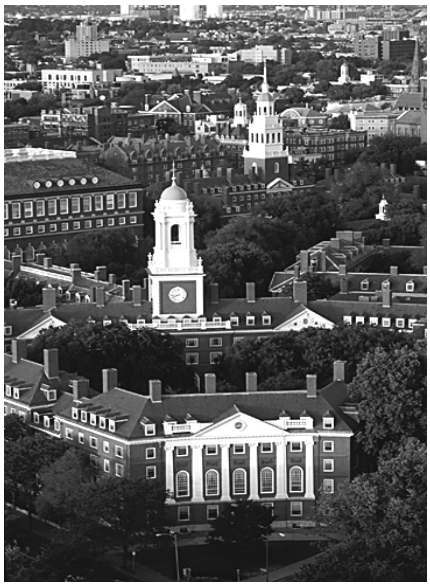
Sever Hall Elevation



Sever Wall Section

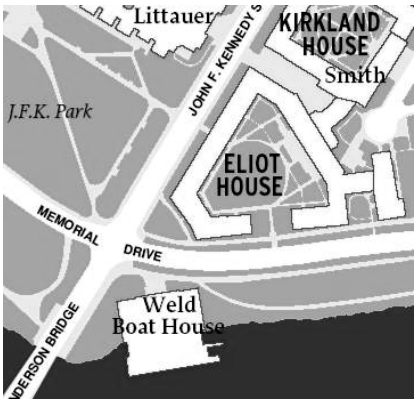
Appendix B
Eliot House: A Depression Era Project

Coolidge Shepley Bulfinch and Abbott (CSBA) designed Eliot House, a men's dormitory named for Charles William Eliot, President of Harvard College from 1869 to 1909. It was opened in 1931 and is one of seven original houses at Harvard. It was commissioned by Eliot's successor, Harvard President Abbott Lawrence Lowell as a part of his plan to " revitalize education and revive egalitarianism at Harvard College." Eliot House was built at a cost of $3 million with funds provided by Edward Harkness. Located on the banks of the Charles River on a site once used for an electric power plant, it is at the intersection of Memorial Drive and John F. Kennedy Street (formerly Boylston Street).



Eliot House

Eliot House was designed in the style of the houses at Oxford and Cambridge. It has three courtyards: the Forecourt, the Great Court, and the Master's Court. The Great Court is hexagonal in shape because of the irregular shape of the site. The building is five stories high on the south and three stories high on east side. The center court was created to allow winter sun into the interior and most of the rooms have a view of the Charles River.[37]



Eliot House Site

The project is a 313 suite, 3 to 5 story high, Men's dormitory building containing approximately 190,711 square feet and providing housing for 294 students plus 19 tutors.

Suites	No.	Total
One-Man Suites	47	47
Two-Men Suites	90	180
Three-Men Suites	21	63
Four-Men Suites	1	4
Total Students		294
Tutors' Suites	19	19
Total Residents		**313**

Eliot House Residences

Construction Time and Cost

Construction commenced in April 1930 and was completed in the Fall of 1931, although the Final Certificate for Payment was not issued until June 1932.

The Architect's Final Certificate for Payment was issued June 10, 1932 and provides the following cost breakdown:

Original Contract Sum	$3,017,375.00	$15.82/sqft
Final Cost of the Work	2,780,162.28	14.58/sqft
Less: Mechanical Trades	379,666.81	1.99/sqft
General Construction Cost	$2,400,495.47	$12.59/sqft

[37] Source: http://www.eliot.harvard.edu/html/history.shtml

Eliot House was completed for less than the contract amount and an unusually large number of working drawings were prepared by the architect. This may be explained by the United States economic conditions at the time. Harvard commissioned CSBA to design Eliot House in the year of the 1929 stock market crash. Construction commenced in 1930, and the building was completed in late 1931. In September 1931 a bank panic spread across the United States and more than 800 banks shut down in September and October, just when Eliot House opened. Interestingly, in 1930 US college students coined the term "rat race" to describe the working environment. By 1932 US unemployment reached 13,000,000, eventually to reach 25% of the workforce, and the US economy was operating at less than half its pre-crash volume. The number of architectural firms in the US declined by 40% between 1928 and 1932 and the firms that remained open were forced to drastically reduce their staffs. By 1932, 85% of architects and architectural drafters were unemployed and, according to F.W. Dodge, construction was just 14% of 1928 levels and new building projects were scarce[38] The "Great Depression" was underway as Eliot House was being designed and constructed.

Architect

Coolidge Shepley Bulfinch and Abbott (SBRA) was the architect of Eliot House. Led by Charles Coolidge with partners Henry Richardson Shepley, Francis Lewis Bulfinch and Lewis Abbott, the firm had a number of notable projects underway in addition to Eliot House, including a new medical school for the University of Virginia and the other six Harkness Houses. Unlike most architectural firms at the time, CSBA actually grew in size and volume during the depression.

The role of the architect during the period was summarized in the Preface to the 1927 Edition of the Handbook of Architectural Practice, published by the American Institute of Architects: "The architect, though primarily an artist, but still the master, either in himself or through others, of all the applied sciences necessary to sound and economic building, sciences that have generated and that attempt to satisfy many of the exacting and complex demands of modern life The architect must play the role of creative artist, sound constructor, professional advisor, business administrator, and fearless judge."[39] Clearly, the role of the architect, at least as posited by the American Institute of Architects, was one of full involvement in all aspects of the building process.

The role of the Architect during construction was described in the Owner-Contractor Agreement as follows: "Work included in the contract is to be done under the supervision of the said architects and their decision as to the true construction and meaning of all plans, drawings and specifications shall be final."[40] The architect's role during construction was further described as: "The Architect shall have general supervision and direction of the work." described in Article 38 of AIA Standard Form A2, The General Conditions of the Contract for the Construction of Buildings, Fourth Edition, copyright 1915-1918-1925 by the American Institute of Architects, The Octagon, Washington, D.C. (10 pages.) The AIA Standard Form of Agreement Between Owner and Architect, Third Edition, copyright 1917-1926, described the architect's role during construction as endeavoring to protect the Owner against defects and deficiencies of the contractor, but noted that the Architect did not guarantee the performance of their contracts. Because the contract for construction was on a cost of the work basis, the contractor's Applications for Payment contained significant supporting material. In addition to the general construction contract, CSBA also separately administered some 19 separate contracts for the purchase and installation of equipment.

Harvard agreed to pay the architect a fee of 6% of the construction cost of $3,017,375, and the fee included the costs of mechanical and electrical engineering services. CSBA provided construction supervision of Eliot House.

Fees normally charged by architects during this period are given in the Handbook of Architectural Practice. The Handbook states that architects' minimum fee for normal architectural services was to be

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[38] Elliott, Cecil D. *The American Architect from the Colonial Era to the Present*. McFarland Company. Jefferson, North Carolina, 2003. p. 154.

[39] *The Handbook of Architectural Practice*. The American Institute of Architects. Washington, DC, 1927.

[40] From a carbon copy of the original owner-contractor agreement in archives of SBRA.

6% of the cost of construction. A fee of 8% to 10% was suggested for residential work, 7½% for churches, and 10% or more for alterations to existing buildings. [41]

Consultants

Three consultants were employed and paid by the architect. No record was found of any drawings or specifications produced by these consultants.

Heating and Ventilating Engineers: Richardson & Gay. Fee basis was 6% of the $118,910 construction cost of heating and ventilating work.

Electrical Contractor and Engineer: Hixon Electric Co. Fee basis was 4.2% of the $112,370 construction cost of the electrical work. A note in the architect's file indicates Hixon Electric Co. was both the electrical engineer and electrical subcontractor on the project.

Plumbing: James A. Cotter Co. Cotter was paid $3,240 for engineering services related to the plumbing work.

Contractor

The General Contractor was Whidden-Beekman Co. of Boston. The Owner-Contractor Agreement was a 15 page, double spaced typed single sided document, printed on legal size paper, and executed November 10, 1930. The agreement provided for a completion date of August 15, 1931. The Contractor's fee was 5% of the final Cost of the Work, not including amounts paid for Mechanical Trades, defined as Plumbing, Heating, Electrical and other mechanical work. The contract sum was based on a Cost of the Work, plus a Fee, with a "Guaranteed Limiting Sum" of $3,017,375. The contractor was obligated to pay all costs above the guaranteed sum. The contract called for the architect to furnish the contractor " 3 copies of scale drawings and one copy of full sized details, this latter to be such as can be blue-printed."

Major Subcontractors

Heating and Ventilating: James S. Cassady Co., contract amount $118,910.00.

Electrical: Hixon Electric Co., contract amount $112,370.00.

Plumbing: James Cotter Co., contract amount unavailable.

Documentation

The professional standard for architectural working drawings the period is found in the then current edition The Handbook of Architectural Practice: "A good working drawing is that which gives the builder exactly the information he needs to build from, no less and *no more.* (Emphasis in original.) It must be clear and clean and simple. It must be arranged in orderly and readable manner on the sheet. It must be accurately drawn, so that scaled measurements will agree with the figures. It must present the essentials and nothing superfluous. It must avoid unnecessary repetitions." The Handbook further instructs that the architect should endeavor to produce complete and accurate working drawings and specifications and "never call upon the contractor to make good the oversights or errors in them nor attempt to shirk responsibility by indefinite clauses." [42]

The architect produced 533 sheets of working drawings for Eliot House. (Appendix B.) Of these, 273 sheets contain full-size drawings, more than 50% of the total number of sheets. The large number of full-

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[41] *The Handbook of Architectural Practice*. The American Institute of Architects. Washington, DC, 1927. p. 14-15.

[42] Ibid, p. 46.

size drawings without doubt contributed to the unusually high number of working drawings sheets produced for this project. It is unclear why the architect adopted this approach, except perhaps, unlike Sever Hall, the contractor did not produce supplemental drawings for the tradesmen. Or it may have been because of the depression. The architect's fee was based on a percentage of construction cost. Additional hours expended to produce more drawings did not increase fee billings to the client. Instead of laying off draftsmen, the firm may have chosen to increase the quantity of drawings to provide work for the staff, hoping for better times, although this must be considered speculation.

All of the Eliot House working drawings were done by hand in pencil on vellum in the style of the day. As was also the practice in some offices, the drawings may have been traced from original pencil drawings and then copied using the "blueprinting" process[43]. The Eliot House working drawings were well-dimensioned and adequately noted, unlike the Sever Hall drawings. However, unlike the later projects, the working drawings list does not provide the details regarding the structural or MEP drawings. These drawings were probably prepared by the consultants and issued separately, the quantity of which is unknown, and their number would have been in addition to the 533 architectural working drawings prepared by the architect.

The architect's specifications contained 135 double spaced, single-sided legal size pages, and contained about 30,000 words. Bound in the specifications was a copy of the American Institute of Architects Standard Form A2, The General Conditions of the Contract for the Construction of Buildings, Fourth Edition, copyright 1915-1918-1925. (10 Pages) There was also one three page addendum issued July 29, 1930. The specifications were reproduced using the same blueprinting process used for the construction documents. The specifications included $274,128 in allowances to be included in the contract sum for items like elevators, dumbwaiters, and equipment.

Tabular Data

Eliot House[44]		**Remarks**
Completion Date	1931	
Approximate Building Area	190,711 sqft	
Construction Cost	$2,780,162	Contract amount was $3,017,375
Cost Per Square Foot	$14.58	
Number of floors	3-5	
Sheets of Construction Drawings	533	Includes 273 sheets of full-size details
Contractor	Whidden-Beekman Co.	

Eliot House Drawings

No.	Title	Type	Method/Media/Size	Scale

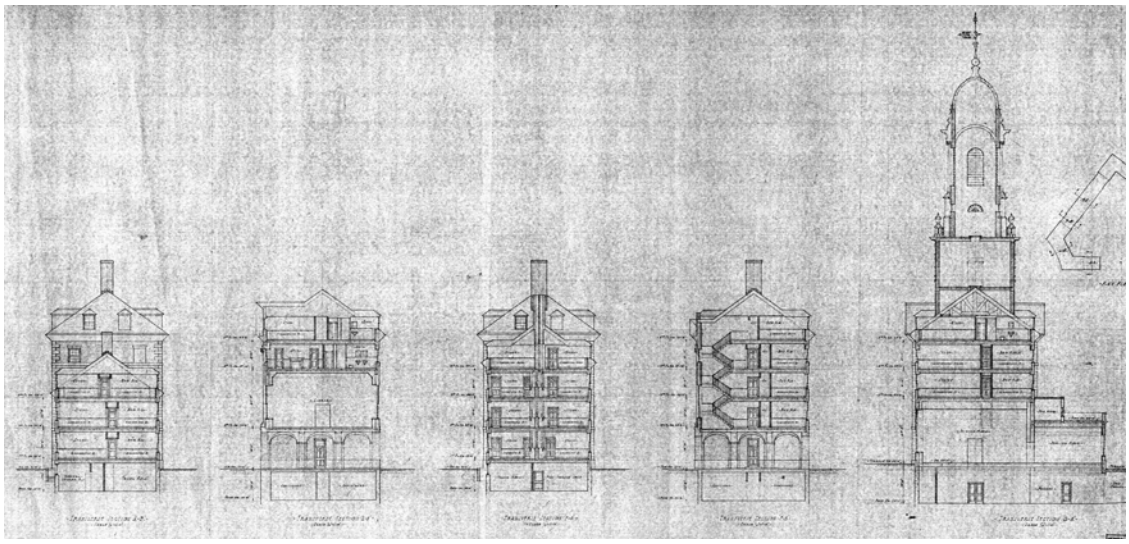
[43] Sir John Herschel, son of astronomer William Herschel, invented blueprinting in 1840. Herschel discovered that paper coated with potassium citrate and exposed to light produced a blue color. By laying a drawing made on translucent paper on top of coated paper and exposing these layers to bright light, a negative print of a drawing could be produced. The drawn lines blocked the light and became white images on a blue field. By the early 20th century, blueprinting machines had been developed to speed up the copying process and blueprinting became the standard method of reproducing architects' drawings for construction. Although the blueprinting process has been replaced by the modern "blueline" or "whiteprinting" process, the term blueprint is still used today to describe architects' construction drawings.

[44] Some of these figures are from a typewritten data card found in the H. H. Richardson files at SBRA.

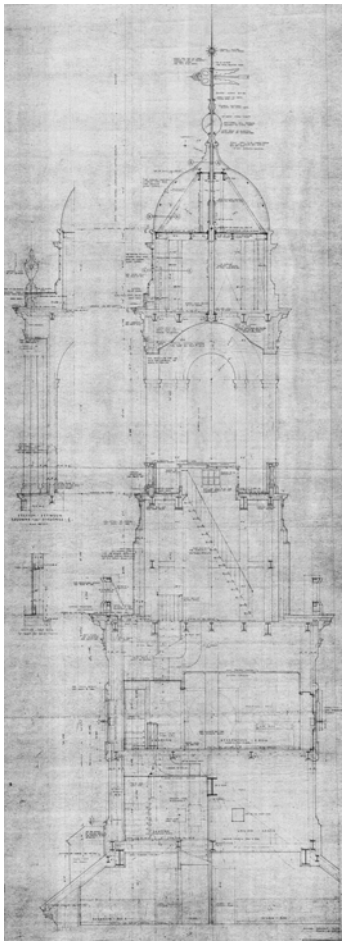
No.	Title	Type	Method/Media/Size	Scale
1	Key Plan	Working Drawing	Hand Drawn/Pencil/30" x 60"	1/32" = 1'-0"
2	Plot Plan	Working Drawing	Hand Drawn/Pencil/30" x 60"	1/16" = 1'-0"
2-A	Studies for Drain in Great Court	Working Drawing	Hand Drawn/Pencil/30" x 60"	1/16" = 1'-0
3	Basement Plan	Working Drawing	Hand Drawn/Pencil/30" x 60"	1/8" = 1'-0"
4	First Floor Plan	Working Drawing	Hand Drawn/Pencil/30" x 60"	1/8" = 1'-0"
5	Second Floor Plan	Working Drawing	Hand Drawn/Pencil/30" x 60"	1/8" = 1'-0"
6	Third Floor Plan	Working Drawing	Hand Drawn/Pencil/30" x 60"	1/8" = 1'-0"
7	Fourth Floor Plan	Working Drawing	Hand Drawn/Pencil/30" x 60"	1/8" = 1'-0"
8	Fifth Floor Plan	Working Drawing	Hand Drawn/Pencil/30" x 60"	1/8" = 1'-0"
9	Tower Plan & Roof Plan	Working Drawing	Hand Drawn/Pencil/30" x 60"	1/8" = 1'-0"
10	Memorial Drive Elevation	Working Drawing	Hand Drawn/Pencil/30" x 60"	1/8" = 1'-0"
11	Boylston Street Elevation	Working Drawing	Hand Drawn/Pencil/30" x 60"	1/8" = 1'-0"
12	Rear Elevations D, E & H	Working Drawing	Hand Drawn/Pencil/30" x 60"	1/8" = 1'-0"
13	East Elevations C & D-H –West H	Working Drawing	Hand Drawn/Pencil/30" x 60"	1/8" = 1'-0"
14	Details & Sections Thru Areas	Working Drawing	Hand Drawn/Pencil/30" x 60"	3/4" = 1'-0"
15	Court Elevations of B, C & F	Working Drawing	Hand Drawn/Pencil/30" x 60"	1/8" = 1'-0"
16	Sections	Working Drawing	Hand Drawn/Pencil/30" x 60"	1/8" = 1'-0"
17	Serving Room	Working Drawing	Hand Drawn/Pencil/30" x 60"	1/4" = 1'-0"
18	Wall Section – 5 Story Bldg.	Working Drawing	Hand Drawn/Pencil/30" x 60"	3/4" = 1'-0"
19	Wall Section – 4 Story Bldg.	Working Drawing	Hand Drawn/Pencil/30" x 60"	3/4" = 1'-0"
20	Wall Section – 3 Story Bldg.	Working Drawing	Hand Drawn/Pencil/30" x 60"	3/4" = 1'-0"
21	Typical Fireplaces	Working Drawing	Hand Drawn/Pencil/30" x 60"	3/4" = 1'-0"
22	Stair Detail	Working Drawing	Hand Drawn/Pencil/30" x 60"	3" = 1'-0"
23	No drawing title			
24	Stair Details	Working Drawing	Hand Drawn/Pencil/30" x 60"	1/4" = 1'-0"
25	Stair Details	Working Drawing	Hand Drawn/Pencil/30" x 60"	1/4" = 1'-0"
26	Double Hung & Single Hung Sash; Bsmt Windows	Working Drawing	Hand Drawn/Pencil/30" x 60"	Full Size
27	Window Frame	Working Drawing	Hand Drawn/Pencil/30" x 60"	Full Size
28	Door Schedule	Working Drawing	Hand Drawn/Pencil/30" x 60"	3/4" = 1'-0"
29	Door Schedule	Working Drawing	Hand Drawn/Pencil/30" x 60"	3/4" = 1'-0"
30	Niche for Fire Extinguishers	Working Drawing	Hand Drawn/Pencil/30" x 60"	1½" = 1'0"
31	Excavation Plan Showing Basement Grades	Working Drawing	Hand Drawn/Pencil/30" x 60"	1/16" = 1'-0"
32	Trunk Rack & Wood Lockers	Working Drawing	Hand Drawn/Pencil/30" x 60"	Full Size
33	1st & 3rd Floor Bath Rooms	Working Drawing	Hand Drawn/Pencil/30" x 60"	1/4" = 1'-0"
34	2nd & 4th Floor Bath Rooms	Working Drawing	Hand Drawn/Pencil/30" x 60"	1/4" = 1'-0"
35	Basement & 5th Floor Bath Rooms	Working Drawing	Hand Drawn/Pencil/30" x 60"	1/4" = 1'-0"
36	Revision of 5th Floor Bath Rooms	Working Drawing	Hand Drawn/Pencil/30" x 60"	1/8" = 1'-0"
37	Dormer Window	Working Drawing	Hand Drawn/Pencil/30" x 60"	Full Size
↓	↓	↓	↓	↓
↓	↓	↓	↓	↓
↓	↓	↓	↓	↓
533	Special Cupboards, Fellows Dining Room.	Working Drawing	Hand Drawn/Pencil/30" x 60"	Full Size
			Total	**533**

A sample of the architectural working drawings shown. Other drawings similar. 273 of the drawings are full size details that today would be produced by the contractor and subcontractors as shop drawings.

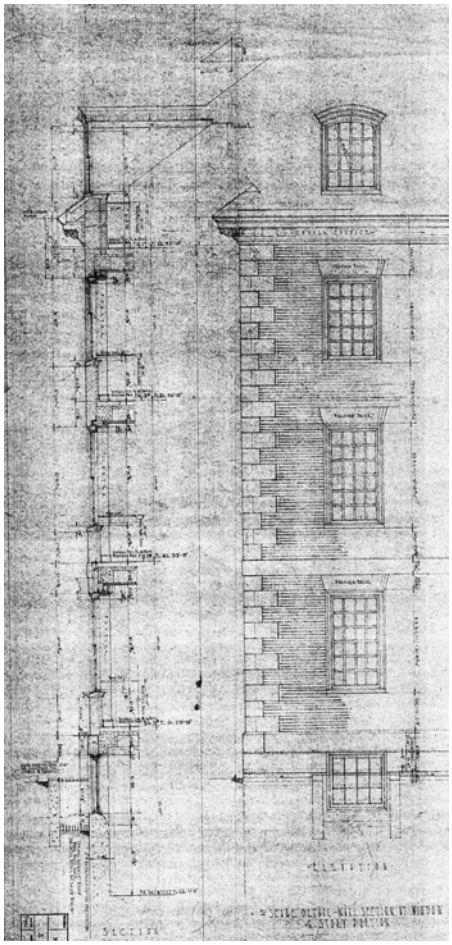
Eliot House Sample Working Drawings



Eliot House Building Section



Eliot House Tower

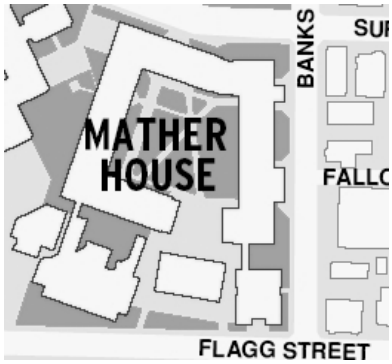


Eliot House Wall Section

Appendix C
Mather House: A project of the 1970s

Mather House

Located at 10 Cowperthwait Street in Cambridge, MA, Mather House is composed of two buildings: The Low-rise building surrounds a courtyard which provided entry to the Dining Hall, house offices, classrooms, the Junior Common Room, Senior Common Room, other common areas, and student and tutor suites. The Tower contains student and tutor suites, all of which have a view of the Charles River and downtown Boston. The building contains approximately 230,356 square feet



Mather House Site

The building program for Mather House was prepared by the FAS committee and delivered to Dean Franklin L Ford on September 18, 1964. The site was restricted by Dunster House and Peabody Terrace, thus a high-rise solution was imposed from the beginning. The program required all of the public rooms to be grouped together and the architect chose to arrange these spaces to take advantage of the views and provide a functional link with the Dunster House dining hall.

Construction Time and Cost

Construction of Mather House commenced in April 1968 and was completed in 1972. Mather House was completed at a final construction cost of $8,732,088, almost $700,000 above the estimated cost contained in the Owner-Contractor Agreement.

Residential	**No.**	**Total**
Tower Residences		
Singles	26	26
Doubles	60	120
Low Residences		
Four-Men Suites	40	160
Five-Men Suites	5	40
Six-Men Suites	8	48
1 BR Private Suite	1	1
Total Students		**395**
Additional Residences		
Master's Residence	1	1
Senior Tutor Apt.	1	1
Married Tutor Apt.	2	2
Tutor Apt.	10	10
Guest Suites	2	2
Tutors' Suites	19	19

Mather House Suites

Architect

Mather House was designed by Shepley, Bulfinch, Richardson and Abbot (SBRA) which designed all of Harvard's residential houses. Jean-Paul Carlian was the design architect (the partner in charge), and Bob Tacconi was the project architect, assisted by Mason Smith. The Owner-Architect Agreement used was AIA B131, The Standard Form of Agreement Between Owner and Architect, dated September 1, 1966. The architect was to be paid hourly with a maximum fee of 6½% of the cost of construction. This fee included structural and MEP consultant fees. The architect's compensation was originally to be earned on the basis of 2.5 times direct labor cost, plus $20.00 per hour for principal time, plus the actual cost of consulting engineering fees. However, at the end of the project Harvard subsequently renegotiated the billing multiple to 2.0 times direct payroll and limited the maximum fee to $500,000. Fees for the engineering consultants were $153,000 and were included in the architect's fee. Harvard added the condition that should the architect's hourly compensation be less than the maximum limit, all savings were to revert to the owner.

The role of the architect during construction was described in the Owner-Architect Agreement and required the architect to check and approve samples and shut drawings for conformance with the design concept, and " make periodic visits to the site to familiarize himself generally with the progress and quality of the work and to determine in general, is the work is proceeding in accordance with contract documents. He will not be required to make exhaustive or continuous on-site inspections. To check the quality or quality of the work, and he will not be responsible for the contractor's failure to carry out the construction work in accordance with contract documents." The architect was further required to guard the owner against defects and deficiencies in the work of contractors, and he had the right to condemn work if it failed to meet his interpretation of the contract documents. But this is the standard language contained in AIA document B-131, dated September 1963. Harvard made no modifications to this language. By agreement, Harvard was to take possession of the architect's original construction document tracings one year after construction was complete.

Mather House

Consultants

Four primary engineering consultants were hired and paid by the architect. The fees for engineering consultants was $153,000.

Structural Engineer: LeMessurier Associates, Boston, MA

Heating and Ventilating Engineer: Francis J. Lineham Jr. & Associates, Boston, MA

Electrical Engineer: Norman Associates, Boston, MA

Plumbing Engineer: Robert W. Sullivan, Inc., Boston, MA

Contractor

Turner Construction Company was the general contractor. The Owner-Contractor Agreement was signed on April 9, 1968, and the contract compensation basis was "Cost of the Work, plus a Fee," with a Guaranteed Maximum Price. The contractor's fee was a stipulated sum of $280,000 and the estimated construction cost as $8,070,000 (the fee was 3.47% of the construction cost). The contractor was to receive 25% of any construction savings that it could generate, but that amount was not to exceed an additional 25% of the contractor's stipulated fee. In effect, the contractor was provided an incentive to find less than 4% in total cost savings.

Major Subcontractors

Heating and Ventilating: Bay State York, contract amount $420,865

Electrical: M. B. Foster Electric Co., contract amount $829,710

Plumbing: F. Sullivan Co., contract amount $512.410

Mather House Drawings

Series	Category	Type	Method/Media/Size	Sheets
A	Architectural	Construction Document	Hand Drawn/34" x 48"	95
S	Structural	Construction Document	Hand Drawn/34" x 48"	30
P	Plumbing	Construction Document	Hand Drawn/34" x 48"	35
SP	Sprinkler	Construction Document	Hand Drawn/34" x 48"	7
HV	Heating & Ventilating	Construction Document	Hand Drawn/34" x 48"	30
E	Electrical	Construction Document	Hand Drawn/34" x 48"	37
			Total	**244**

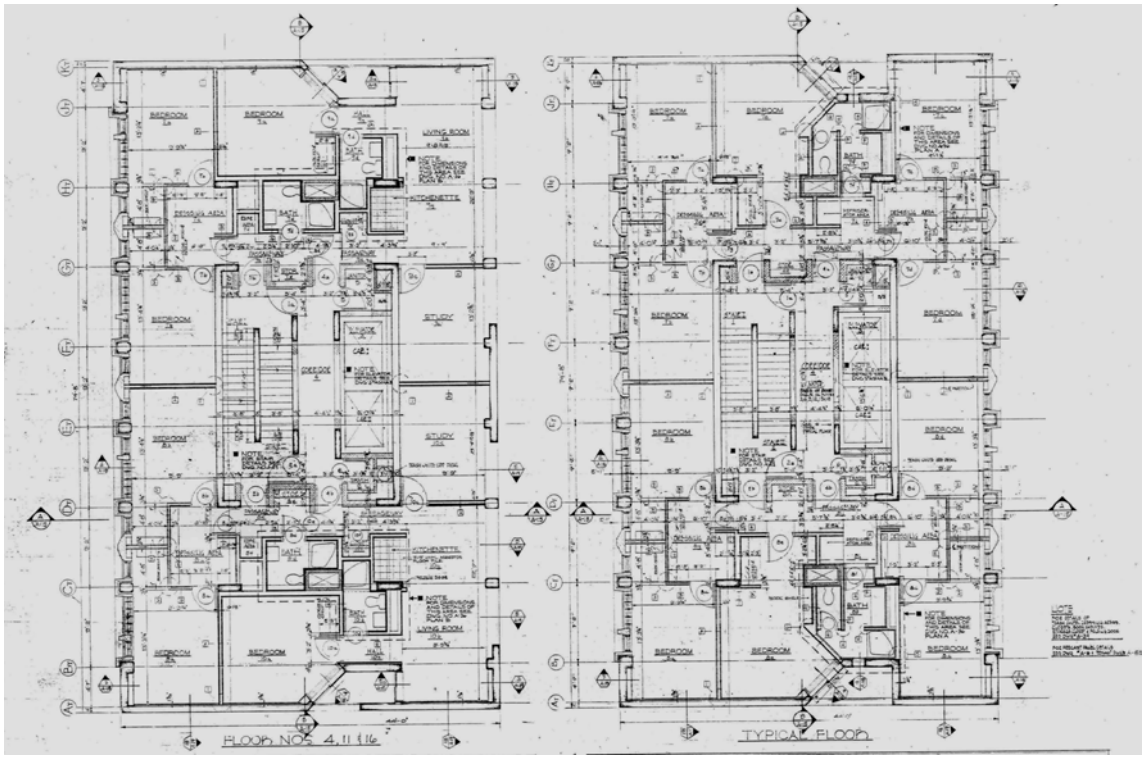
Documentation

All 253 construction drawings prepared for Mather House were hand-drawn. CAD had not yet been introduced at the time. As a point of reference, during the period Mather House was under construction, Ted Hoff designed the world's first microprocessor. In 1972, as Mather House was being completed, Intel introduced its 8008 microprocessor and Hewlett Packard introduced the first hand-held scientific calculator, the HP-35, at a price of $395. It would be ten more years before AutoCAD Version 1.0 was introduced for the personal computer. High technology for production of architectural drawings was still a distant dream for the architect when Mather House was being designed.

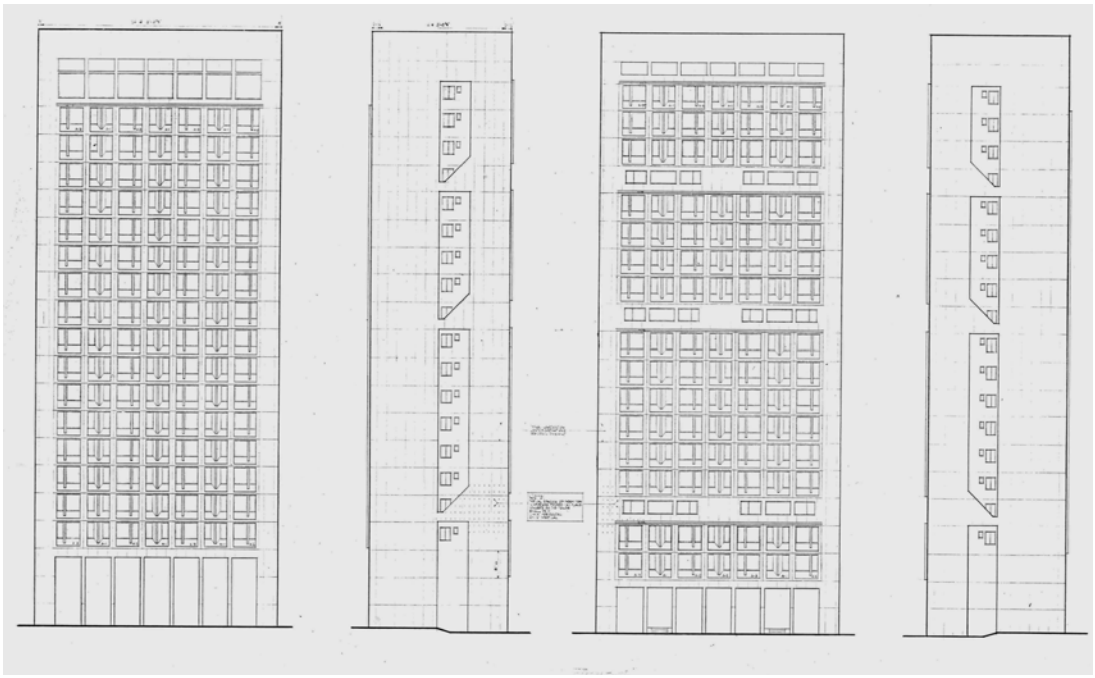
Summary Information for Mather House

Mather House	Data	Remarks
Completion Date	1972	
Approximate Building Area	220,356 sqft	
Construction Cost	$8,732,088	
Cost Per Square Foot	$39.63	
Number of floors	Varies	
Sheets of Construction Drawings	253	Includes consultant drawings
Contractor	Tuner Construction	

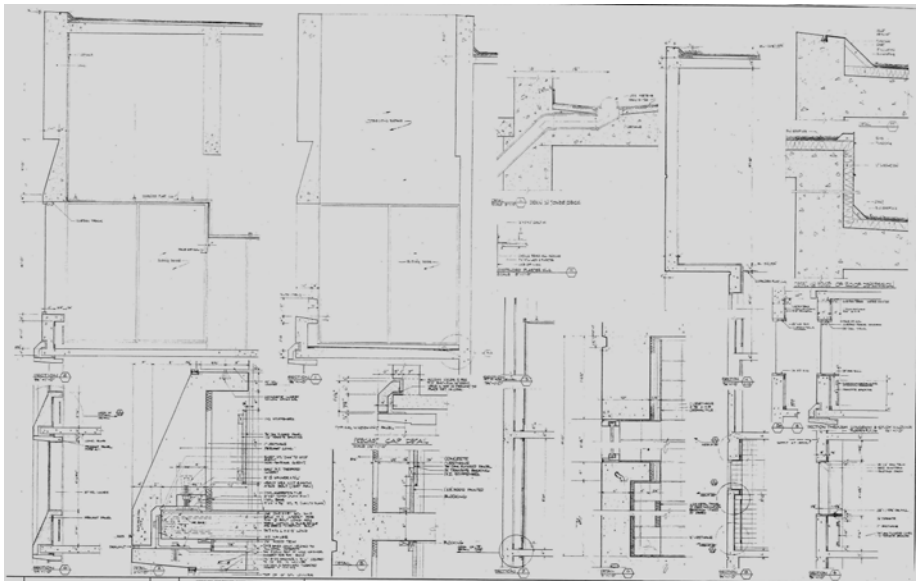
Mather House Sample Working Drawings



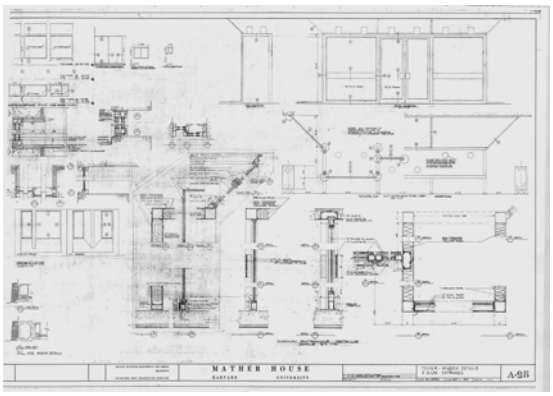
Mather House Tower Floor Plan



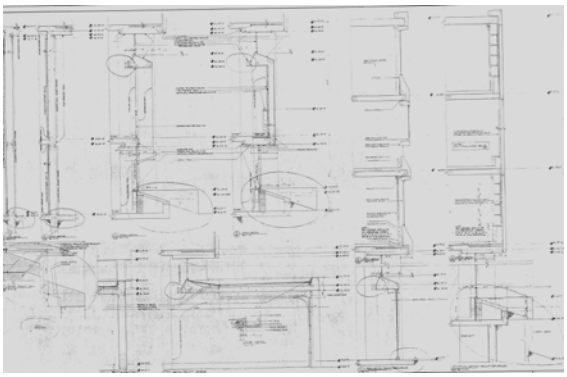
Mather House Tower Elevations



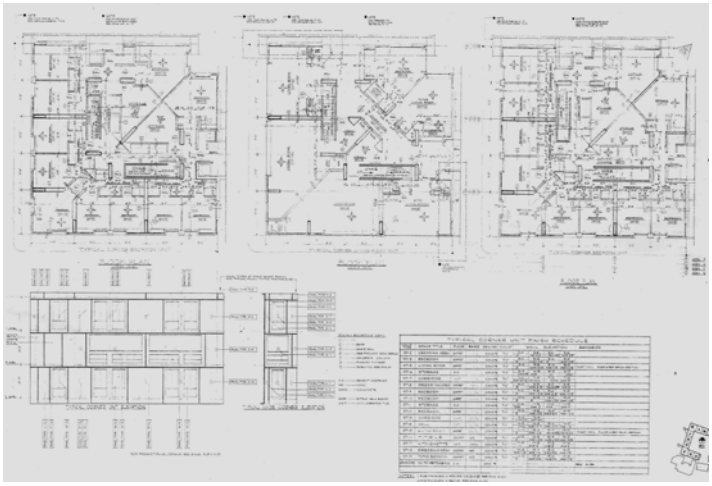
Mather House Wall Sections



Mather House Details



Mather House Wall Sections



Mather House Plans & Sections

Appendix D
Georgetown Hotung International Law Center, 2004

The Georgetown University Law School project consists of two buildings: an International Law Center (Eric Hotung International Law Center) and a Sport and Fitness Center (Scott K. Ginsburg Sport & Fitness Center). Built on what was once a parking lot, the two buildings have a combined gross building area of 164,000 sqft. The two buildings connect to an existing dormitory to form a new campus quadrangle. The project also contains below graded parking facilities. The design requirements were contained in the original building program, which was produced on May 4, 2001.

Georgetown Law Center

The Law Center contains classrooms, faculty offices, offices and facilities for alumni, Law Journal offices, continuing law education offices, a high-tech moot court room, an international law library, and research facilities for the advanced study of international law. The Law Center contains approximately 59,000 sqft of usable area.

The Fitness Center contains a gymnasium racquetball courts, aerobic rooms, weight training, workout rooms, swimming pool, locker rooms, food service and a casual dining area. The fitness Center is for the use of students, faculty, and their families at Georgetown University Law Center. The fitness Center contains approximately 46,000 sqft of usable area.

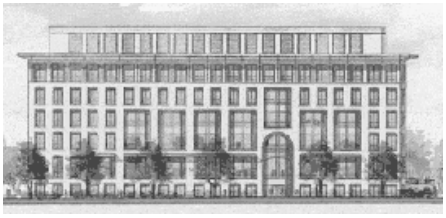
Georgetown Law Center

Construction Time and Cost

Construction started in 2002 and completed in 2004. The final construction cost of the project was $45,482,516.

Architect

Shepley Bulfinch Richardson & Abbott (SBRA) designed the Hotung International Law Center. Ron Finiw was the principal in charge, Ralph Jackson the design architect, John Fasano the project architect and Buddy Mear the project manager and responsible for the construction administration. Ellerbe Beckett (EB) of Washington, DC, was the Associate Architect, Structural and MEP Engineer. SBRA was the architect of record. Ellerbe Beckett participated with SBRA in producing the contract documents. SBRA and Ellerbe Beckett divided responsibilities for the production of documents, and the architectural fee was apportioned accordingly.



Georgetown Law Center

The architect worked closely with the owner-selected construction manager, Whiting-Turner, from the beginning of the project. The CM provided cost estimates at each major phase of the architect's services, and two value engineering sessions in the design phases resulted in a 10% decrease in the project scope to meet the owner's budget, achieved primarily by reducing of the underground parking and some reduction in the amount of glazing.

SBRA does not have a separate department for construction administration services. The project manager follows the project into construction and personally handle's the architect's services during construction, including processing shop drawings, applications for payment, requests for information, change orders and conducting field visits.

The gross architectural and engineering fee was set at $5,108,040, which included structural and MEP engineering services, as well as "excluded services" provided by other consultants, as shown below. Fees were allocated between SBRA and Ellerbe-Beckett based on the portion of the service each firm was to provide.

The Owner-Architect Agreement was a standard AIA Form B141-1987 Edition, modified by a 15 page addition to Article 12, "Other Conditions or Services." Among the modifications to the B141 agreement was a notice to the architect that the owner would retain a construction manager at inception of the project, with which the architect was obligated to cooperate; a fixed limit of construction cost with the requirement that the architect will design to that cost. Attached to the agreement was a list of all anticipated working drawings and a schedule of fee allocations among SBRA, Ellerbe-Beckett, and the consultants. The owner was fully aware of all financial arrangements among the design team.

Consultants

Landscape Architect: Lee & Liu, Washington, DC

Civil Consultant: Wiles Mensche Corp., Reston, VA

Pool Design: Aquatic Design Group, Carlsbad, CA

Interior Design: Group Goetz Architects, Washington, DC

Food Service Consultant: Thomas Ricca Associates, Englewood, CO

Contractor

The general contractor was the Whiting-Turner Contracting Co., of Bethesda, MD. Whiting-Turner (No affiliation with Turner Construction) acted as Construction Manager at Risk (CM) on this project. The CM was involved in the project from its inception, having been hired by the owner to work with the architect. The CM provided pre-construction services, including counseling the architect on systems, providing cost estimates and schedules. The architect verified the CM's cost estimates however, by using another estimating source. The CM attended every meeting with the owner and held a continuous dialog with the owner and architect throughout the design and construction process. The Owner-Contractor Agreement was a Cost of the Work, Plus a Fee, with a Guaranteed Maximum Price form.

Documentation

All of the working drawings for the Law Center were prepared using CAD. No hand-drawn working drawings were produced. However, Buddy Mear, project manager for the Law Center, noted that hand-drawn design sketches produced by SBRA Design Principal Ralph Jackson were issued in early design phases of the project. The architect, engineers, and consultants produced 415 sheets of working drawings, of which 209 were architectural working drawings. (Appendix D) SBRA and Ellerbe-Beckett shared responsibility for the production of the architectural drawings.

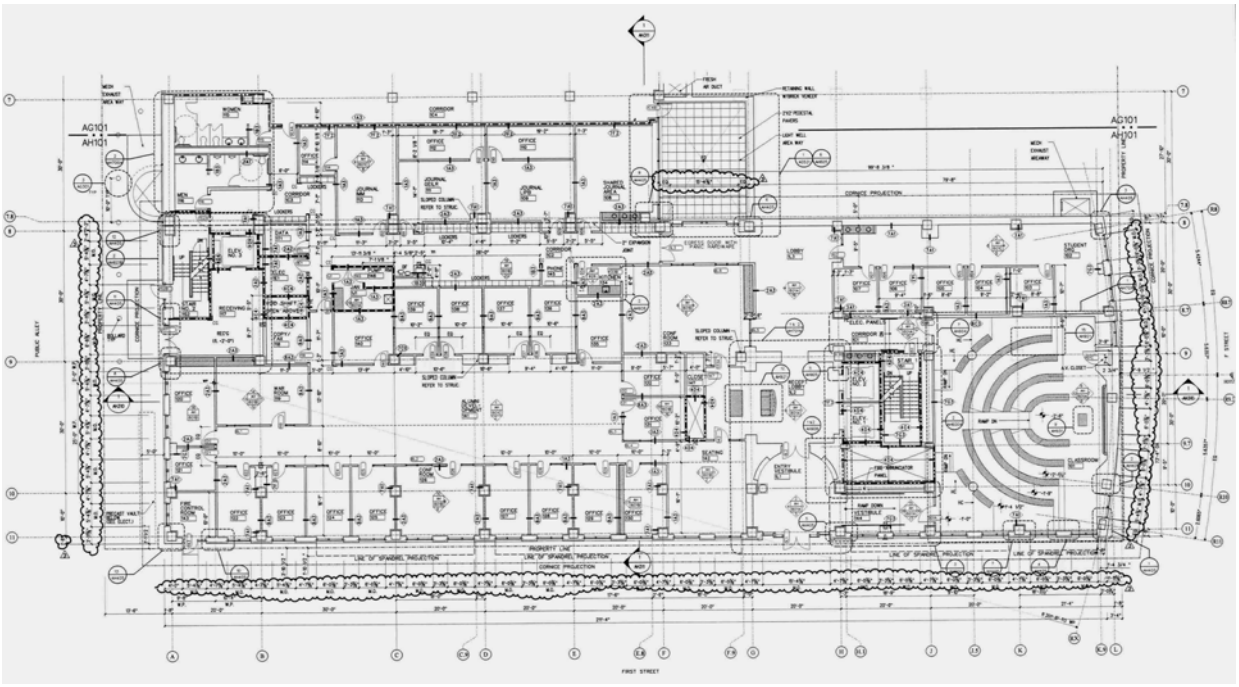
Summary Information for the Georgetown Law Center

Georgetown Law Center		**Remarks**
Completion Date	2004	
Approximate Building Area	164,000 sqft	
Construction Cost	$45,482,516	
Cost Per Square Foot	$277.33	
Number of floors	Varies	
Sheets of Construction Drawings	415	Includes consultant drawings
Contractor	Whiting-Turner	

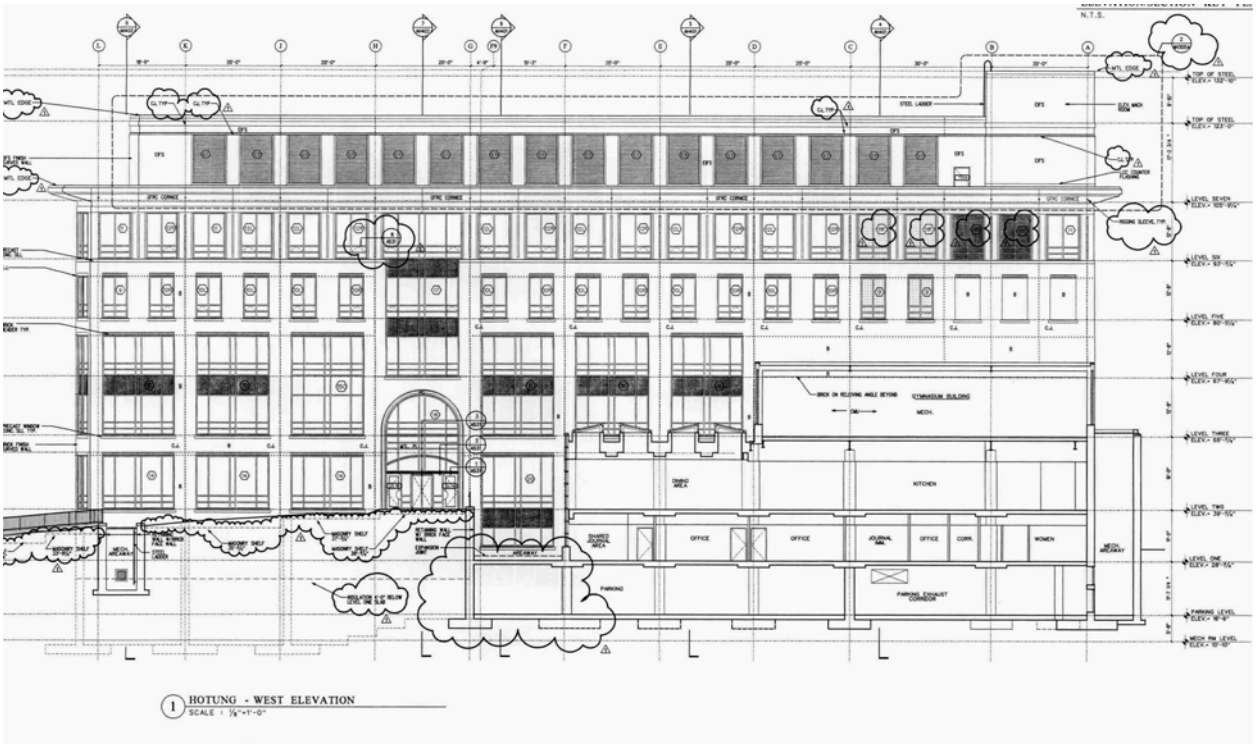
Georgetown Law Building Drawings

Series	**Category**	**Type**	**Method/Media/Size**	**Sheets**
A	Architectural	Construction Document	AutoCAD/Plot/30” x 42”	202
G	Code	Construction Document	AutoCAD/Plot/30” x 42”	7
C	Civil	Construction Document	AutoCAD/Plot/30” x 42”	12
L	Landscape	Construction Document	AutoCAD/Plot/30” x 42”	13
S	Structural	Construction Document	AutoCAD/Plot/30” x 42”	35
SP	Swimming Pool	Construction Document	AutoCAD/Plot/30” x 42”	7
HS	Hydrotherapy	Construction Document	AutoCAD/Plot/30” x 42”	4
MR	Mechanical Rooms	Construction Document	AutoCAD/Plot/30” x 42”	4
P	Plumbing	Construction Document	AutoCAD/Plot/30” x 42”	27
M	Mechanical	Construction Document	AutoCAD/Plot/30” x 42”	23
E	Electrical	Construction Document	AutoCAD/Plot/30” x 42”	74
FS	Food Service	Construction Document	AutoCAD/Plot/30” x 42”	7
			Total	**415**

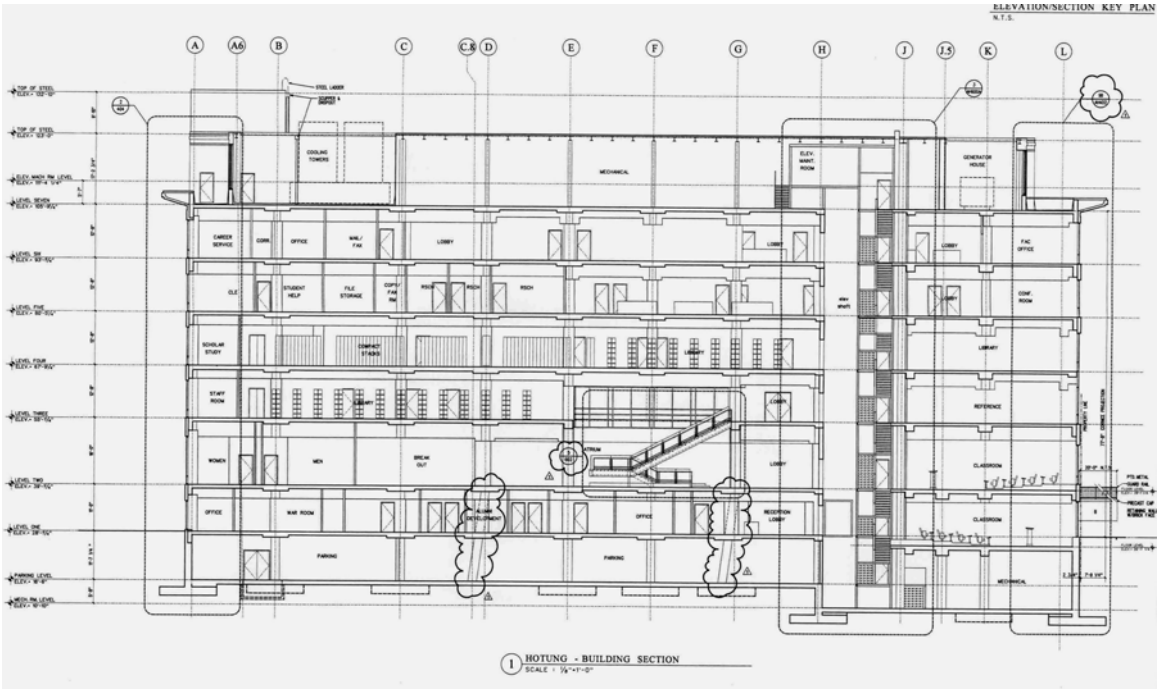
Georgetown Sample Working Drawings



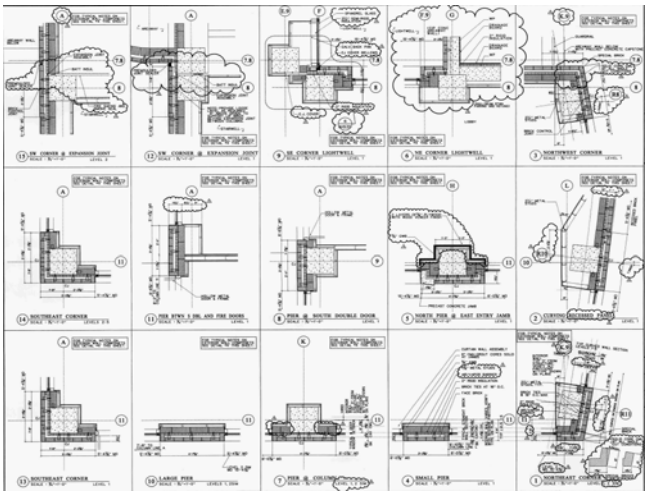
Law Center First Floor Plan



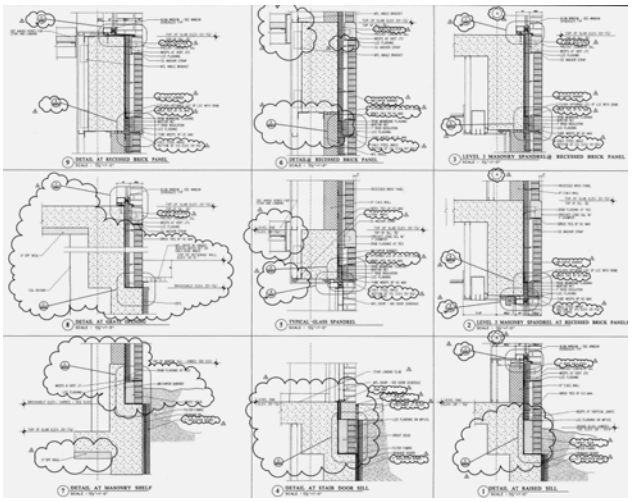
Law Center Elevation



Law Center Building Section



Law Center Details



Law Center Details

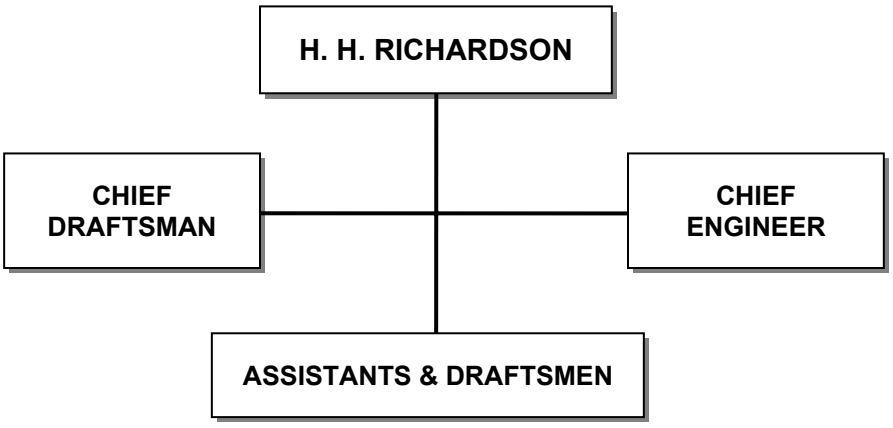
Appendix E
Evolution of an Architectural Practice

The Office of H. H. Richardson (1874-1886)

Born in New Orleans in 1838, Henry Hobson Richardson was a graduate of Harvard College and the second US citizen to study at the famed Ecole des Beaux-Arts in Paris, preceded only by Richard Morris Hunt.[45] Returning home after the Civil War, Richardson opened a small architectural office in New York with partner Charles Gambrill. Richardson subsequently opened his own office. Richardson's first commission in Boston was Trinity Church in Copley Square. With a small staff, including George Foster Shepley, Charles Allerton Coolidge, and Charles Hercules Rutan, Richardson subsequently designed 85 buildings and 65 projects before his death in 1886, at an age of 48 years old.

H.H. Richardson designed the Marshall Field Wholesale Store in Chicago, Ames Monument in Wyoming, Oliver Ames Free Library in North Easton, Massachusetts, Allegheny County Courthouse in Pittsburgh and the Cincinnati Chamber of Commerce. He and he successor firms till SBRA have designed 120 projects for Harvard.

H.H. Richardson



H. H. Richardson 1878-1886

Shepley Rutan and Coolidge (1886-1915)

Richardson died in 1886 at age 48. At the time of Richardson's death, the firm had twenty-five projects at various stages of completion, and leads for many more. Richardson's employees formed a partnership to continue the practice and the firm became Shepley Rutan and Coolidge (SRC), headed by George Foster Shepley. As a result of Charles Coolidge's travels, in 1888, the firm was commissioned by Senator and

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[45] The first school of architecture in the United States opened at the Massachusetts Institute of Technology (MIT) in 1868. Cornell opened an architectural program in 1871, and the University of Illinois followed in 1873. The first architectural registration law was enacted in Illinois in 1897.

Mrs. Leland Stanford to join with landscape architect, Frederick Law Olmsted in the planning of the new campus for Stanford University in Palo Alto, California.

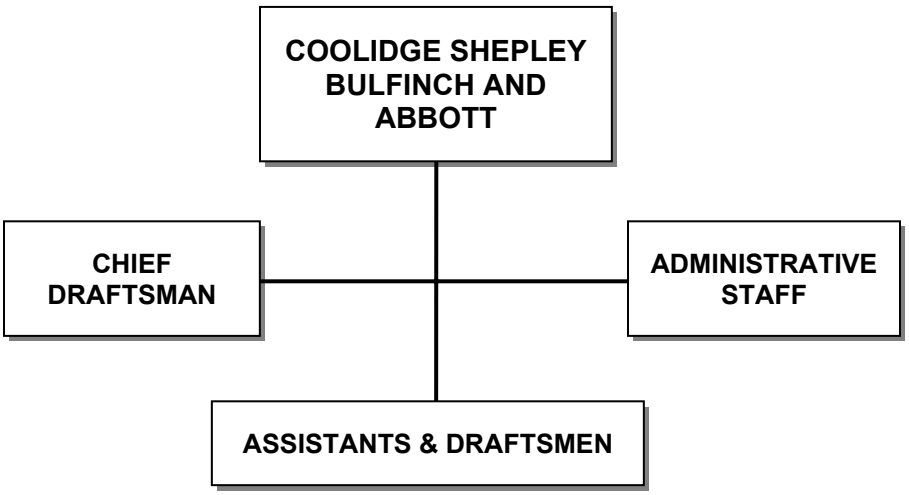
SRC introduced the skyscraper to Boston in 1889 with its design of the 14-story Ames Building, the world's tallest building at the time. The firm moved its offices into the new building and remained there for the next 93 years. Among other projects, SRC designed the Chicago Art Institute, Chicago Public Library, Boston's South Station Terminal, Chicago's Corn Exchange Bank Building, more than a dozen buildings for the University of Chicago, and a new campus for the Harvard Medical School.

Coolidge and Shattuck (1915-1924)

George Foster Shepley died young, followed by Charles Rutan in 1915. Charles Coolidge offered a partnership to George Shattuck, a long-time employee, and the firm became known as Coolidge and Shattuck. The firm completed projects for the Rockefeller Center for Medical Research in New York, the Peking Union Medical Center in China, and Massachusetts General Hospital.

Coolidge Shepley Bulfinch and Abbott (1924-1952)

In 1924, civil engineer Francis Lewis Bulfinch, Henry Richardson Shepley and Lewis Abbott were made partners and the firm became Coolidge Shepley Bulfinch and Abbott. (CSBA) During this period, twenty projects were designed for the Rockefeller Institute, a medical school for the University of Virginia, and seven dormitories for Harvard, including Eliot House. The firm also designed the Woods Hole Oceanographic Institution laboratory, and several major medical facilities.



CSBA abt 1932

Shepley Bulfinch Richardson and Abbott (1952-Present)

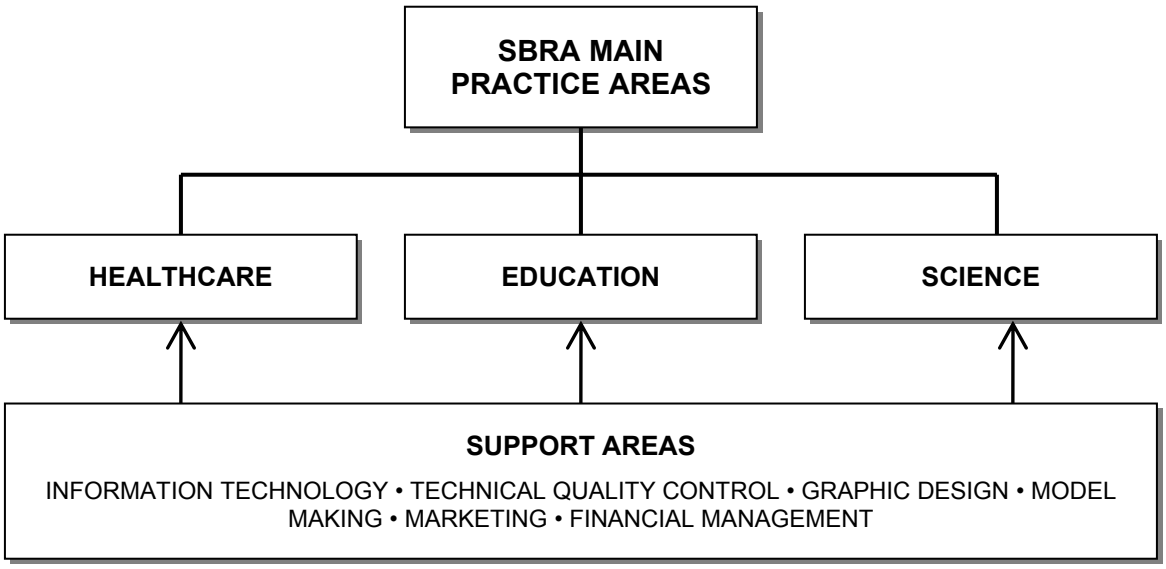
Charles Coolidge passed away in 1936, leaving the practice to Henry Richardson Shepley. Coolidge's name was replaced by that of Joseph Priestly Richardson, H. H. Richardson's grandson and the firm became known by its present name, Shepley Bulfinch Richardson and Abbott (SBRA). Henry Richardson Shepley died in 1962, passing leadership to Joseph Priestly Richardson. In 1970, the firm won the American Institute of Architects' National Honor Award for its design of the Tramway Terminal in Squaw Valley, California and in 1973 won the AIA Firm Award, citing the firm for consistent design and training of

young practitioners. Projects completed during the 1970s include New England Telephone Company, Museum of Our National Heritage in Lexington, Massachusetts, facilities for Bunker Hill Community College, Ambulatory Patient Center at Rhode Island Hospital, College Center for Vassar College, Boston's Provident Institute for Savings, a major renovation of the historic Boston Athenaeum, and the Tower Building at Danbury Hospital.

In 1982 the firm moved to its present location in Boston's Insurance Exchange Building at 40 Broad Street in downtown Boston, a building designed by Coolidge and Shattuck in 1924. During the 1980s, the firm designed major projects for clients such as Rhode Island and Danbury Hospitals, Maine Medical Center, Harvard University, University of New Hampshire, the Commonwealth of Massachusetts and others. Projects include science facilities for Fye Laboratory at the Woods Hole (MA) Oceanographic Institution; the USDA/Human Nutrition Research Center at Tufts University; Bristol County Courthouse in New Bedford, Massachusetts; South Quadrangle Museums for the Smithsonian Institution; an inpatient facility for Children's Hospital in Boston; and corporate headquarters for the American College of Physicians in Philadelphia and the Andover Companies.

Hugh Shepley, the last descendent of one of the firm's original partners, retired in 1990 and the firm became a corporate managed practice. The firm survived the range of ownership transitions and changes in forms of practice - sole practitioner, partnership, and a century later, incorporation in 1972. Along the way, the firm weathered the loss of its founder and subsequent family owner-practitioners.[46]

Today, the firm is led by president Carole Wedge, the firm's first-ever woman president.



SBRA Today

Today, with a staff of 225 professionals at its headquarters at 40 Broad Street in downtown Boston, the firm ranks among the largest architectural practices in the United States. The firm is managed by a Board of Directors that includes the President and four Principals, which are supported by approximately forty Senior Associates and Associates. There are a total of 25 principals, including the President and those serving on the board of Directors.

It is organized into three primary practice areas - healthcare, education and science. Each practice area is supported by the firm's resources in information technology, technical quality control, graphic design

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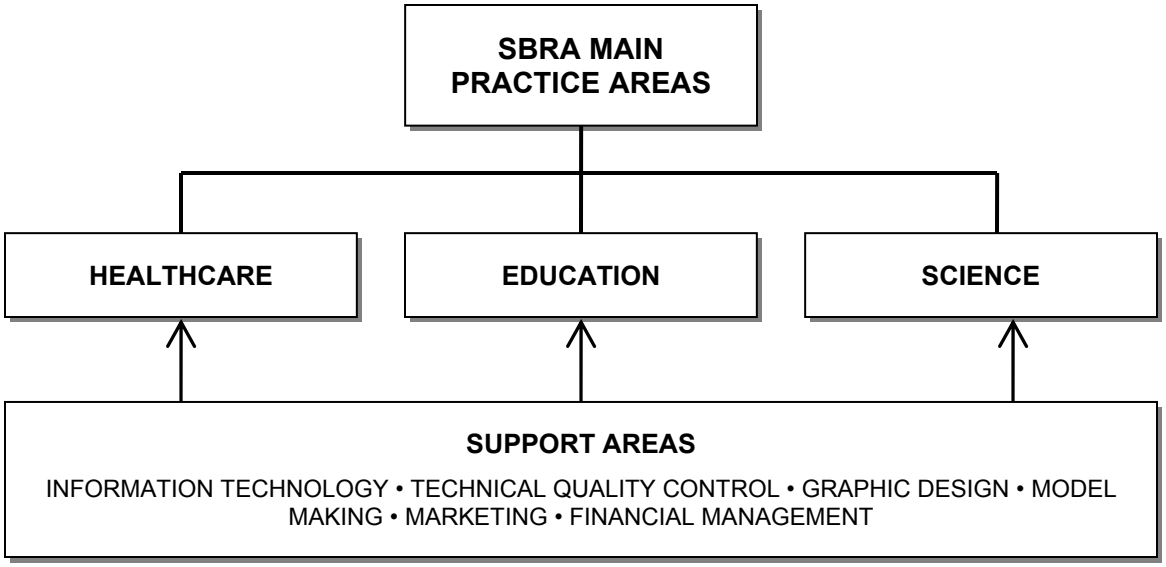
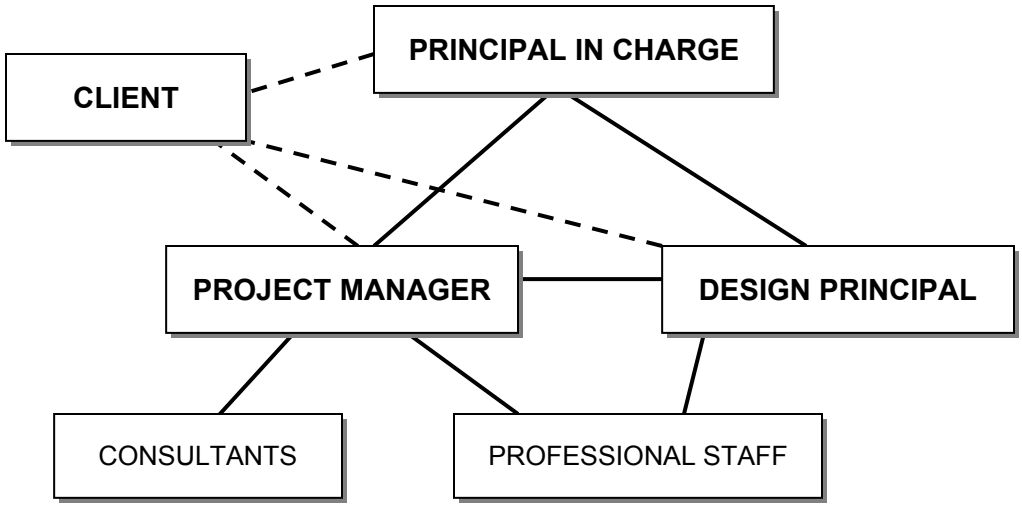
[46] Much of the history of Shepley Bulfinch Richardson and Abbott is from the firm's website: <http://www.sbra.com>

and model-making, marketing, and financial management. In addition to its architectural, planning and interior design services, the firm also has special expertise in historic preservation, restoration and renovation; and building envelope technology.

SBRA has been recognized with awards from leading client and design organizations for over a century, and has been widely published in trade and consumer media throughout the world. In 1997, SBRA was named one of America's best-managed firms in a survey by Architectural Record magazine.

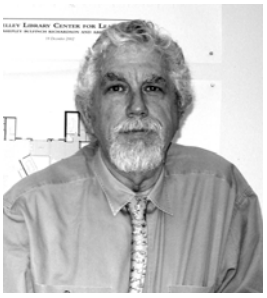


SBRA Main Areas of Practice



SBRA Typical Project Organization Today

Appendix F
Interview with Buddy Mear, AIA
Law Center Project Manager



Buddy Mear, AIA, joined SBRA in 2001. In addition to serving as the project manager for the Georgetown Law Center, Buddy is a member of the firm's Education Practice Group. He received his Bachelor of Arts degree from Harvard University and his Master of Architecture degree from Yale University. Buddy has been widely published in architecture and design periodicals, including Architecture, Contract, Metropolitan Home and House and Garden. Mear began his architectural career in 1973. has a substantial amount of experience at a number of firms before joining SBRA, including a stint at Sir James Stirling's firm in London.

1. *What is your opinion about the changes in role of the architect in construction from the past to the present, including how the architect's approach to contracts, design, and production documentation and/or working drawings changed from the past.*

   Mear noted that the number of working drawings being produced today is greater than in the past, citing a library renovation he was involved. Perkins & Will, the architect of the original 1963 building, produced only 11 sheets of working drawings for a 40,000 square foot library. For the renovation, SBRA produced 124 sheets of working drawings. Mear speculates that the original architect and contractor had a close working relationship to account for the few drawings.

   Mear thinks that although there is more detail in contracts and documentation, the services architects render today are about the same as when he started his career in 1973. The computer has had an impact, but he notes that Ralph Jackson, Design Principal on the Law Center, used free-hand sketches and diagrams to illustrate the Law Center design.

   At SBRA, the project manager follows the project into construction, and personally administers the contract for construction. Mear handles change orders, requests for information, (RFI) processing of contractor submittals, and applications for payments, rather than turning the project over to a construction-oriented staff member. He feels visits to the job site are adequately described in the AIA contract forms, and points out that by using the RFI process instead of rendering on the site decisions improves the quality of the decisions because he has time to consult the documents and seek others' opinion. He describes the process as a system of checks and balances.

2. *Has the increasingly litigious building environment required architects to produce more documentation and a greater number of drawings and specifications?*

   Notwithstanding the earlier example, Mear stated about the same number working drawings are being produced by architects today compared to when he started his career in 1973. However, in his personal experience, he has observed an increase in the detail of the specifications rather than more working drawings. He notes that architects today are more careful about the materials they specify, noting that because of past experience, there are some materials that SBRA will not specify for use on their projects.

3. *Does the architect's current approach to documentation inhibit innovation during construction or in any other way?*

   SBRA encourages innovation and seeking new ways of doing things, according to Mear, and he does not believe that the architect's documentation today inhibits innovation. On the contrary, he feels innovation is alive and well, and cites the successful interaction with the construction manager on the Georgetown Law Center as an example of the contractor, owner, and architect working together to produce innovative design.

4. *What effect has the use of computers had on the architect's documentation? Has the computer increased the documentation and the amount of information provided to the building contractor and suppliers. Is this approach likely to continue? How has the computer changed the architect's role during construction, such as the use of extranets for processing RFIs and other uses?*

   Mear believes the computer has been an improvement and does not believe additional working drawings necessarily result from its use. He laments the lack of some of the artistic effects used to enhance the drawings by architects in the past, such as changing in line weights to better illustrate a drawing, which was part of the draftsman's skill in the past. He also notes that sometimes drawing by hand allows time for deeper thinking about what occurs "around corners," meaning that taking time with a routine part of a drawing provides opportunities to think through other details. Interestingly, Mear notes that the production rate of 40 hours per working drawing sheet of remains in use today, just as in the 1970s, indicating that the use of the computer has not materially reduced the amount of time it takes to produce a set of working drawings.

   Mear also noted that the less an architect draws, the more decisions are made by others. He relates to James Sterling's office philosophy of "drawing every visible surface."

5. *Comment on the current state of the industry and how architects have changed their approach to rendering services.*

   Mear is positive about the state of the industry, and is very impressed with the creativity of today's architects. Somewhat humorously, Mear notes that he presided over the death of Modernism, and personally experienced the rise and fall of Post-modernism in his career. Although noting that the architect's services have remained more or less the same over the span of his experience, he does note a difference between American and European attitudes about design, adding that he sometimes thinks "Europeans feel everybody should be entitled to beauty while Americans seem to feel everybody is entitled to profit."

6. *Comment on the business and design risks that are faced by architects today as compared to the past; how important are these risks; and how these risks have changed the architect's documentation and role in construction.*

   Mear did not have much comment on the business or design risks, adding that at SBRA he feels quite protected. The firm provides an atmosphere of security, and uses its legal counsel as required, but he does not feel that his documentation or role in construction has been affected significantly because of increased risks.