PRESERVATION CONSTRUCTION: DESIGN-BUILD VERSUS DESIGN-BID-BUILD

by

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(Under the Direction of Wayde Brown)

ABSTRACT

This thesis will compare the two major construction delivery systems in their application in preservation construction projects, Design-Build (DB) and Design-Bid-Build (DBB). Several factors of construction influence the choice of DB or DBB delivery systems. What are these factors, and how do they affect final products in the context of preservation construction? These factors will be determined and described based on the author's personal experience working for Aeon Preservation Services, LLC. on two preservation projects. The projects, the restoration of original cast iron canopies at The Department of Veterans Affairs building and the stone façade restoration at the National Gallery of Art West Building, were both located in Washington, D.C. and are examples of DB and DBB. These projects will be analyzed and compared using case studies.

INDEX WORDS: Historic preservation, Preservation construction, Construction, Construction management, Project delivery systems, Design-Build, Design-Bid-Build, The Veterans Affairs building, The National Gallery of Art West Building

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DEDICATION

I would like to dedicate this Masters Thesis to my beloved State of Georgia.

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I would like to acknowledge my family and friends, the faculty and staff of the University of Georgia's College of Environment and Design, especially Wayde Brown, and my employer, Aeon Preservation Services. Without the assistance of these individuals, this thesis would not have been possible.

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CHAPTER 1

INTRODUCTION

Historic buildings provide a tangible connection to the past and contribute to a community's identity and stability. They allow visitors to experience the social, economic, and aesthetic values of a particular period. Many historic structures represent the highest architectural achievements. Others reveal extraordinary construction techniques and craftsmanship. Numerous are significant because they represent a vernacular building type. Many provide a unique perspective on important people or events in history. Preservation of these structures is vital to maintain and improve our cultural resource stock, and construction is a critical component of historic preservation.

Historic preservation construction is a general term that refers to several kinds of treatments of historic properties. As described by the Secretary of the Interiors Standards for The Treatment of Historic Properties, the treatments for historic properties may include preservation, rehabilitation, restoration, and reconstruction. It is important that any preservation construction follows these standards. Despite sharing processes with new construction, components of preservation construction are unique and can often be difficult for inexperienced designers, contractors and clients. Therefore, preservation construction requires analysis in the context of management and delivery systems.

Historic preservation construction utilizes project delivery systems (PDSs) as does new construction. There are four basic categories of PDSs: Design-Bid-Build, Construction Management At Risk, Design-Build, and Integrated Project Delivery.[1] A PDS defines how the participants in a project are organized to transform the owner's project goals and objectives into a finished facility. Often the client determines the PDS to be used prior to the creation of any project documents. The required process is defined in the invitation to bid and/or construction documents. The chosen contractor agrees to follow the prescribed PDS by signing the contract.

Design-Build and Design-Bid-Build management systems are two of the most common PDSs in both preservation construction and new construction. Design-Build is a Project Delivery System (PDS) where the owner holds a single contract with a design and construction entity. The Design-Build contractor is responsible for both the design phase and construction phase including materials and trade work. Also known as 'traditional method,' Design-Bid-Build is a PDS in which the project owner holds two contracts. One contract is with the designer; responsible for design, documentation, and management. The second contract is with the contractor, responsible for supplying materials, completing construction, and possibly continued maintenance. Generally, the designer is an architecture firm, and the contractor is a builder or general contractor. DB and DBB are two different systems, utilizing different management structures. Since the creation

[1] The Construction Management Association of America, "An Owners Guide to Project Delivery Methods" cmaanet.org, http://cmaanet.org/files/Owners%20Guide%20to%20Project%20Delivery%20Methods%20Final.pdf (accessed June 3, 2013).

of formal construction management in the 1960s,[2] DBB has been the most common project delivery system. However, "the design-build (DB) project delivery system has grown in popularity, and is seen by some in the industry as a solution for addressing the limitations of other methods."[3]

Within the context of historic preservation construction, little formal analysis of construction management techniques exists. It is important to analyze management of preservation construction projects to improve efficiency. Historic preservation is often controversial especially when public capital is involved. Implementing appropriate PDSs increases the value of the public funds. Efficient projects improve public perception of the responsible entities while providing tangible products that illustrate the conscientious use of public funds. Analyzing preservation construction management is critical to the viability of the historic preservation field by increasing the efficiency of projects. This thesis attempts to answer the question, what factors influence the choice of Design-Bid-Build versus Design-Build in preservation construction?

Methodology

In depth analysis of Construction Project Management, Preservation Construction, Preservation Construction Administration and Contracts, Design- Build, and Design-BID-Build are discussed. Studies of two construction projects are presented

[2] Miklos Hajdu, *Network Scheduling Techniques for Construction Project Management* (Dordrecht: Kluwer Academic Publishers, Netherlands, 1997), pages 13.
[3] The Construction Management Association of America, "An Owners Guide to Project Delivery Methods" cmaanet.org, http://cmaanet.org/files/Owners%20Guide%20to%20Project%20Delivery%20Methods%20Final.pdf (accessed June 3, 2013).

as examples of DB and DBB implementation in historic preservation construction. First is the canopy rehabilitation at the Department of Veterans Affairs building (DB project) and second is the masonry rehabilitation of the National Gallery of Art West Building (DBB project). Both buildings are located in Washington, D.C., both projects were preservation construction in nature (both scopes included construction impacting significant historical and architectural features), both projects ran concurrently, both projects had a similar owner/client, and both buildings are either on or eligible for the National Register of Historic Buildings. A comparative analysis of DBB and DB in historic preservation construction will be followed by research results. An answer to the question “what factors determine the implementation of DB vs. DBB” and suggestions for further research will compose the conclusion.

CHAPTER 2

CONSTRUCTION MANAGEMENT AND ITS HISTORY

The Construction Management Association of America defines construction management as "a professional service responsible for the planning and control of resources within a project framework. Applying effective management techniques in the planning, design, and construction of a project from inception to completion is crucial for the purpose of controlling time, cost, and quality."[4] Construction Management is a discipline uniquely tailored to the planning, design and construction process of capital projects.[5] The five functions of a manager include: (1) to plan, (2) to organize, (3) to coordinate, (4) to control, and (5) to direct or command.[6] Construction management has become a critical component in the construction process and is effective and viable regardless of the chosen contract form or project delivery method. Historically, owners have utilized construction management successfully in all contracting methods and delivery systems, using either internal staffing or third-party firms. Construction management is a subset of project management and follows the historic trajectory of project management.

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[4] The Construction Management Association of America, "An Owners Guide to Project Delivery Methods" cmaanet.org, http://cmaanet.org/files/Owners%20Guide%20to%20Project%20Delivery%20Methods%20Final.pdf (accessed June 3, 2013).

[5] The Construction Management Association of America, "An Owners Guide to Project Delivery Methods" cmaanet.org, http://cmaanet.org/files/Owners%20Guide%20to%20Project%20Delivery%20Methods%20Final.pdf (accessed June 3, 2013).

[6] Harold Kerzner, *Project Management: A System Approach to Planning, Scheduling, and Controlling*. (New York: John Wiley & Sons, Inc. 1995)

In the article, "Brief History of Project Management," Dr. Young Hoon Kwak identified four periods in the history of modern project management (see Table 2.1).[7]

Table 2.1: Four Periods of Project Management

Periods	Theme
Prior to 1958	Craft system to Human Relations Administration
1958 – 1979	Application of Management Science
1980 – 1994	Production Center: Human Resources
1995 – present	Creating a new environment

Prior to 1958; Craft System to Human Relations Administration

The origin of the modern construction project management concept started between about 1900 and the 1950s. During this time, technological advancement shortened the project schedule. Prior to the twentieth century, construction was viewed as a craft, handed down from generation to generation. However, large-scale projects in the United States required innovative management methodologies during the early twentieth century. Business leaders found themselves faced with the daunting task of organizing the manual labor of thousands of workers and the processing and assembly of unprecedented quantities of raw material. Studies of organizing and managing 'work,' and theories on improving production, marked the beginning of modern construction management.

[7] Elias G. Carayannis, et. al., *The Story of Project Management: An interdisciplinary Approach* (Westport: Quorum Books, 2003), http://home.gwu.edu/~kwak/PM_History.pdf (accessed June 4, 2013) page 1.

Near the turn of the twentieth century, Frederick Winslow Taylor (1856–1915) began detailed studies of 'work.' Taylor, an American mechanical engineer and theorist, sought to improve industrial efficiency. He is regarded as the father of scientific management and was one of the first management consultants. Taylor, an intellectual leader of the 'Efficiency Movement,' highly influenced the Progressive Era. He applied scientific reasoning to work, showing that labor can be analyzed and improved by focusing on its elementary parts. Taylor's work culminated in 1911 with the publication of the monograph, *The Principles of Scientific Management*. In this publication, Taylor introduced the concept of working more efficiently, rather than working harder and longer.[8]

Taylor's associate, Henry Laurence Gantt (1861–1919), studied in great detail the order of operations in work. Gantt was an American mechanical engineer, who pioneered the use of management visual aids. Gantt created the Gantt Chart in the 1910s, a popular type of bar chart that illustrates a project schedule. Gantt Charts have become a common technique for representing the phases and activities of a project work breakdown structure, so they can be understood by a wide audience (Figure 2.1). Now considered a common charting technique, Gantt Charts were considered revolutionary at the time they were introduced. Gantt Charts were employed on major

[8] Daniel Nelson, *Frederick W. Taylor and the Rise of Scientific Management*. (Madison: University of Wisconsin Press, USA, 1980), pages 171 – 173.

infrastructure projects including the Hoover Dam and are still accepted today as an important tool in construction management.[9]

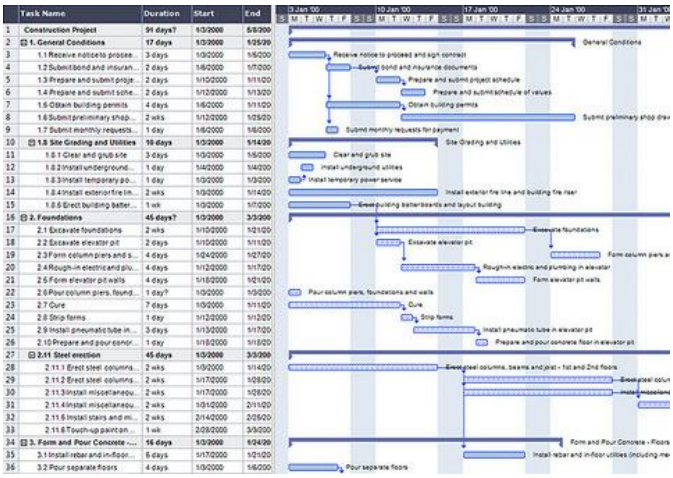

Figure 2.1: Computer-Aided Construction Project Gantt Chart

The Hoover Dam (1931 – 1936) is an example of a large scale project prior to 1958, constructed using Gantt charts and emerging construction project management systems. In 1928, the congress passed the Boulder Canyon Act assigning $175 million to the Hoover Dam project. The 'Big Six' consisted of Utah Construction, Pacific Bridge, H.J. Kaiser, W.A MacDonald and Kahn, Morrison-Knudsen, and J.H. Shea which formed a consortium to work as a general contractor. It was crucial for the companies to have a detail project planning, controlling, and coordinating plan because the project involved six independent companies.[10]

The construction site, located in the middle of the desert, had no infrastructure. Boulder City was created to accommodate workers to live near the construction site.

[9] Michael Chatfield and Richard Vangermeersch (editors), The History of accounting : an international encyclopedia (New York: Garland Publishing, USA, 1996), page 269.
[10] Elias G. Carayannis, et. al., *The Story of Project Management: An interdisciplinary Approach* (Westport: Quorum Books, USA, 2003), http://home.gwu.edu/~kwak/PM_History.pdf (accessed June 4, 2013) page 3.

The project required both physical and human resources, employing approximately 5,200 workers, and a large amount of concrete, structural steel components, steel pipe, etc. The project was successfully completed under budget and ahead of schedule. The Hoover Dam project is one of the highest gravity dams in the United States, and generates more than four billion kilowatt-hours of electricity a year.[11] The Hoover Dam is still operational and exemplifies successful implementation of early construction project management.

1958 – 1979; Application of Management Science

Modern construction management formed from the development of modern project management in the 1950s. Businesses and other organizations began to see the benefit of organizing work around projects and to understand the critical need to communicate and integrate work across multiple departments and professions. In the 1960s, many industries were influenced by the development of silicon chips and minicomputers. The first standardized computer code and microprocessor were created in 1958.[12] Significant technological advancement between 1958 and 1979 enhanced construction management improvements in construction management systems which paralleled the project management systems utilized in the creation of these technologies.

[11] Elias G. Carayannis, et. al., *The Story of Project Management: An interdisciplinary Approach* (Westport: Quorum Books, USA, 2003), http://home.gwu.edu/~kwak/PM_History.pdf (accessed June 4, 2013) page 3.
[12] Elias G. Carayannis, et. al., *The Story of Project Management: An interdisciplinary Approach* (Westport: Quorum Books, USA, 2003), http://home.gwu.edu/~kwak/PM_History.pdf (accessed June 4, 2013) page 3.

Between 1958 and 1979, several core project management tools were introduced. The development of two mathematical project-scheduling models: the Program Evaluation and Review Technique (PERT) & the Critical Path Method (CPM) marked the beginning of modern project management. CPM/PERT was calculated in large computer systems, and specialized programmers operated the CPM/PERT mainly for government sector projects. The common organizations used the project office as 'brokers of information' having small number of skilled schedulers and estimators.[13]

PERT was developed by Booz-Allen & Hamilton in conjunction with the Lockheed Corporation as part of the United States Navy's Polaris missile submarine program. PERT is a method for analyzing the tasks involved for completing a given project, especially the time needed to complete each task, and identifying the minimum time needed to complete the total project (Figure 2.2).

> This Program Evaluation and Review Technique (code-named PERT) is applied as a decision-making tool designed to save time in achieving end-objectives, and is of particular interest to those engaged in research and development programs for which time is a critical factor.
>
> The new technique takes recognition of three factors that influence successful achievement of research and development program objectives: time, resources, and technical performance specifications.[14]

[13] Elias G. Carayannis, et. al., *The Story of Project Management: An interdisciplinary Approach* (Westport: Quorum Books, USA, 2003), http://home.gwu.edu/~kwak/PM_History.pdf (accessed June 4, 2013) page 3 – 4.

[14] W. Fazar, "Program Evaluation and Review Technique", The American Statistician, Vol. 13, No. 2, (April 1959), p.10.

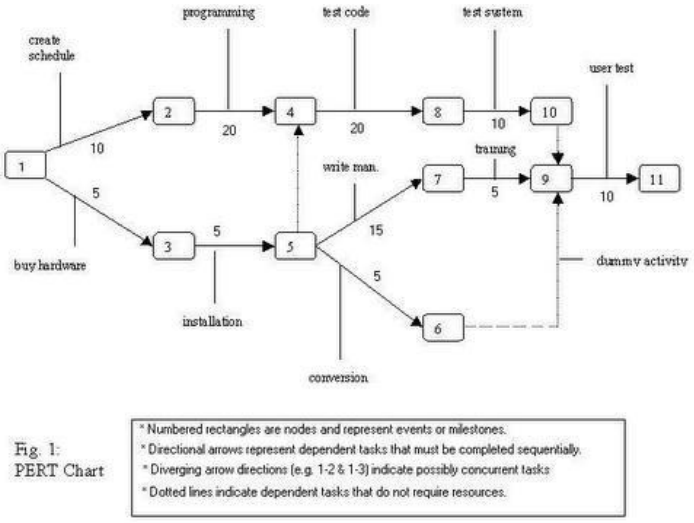

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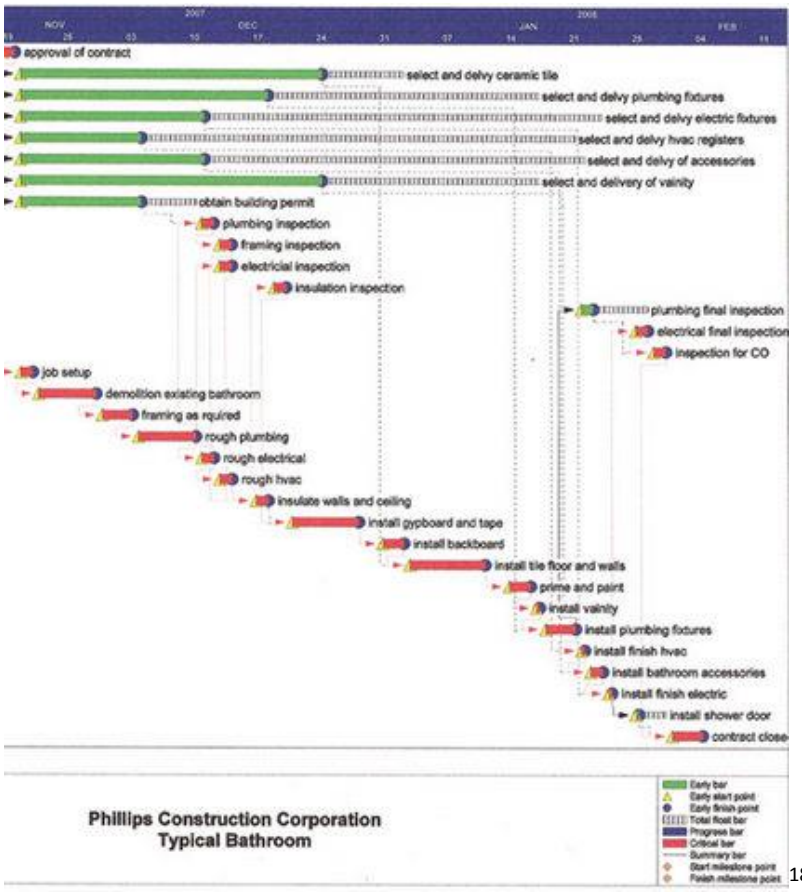
Figure 2.2: PERT Flow Chart

CPM was developed in a joint venture by the DuPont Corporation and Remington Rand Corporation for managing plant maintenance projects. The critical path determines the 'float,' or schedule flexibility, for each activity by calculating the earliest start date, earliest finish date, latest start date, and latest finish date for each activity (Figure 2.3). "It was an activity on arrow network technique, in which money was tied to the activities and which produced time cost trade off calculations."[16] The construction industry adopted CPM in two techniques: CPM Time Cost Trade-Off and CPM Least Cost Scheduling. CPM Time Cost Trade-off technique determines a hierarchy of importance based on criticality of tasks. CPM Least Cost Scheduling creates a schedule of tasks based on cost values. CPM Least Cost Scheduling incorporates not only

[15] TechTarget, "PERT chart (Program Evaluation Review Technique)," techtarget.com, http://cdn.ttgtmedia.com/WhatIs/images/pert_chart.jpg (accessed June 4, 2013).
[16] Miklos Hajdu, *Network Scheduling Techniques for Construction Project Management* (Dordrecht: Kluwer Academic Publishers, Netherlands, 1997), page 14.

cost of specific tasks but the cost of tasks relative to their position in the project schedule.[17]



[18]

Figure 2.3: CPM Flow Chart

By the 1960s, increasingly larger construction projects were initiated, bolstered by favorable economic conditions. At that time, there was no separate profession dedicated to the overall management of large scale projects on behalf of the owner. It was common for large projects, mostly for public owners, private non-profit institutions and major corporations, to run into both delays in construction and unpredicted high

[17] Miklos Hajdu , *Network Scheduling Techniques for Construction Project Management* (Dordrecht: Kluwer Academic Publishers, Netherlands, 1997), pages 14 – 15.
[18] Philips Construction Corporation, "Sample CPM Chart for Bathroom," phicon.net, http://www.phicon.net/CPM_large.html (accessed June 4, 2013).

bids as well as significant cost increases to the owner during construction. As a result, the professional 'construction manager' was created.[19]

The modern construction management profession was developed to monitor and facilitate proper product delivery using established systems. With the development of professional construction management, the construction manager became a fee- or incentive-compensated entity that replaced the general contractor. The concept was that the professional construction manager would bid out the project competitively to trade or 'sub' contractors and building product manufacturers. These contracts would be between the owner and the respective trade contractor or supplier, with the construction manager designated as the owner's representative. According to George T. Herry, leading innovator in construction project management in the Southeast, "If there needed to be early awards of certain of the trade contracts or long lead procurements before the final design was completed, they would be awarded in a similar fashion."[20]

1980-1994: Production Center: Human Resources

During the 1980s and early 1990s, the revolution of information technology improved efficiency in managing and controlling complex project schedules, and construction management again followed this evolution. During the 1950s through the

[19] George T. Heery, "A History of Construction Management Program Management and Development Management," brookwoodgroup.com, http://www.brookwoodgroup.com/downloads/2011_history_CMPMDM.pdf page 2, (accessed June 4, 2013).
[20] George T. Herry, "A History of Construction Management Program Management and Development Management," brookwoodgroup.com, http://www.brookwoodgroup.com/downloads/2011_history_CMPMDM.pdf page 2, (accessed June 4, 2013).

1970s, computer engineers were responsible for operating project management systems because the mainframe systems were difficult to use. During the late 1970s and early 1980s, project management software for the Personal Computer became widely available by a number of companies.[21] Increased accessibility, ease of use, and decreasing software costs allowed construction managers to adopt computer programs to aid in management, scheduling, and estimating.

An example of the innovations in construction project management between the 1980s and early 1990s is the English-France Channel project (1989 – 1991). This project illustrated the application of high technology and the resulting improvements in project management tools and practices. The English-France Channel project was an international project involving two governments (British and French), several financial institutions, engineering construction companies, and other various organizations between the two countries. The project goal, cost, schedule, and other factors needed to be coordinated for completion of the project. The language, use of standard metrics, and other communication differences needed to be standardized. The adoption of computer-aided project management practices led to the completion of the project with reduced change orders, increased productivity and resulted in a reliable product.[22]

[21] Elias G. Carayannis, et. al., *The Story of Project Management: An interdisciplinary Approach* (Westport: Quorum Books, USA, 2003), http://home.gwu.edu/~kwak/PM_History.pdf (accessed June 4, 2013) pages 5 – 6.
[22] Elias G. Carayannis, et. al., *The Story of Project Management: An interdisciplinary Approach* (Westport: Quorum Books, USA, 2003), http://home.gwu.edu/~kwak/PM_History.pdf (accessed June 4, 2013) page 6.

1995 to present: Creating a New Environment

The expansion of and the increased accessibility to the Internet marked the latest change in project management and thus construction management. The Internet affected virtually all business practices in the mid 1990s. It provided a fast, interactive, and customized medium that allowed owners, managers and contractors to browse, purchase, and track products and services online in or near real-time. As a result, the Internet permitted organizations to be more productive, more efficient, and more customer-oriented. Between 1995 and 2000, the project management community adopted internet technology to become more efficient in controlling and managing various aspects of projects.[23] Information technology revolutionized traditional business practices, and various industries started to adopt and to apply project management practices including the field of construction management. Internet-accessible construction management programs, such as E-builder™, have become widely adopted.

An example of the latest evolution in construction project management is the United States Department of Energy's Innovation Hub for Energy-Efficient Buildings (EEB Hub). A team of construction companies was chosen by Pennsylvania State University to provide integrated construction management services for the $30 million retrofit of the circa 1936 Building 661 at the Navy Yard in Philadelphia, Pennsylvania. "The building functions as a living laboratory to showcase multiple energy saving technologies, with built-in monitoring and verification strategies for testing and performing energy

[23] Elias G. Carayannis, et. al., *The Story of Project Management: An interdisciplinary Approach* (Westport: Quorum Books, USA, 2003), http://home.gwu.edu/~kwak/PM_History.pdf (accessed June 4, 2013) page 6 – 7.

efficiency research."[24] This Public-Private Partnership (P3) combined internet-based, real-time construction management and monitoring software with traditional construction management practices. It is an example of advanced computer technology aiding the construction manager in scheduling and projecting phases and tasks during the rehabilitation and renovation of a historic structure.[25]

Construction project management has developed from its beginning in reaction to large scale construction projects to become a standard component of all construction. Formalization and increased professional standards have elevated construction management to the level of academic curriculum. Construction management has become a lucrative field with room for individual growth, and many colleges and universities offer undergraduate and graduate degrees in construction management. The need for professional managers will increase in the future as the number of projects in energy, manufacturing, transportation and historic preservation increases.

[24] Energy Efficient Buildings Hub, "The Center for Building Energy Science," eebhub.org, http://www.eebhub.org/projects-list/navy-yard-building-661/ (accessed June 5, 2013).
[25] Balfour Beatty, "Balfour Beatty awarded U.S. Department of Energy Innovation Hub project at Philadelphia Navy Yard," balfourbeattyus.com, http://www.balfourbeattyus.com/Media-Center/Press-Releases/Balfour-Beatty-awarded-U-S--Department-of-Energy-I (accessed June 5, 2013).

CHAPTER 3

INTRODUCTION TO PRESERVATION CONSTRUCTION

Overview of Historic Preservation

The term 'historic building' encompasses a large range of building stock that may or may not be officially recognized. The National Trust for Historic Preservation maintains that there are over 1,200,000 commercial and industrial buildings erected over 40 years ago that are still in use in the United States and probably 30 times more residential properties of the same age.[26] According to the National Register of Historic Places criteria, a building must usually be at least 50 years old to be considered historic. However, some jurisdictions have lowered this requirement, for example; New York City has lowered the age threshold to 30 years for significant buildings to be considered Historic Landmarks.[27] The merits of a historic property are evaluated on an individual basis depending on the specific local history and the individual property's architectural distinction and association with important events or people.

It is also important to analyze a property's construction materials, methods and remaining integrity. Buildings that retain a significant amount of their original or unique construction can be more likely considered historic. The National Register of Historic Places Evaluation Criteria is a generally accepted standard for evaluating and

[26] Swanke Hayden Connell Architects, *Historic Preservation Project Planning & Estimating* (Kingston: R.S. Means, USA, 2000), page 3.
[27] Swanke Hayden Connell Architects, *Historic Preservation Project Planning & Estimating* (Kingston: R.S. Means, USA, 2000), page 3.

determining the historic and architectural significance and integrity of a historic property across a wide range of areas.[28] However, criteria for recognition as a historic landmark can vary between municipalities and between local and federal agencies.

There are several levels of preservation agencies on local and state levels. Legal protection of historic structures generally lies with these agencies. For example, New York City's Landmark Preservation Commission is a local agency with the ability to review designs and demolition requests, and designate landmarks and historic districts. State Historic Preservation Officers (SHPOs) administer the national historic preservation program at the state level. SHPOs work in conjunction with the National Park Service (NPS) to review and certify nominations of eligible properties to the National Register of Historic Places. Non-profit state and regional organizations, such as the Georgia Trust for Historic Places, channel local public opinion and concerns regarding preservation to the SHPOs, advocate for specific properties, and provide preservation training and education.[29]

Historic preservation issues on the Federal level are governed and influenced by several agencies. The National Trust for Historic Preservation is an agency "dedicated to protecting historic buildings, neighborhoods, and sites through education and

[28] U.S. Department of the Interior National Parks Service Cultural Resources, National Register Bulletin; How to Apply the National Register Criteria for Evaluation (Washington, D.C.: Department of the Interior, 1995), page i.
[29] Swanke Hayden Connell Architects, *Historic Preservation Project Planning & Estimating* (Kingston: R.S. Means, USA, 2000), pages 4.

advocacy."[30] The National Parks Service (NPS) is a division of the Department of the Interior and is the federal agency responsible for promoting the preservation of cultural resources. The NPS maintains regional offices and provides technical advice, information and guidance on historic preservation. The National Register of Historic Places, the National Historic Landmarks Survey, and the Tax Credit Rehabilitation Program are all administered by the National Parks Service.[31] The Advisory Council on Historic Preservation is an independent federal agency that advises the President and Congress on national preservation issues. The implementation of the Historic Preservation Act of 1966, such as Section 106 review, is also a responsibility of the Advisory Council on Historic Preservation.[32] The National Register of Historic Places is the United States' inventory of historic places and repository of documentation of historic properties. The National Register Criteria for Evaluation identifies the resources and defines significance that qualifies a property for listing. National Historic Landmarks are included on the National Register.[33]

Understanding official historic designations is a critical component of the first steps in a preservation project. A property's status can restrict construction methods and materials while also providing benefits in the form of tax credits and technical

[30] U.S. Department of the Interior National Parks Service Cultural Resources, "National Register Bulletin; How to Apply the National Register Criteria for Evaluation" (Washington, D.C.: Department of the Interior, 1995), copy write page.
[31] U.S. Department of the Interior National Parks Service Cultural Resources, "Historic Preservation Tax Incentives" (Washington, D.C.: Department of the Interior, 2012), cover.
[32] Advisory Council on Historic Preservation, "Citizens Guide to Section 106 Review" (Washington D.C., 2010), page 2.
[33] Swanke Hayden Connell Architects, *Historic Preservation Project Planning & Estimating* (Kingston: R.S. Means, USA, 2000), pages 5 – 9.

assistance. Determining the organizations that must be contacted or consulted is the first step in determining a preservation construction project's feasibility.

Preservation Construction

Maintaining integrity of a historic building is the most important aspect of any historic construction project. "Integrity is the ability of a property to convey its significance."[34] A property that retains the identity for which it is significant possesses integrity. According to the National Register of Historic Places nomination criteria, there are seven aspects of historic integrity: location, design, settings, materials, workmanship, feeling, and association.[35] Location is the place where a historic property was constructed or the place where a historic event occurred. Design is the combination of elements that create form, plan, space structure, and style of a property. Setting is the physical environment of a historic property. Materials are the physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property. Workmanship is the physical evidence of the crafts of a particular culture or people during any given period of history or prehistory. Feeling is a property's expression of the aesthetic or historic sense of a

[34] U.S. Department of the Interior National Parks Service Cultural Resources, National Register Bulletin; How to Apply the National Register Criteria for Evaluation (Washington, D.C.: Department of the Interior, 1995), page 44.
[35] U.S. Department of the Interior National Parks Service Cultural Resources, National Register Bulletin; How to Apply the National Register Criteria for Evaluation (Washington, D.C.: Department of the Interior, 1995), page 45.

particular period of time. Association is the direct link between an important historic event or person to a historic property.[36]

The Secretary of the Interior's Standards for the treatment of Historic Properties is a series of concepts about maintaining, repairing, and replacing historic materials, as well as designing new additions or making alterations. The Guidelines offer general design and technical recommendations to assist in applying the Standards to a specific property. Together, they provide a framework and guidance for decision-making about work or changes to a historic property. The Standards and Guidelines can be applied to historic properties of all types, materials, construction, sizes, and use. They include both the exterior and the interior and extend to a property's landscape features, site, environment, as well as related new construction. Federal agencies use the Standards and Guidelines in carrying out their historic preservation responsibilities. State and local officials use them in reviewing both Federal and non-Federal rehabilitation proposals. Historic district and planning commissions across the country use the Standards and Guidelines to guide their design review processes.[37]

Historic buildings often have deficiencies in life safety and accessibility. Additional challenges include updating utilities and decreasing or ending building degradation. However, decisions regarding construction should consider the invasiveness of the project. The value of modifications should be weighed against the

[36] U.S. Department of the Interior National Parks Service Cultural Resources, National Register Bulletin; How to Apply the National Register Criteria for Evaluation (Washington, D.C.: Department of the Interior, 1995), page 44-45.
[37] The National Parks Service, "Secretary of the Interior's Standards for the Treatment of Historic Properties," http://www.nps.gov/tps/standards.htm (accessed June 3, 2013).

importance of maintaining the building's historic integrity. When work is deemed necessary, all improvements should follow The Secretary of the Interiors Standards for the Treatment of Historic Properties. Historic elements and materials should be preserved to the greatest extent possible.[38] For example, small components of a structure's historic fabric, such as door and window hardware, can get lost on large scale preservation projects. These small components distinguish a project as maintaining genuine historic character.

Despite sharing project delivery systems, restoration, conservation, preservation and rehabilitation of historic buildings differ from new construction. Many project components are unique to preservation construction and can often be difficult for inexperienced designers, contractors and clients. These unique factors include: research and documentation, hazardous materials, unforeseen conditions, archaic and obsolete materials and construction, preconstruction investigation, realistic budgeting, detailed specifications, space limitations for utilities, extended maintenance plans, and most importantly preservation guidelines such as The Americans with Disabilities Act and The Secretary of the Interiors Standards for the Treatment of Historic Properties.[39]

Preservation Professionalism

Establishing the preservation team is the first component of the project. The preservation team includes specialists experienced in the design, development, and

[38] The National Parks Service, "Secretary of the Interior's Standards for the Treatment of Historic Properties; with Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings," (Washington, D.C.: Department of the Interior, 1992), page 26.
[39] Swanke Hayden Connell Architects, *Historic Preservation Project Planning & Estimating* (Kingston: R.S. Means, USA, 2000), page xxii.

execution of preservation projects. These include architectural historians, conservators, historic architects, historical engineers, historic preservationists, and historians. Architectural historians study the development of building practices through written records and design and the examination of structures, sites, and objects. Conservators prolong the physical and aesthetic life of prehistoric and historic material culture through documentation, preventative care, treatment, and research. Different combinations of these professionals may be required for specific preservation projects. Historical architects apply artistic and scientific principles to the research, planning, design, and management of the build environment. Historical engineers apply scientific principles to the research, planning, design, and management of structures and machines. Historic preservationists apply strategies to promote the identification, evaluation, documentation, registration protection, treatment, continued use, and interpretation of prehistoric and historic resources. Historians study the past through written records, oral history, and material culture.[40]

The overall project team represents as many disciplines as the project requires. The team may include architects, engineers, contractors, consultants, interior designers, administrators, conservators, curators, and the owner or facility operator. All members of the project team should have specific training outlined by the National Parks Service's Professional Qualification Standards and/or adequate prior experience. The Secretary of the Interior's Historic Preservation Professional Qualifications Standards include

[40] Swanke Hayden Connell Architects, *Historic Preservation Project Planning & Estimating* (Kingston: R.S. Means, USA, 2000), page 12-16.

minimum requirements for professionals practicing in the field of historic preservation. The standards address three components:[41]

1. Academic degrees or comparable training
2. Professional experience
3. Products and activities that demonstrate proficiency in the field of historic preservation

In general, a professional must have a graduate degree in the corresponding or similar field and at least two (2) years of full-time professional experience. Minimum amounts of education and/or training along with full-time professional experience are defined by the qualification standards.[42]

Project Phases

Documentation is the foundation of a successful historic construction project. The Construction Specifications Institute (CSI) and The Association for Preservation Technology International (APTI) developed Standard TD-2-8, "A Guide to Preparing Design and Construction Documents for Historic Projects."[43] This document is the industry standard for developing design and construction documents for preservation projects.

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[41] Swanke Hayden Connell Architects, *Historic Preservation Project Planning & Estimating* (Kingston: R.S. Means, USA, 2000), page 12.
[42] The Secretary of the Interior & The National Parks Service, The Secretary of the interior Standards and Guidelines for Archaeology and Historic Preservation (Washington, D.C. The National Parks Service, USA, 1983), page 1.
[43] Construction Specifications Institute, *Guide to Preparing Design and Construction Documents for Historic Projects* (Alexandria: The Construction Specifications Institute, 1996, page 3.

Phase one of any historic construction project is investigation and documentation. This initial phase includes historic research, Existing Condition Surveys (ECSs), and Historic Structure Reports (HSRs). Historic research gathers data such as the applicable technical data on architectural conditions, material compositions and sources, and building systems.[44] The information collected becomes the basis of on-site documentation of existing conditions. The Existing Condition Survey is the inspection and documentation of the building's composition, design, and as-built conditions. This survey includes visual inspection and scientific analysis. The ECS may also require invasive, destructive, or investigational processes. [45] For example, the internal conditions of a brick-veneered wall cannot be determined without cutting and removing brick to create a probe. The invasiveness should be kept to a minimum. The Historic Structure Report documents the existing condition of the building based on a general building inspection and includes a historic narrative based on archival data.[46]

Phase two is planning and predesign. This phase includes architectural and engineering 'programming.' Architectural and engineering programs identify the requirements applicable to the building's new design and use, specifically code requirements, historic component conservation, new material requirements, necessary

[44] The National Parks Service, "NPS-28: Cultural Resource Management Guideline," http://www.nps.gov/history/history/online_books/nps28/28chap8.htm (accessed June 4, 2013).
[45] Swanke Hayden Connell Architects, *Historic Preservation Project Planning & Estimating* (Kingston: R.S. Means, 2000), pages 18 – 19.
[46] The National Parks Service, "NPS-28: Cultural Resource Management Guideline," http://www.nps.gov/history/history/online_books/nps28/28chap8.htm (accessed June 4, 2013).

utility updates, required structural improvements, etc. The end products of this phase are the overall scope of work, project budget, and post-construction operational costs.[47]

Phase three is the design phase and includes the schematic design, design development, and construction documents.[48] The project requirements, determined by the planning and predesign phase, are integrated with condition surveys to establish the schematic design. The design team selects products to serve as the construction specifications and creates design drawings that establish the scope of work. Detailed drawings and specification outlines are created later from the general construction documents created in this phase. These products compose the construction documents package that will be submitted to contractors.[49] The drawings, specifications, and addendums are used for both bidding and construction.

Phase four is the bidding and negotiating phase and is unique to Design-Bid-Build. It begins by determining necessary qualifications and selecting appropriate contractors. Qualified contractors are determined by either bids, or proposals, and suitability of contractors based on experience and previous projects.[50] At this point, contract inconsistencies are identified and modifications or revisions to documents are

[47] Swanke Hayden Connell Architects, *Historic Preservation Project Planning & Estimating* (Kingston: R.S. Means, USA, 2000), page 18.
[48] American Institute of Architects, "Defining the Architect's Basic Services," http://www.aia.org/aiaucmp/groups/ek_members/documents/pdf/aiap026834.pdf (accessed May 24, 2013).
[49] Swanke Hayden Connell Architects, *Historic Preservation Project Planning & Estimating* (Kingston: R.S. Means, USA, 2000), page 20.
[50] Swanke Hayden Connell Architects, *Historic Preservation Project Planning & Estimating* (Kingston: R.S. Means, USA, 2000), page 21.

determined. Ultimately, contractors are selected by the owner with input from the design team, a contract is signed, and the notice to proceed is issued.

Phase five is the construction phase. The work is administered and the project is built during this phase. Execution of the project includes submittals, mock-ups, periodic reviews of work, quality assurance and quality control, and final acceptance.[51] If the work conforms to the accepted construction documents, the project should be completed on time and on budget. However, change orders, contingency allowances, and additional unit-price work may increase project costs and scope. The final product is evaluated by the design team, quality control entity, the owner(s), and the operators.[52] Once the 'punch list,' or final tasks necessary for completion is fulfilled and the owner is satisfied with the work, the project is complete. The project may include ongoing maintenance or operations plans or contracts.

Preservation construction projects can be complicated and unique. However, once the historic status of a property is determined, the building owner or operator can decide to move forward on a preservation project. This outline of the project phases is often adjusted based on the specifics of a project. However, these phases are generally accepted and followed in the preservation construction industry. The most critical phase of the project schedule is phase one: investigation and documentation. Without proper

[51] Swanke Hayden Connell Architects, *Historic Preservation Project Planning & Estimating* (Kingston: R.S. Means, USA, 2000), pages 21.
[52] Swanke Hayden Connell Architects, *Historic Preservation Project Planning & Estimating* (Kingston: R.S. Means, USA, 2000), pages 21.

investigation and documentation, a preservation project can be difficult or even detrimental to the historic resource.

CHAPTER 4

DESIGN-BUILD (DB) AND DESIGN-BID-BUILD (DBB)

Determining a Project Delivery System

How the project will be designed and constructed, the project delivery method, is one of the most important decisions made by an owner embarking on a construction project. The Construction Management Association of America published "An Owners Guide to Project Delivery Methods" in 2012 to assist owners in making such a decision. It is widely adopted and used frequently when deciding the proper PDS. With a variety of delivery methods in use today across the design and construction industry, it is possible to tailor a delivery method that best meets the unique needs of each owner and each project. For the owner, with a wealth of choices available, the ultimate decision can have pros and cons. Unfortunately, with the variety of delivery systems, along with the accompanying assurances of the superiority of one method over another, confusion is inevitable. However, the increased number of alternatives offers the owner or developer more flexibility to choose an appropriate and effective system for a particular project.[53]

An owner has several areas of concern when embarking on a construction program or project. It is necessary to choose an overall project delivery and contracting strategy that effectively and efficiently delivers the project. There are five key

[53] The Construction Management Association of America, "An Owners Guide to Project Delivery Methods" (2012). Page 7.

considerations that influence the selection of the delivery system for a project: budget, design, schedule, risk assessment, and the owner's level of expertise.[54]

Determining a realistic budget before the design phase is important to evaluate project feasibility, to secure financing, to evaluate risk, and as a tool to choose from among alternative designs or site locations. Once the budget is determined, the owner requires that the project be completed at or near the established budget figure. Owners must decide how quickly they need to establish final project costs and how much risk there is of exceeding this cost.[55]

Design is the second important component of the owner's decision process. Achieving "the desired function of a facility as designed while successfully fulfilling the needs of the owner and users" is paramount.[56] Therefore, the design team should be well qualified in the type of facility being designed. In addition, the owner must ensure that the program needs are clearly conveyed to the design team. Since the design of the facility must be buildable and design intent must be properly communicated, the owner requires that the design documents are constructible, complete, clear and coordinated. The documents should properly incorporate unique features of the site to include subsurface conditions, interfaces with adjoining properties, access, and other

[54] The Construction Management Association of America, "An Owners Guide to Project Delivery Methods" (2012). Page 7.
[55] The Construction Management Association of America, "An Owners Guide to Project Delivery Methods" (2012). Page 9.
[56] The Construction Management Association of America, "An Owners Guide to Project Delivery Methods" (2012). Page 9.

characteristics. It is important for the owner to recognize quality in design. Quality in design is based on the architect's experience and expertise.

The owner has similar needs in the area of scheduling. The dates of design commencement, construction completion and ultimately the operation of a new facility can be critical, either in terms of generating revenue from the facility, or in terms of providing needed functional space by a particular deadline.[57] Therefore, a realistic assessment of project duration and sequencing needs to be performed early in the planning process. The schedule must then be monitored and updated throughout the design, construction and pre-occupancy phases to achieve the desired goal. An owner must decide how critical it is to minimize schedule duration for a project.

Understanding risk is another determining factor. Construction risk is defined as the probability of financial loss associated with the physical (construction) phase of a construction project.[58] In construction, issues of risk are closely tied to the status of the local construction market, on-site safety, the schedule, and the budget. "The owner requires an understanding of the risks involved in construction, and should make a conscientious decision regarding allocation of these risks among project participants, so that all areas of exposure are properly understood."[59] In considering risk allocation, the owner strives to assign risks to those parties that best exercise control over those

[57] The Construction Management Association of America, "An Owners Guide to Project Delivery Methods" (2012). Page 9.
[58] The Construction Management Association of America, "An Owners Guide to Project Delivery Methods" (2012). Page 9.
[59] The Construction Management Association of America, "An Owners Guide to Project Delivery Methods" (2012). Page 10.

aspects. For example, it would typically be problematic to require that the contractor correct problems due to design errors or changes at no extra cost since a contractor generally has little control over the cause or magnitude of such errors or changes.[60] An owner must decide how much project risk they are comfortable in assuming.

The owner's expertise is the final important influence on choosing a delivery method. According to An Owners Guide to Project Delivery Methods, "an owner's familiarity with the construction process and level of in-house management capability has a large influence over the amount of outside assistance required during the process, and may guide the owner in determining the appropriate project delivery method."[61] An owner must make an assessment of its ability to properly perform under the various delivery methods. Design-Build and Design-Bid-Build are complex systems and their implementation and components can vary from project to project.

Design-Build (DB)

Design-Build (DB) is a project delivery system used in the construction industry. It is a method in which the design and construction services are contracted by a single entity known as the Design-Builder or Design-Build contractor. There are two main sequential phases to the Design-Build delivery system; the design phase and the

[60] The Construction Management Association of America, "An Owners Guide to Project Delivery Methods" (2012). Page 10.
[61] The Construction Management Association of America, "An Owners Guide to Project Delivery Methods" (2012). Page 10.

construction phase. Design–build relies on a single point of responsibility contract for the two project phases. There are three variations of the DB project delivery system:[62]

1. Bridging – A designer is retained by the owner to develop the design documents to a specific point (usually schematic level) prior to engaging the Design-Build contractor, who then finishes the design and constructs the project.[63]
2. Public Private Partnership (P3) – A private entity or consortium of investors provides some or all of the required capital with a commitment to deliver a completed project for a public sector owner in exchange for revenue that the completed facility is anticipated to generate.[64]
3. True DB – Based on qualifications, a Design-Builder is hired to complete all phases of design and construction including program and schematic design, construction management, trade work and materials. This form is similar to Bridging but all work is performed under one contract.

DB Management Process

Often with the Design-Build delivery method, the owner produces bridging documents created by an architect hired by the owner; these bridging documents provide the basis of the design that sets forth their expectations for the design and construction of the project. Typically, these bridging documents contain schematic

[62] The Construction Management Association of America, "An Owners Guide to Project Delivery Methods" (2012). Page 11.
[63]The Construction Management Association of America, "An Owners Guide to Project Delivery Methods" (2012). Page 7.
[64] The Construction Management Association of America, "An Owners Guide to Project Delivery Methods" (2012). Page 7.

drawings and specifications. When the owner's architect completes the bridging documents, the job is advertised and/or delivered to selected companies to begin the proposal process. By analyzing bridging documents, the DB entity understands how to create the DB proposal, tailored to the needs and desires of the owner.[65] Unique to DB contracts, the DB entities have the ability to alter the bridging documents and also have more freedom to tailor the design to what that particular team believes is best for the owner and the project.[66] Any changes to the bridging documents must be approved by the owner.

The DB entities acquire and analyze the bridging documents from the owner, noting all design, materials, and other aspects that need to be completed for their proposal. At that point, the DB entities prepare their final proposal and submit them to the owner. "This proposal is considered their 'bid' for the job, and typically has a guaranteed maximum price (GMP)."[67] Unit prices for individual tasks, based on time and material costs can be requested by the owner and identified in the RFP. These costs determined by the contractor and are reflected in the proposal. The DB entities proposals typically must to be turned into the owner at a specific time and place.

[65] James David Fernane, "Comparison of design-build and design-bid-build performance of public university projects" (Master's Thesis, University of Nevada, 2011), 7, in digitalscholarship.unlv.edu, http://digitalscholarship.unlv.edu/cgi/viewcontent.cgi?article=2212&context=thesesdissertations (accessed June 4, 2013).

[66] Cushman, Robert Frank and Michael C. Loulakis, *Design-Build Contracting Handbook*, (Aspen: Aspen Publishers, 2001), page 9.

[67] James David Fernane, "Comparison of design-build and design-bid-build performance of public university projects" (Master's Thesis, University of Nevada, 2011), 7, in digitalscholarship.unlv.edu, http://digitalscholarship.unlv.edu/cgi/viewcontent.cgi?article=2212&context=thesesdissertations (accessed June 4, 2013).

After the proposals are accepted, the owner begins a lengthy review process that includes different levels of criteria by which the proposals are judged and scored. This is sometimes referred to as the 'best value' selection process. Best-value is one of three forms of selection: lowest-bid, best-value, and qualifications-based. Lowest- bid and qualifications based selection are rare selection processes when DB contractors are desired. Criteria are built into the selection process that allows the owner to select the DB entity based on the best value for the owner.[68] Thus, the owner does not have to be committed to a low bidder. The DB entity that scores the highest in a sum of all the categories is offered the job, contingent on their ability to provide accurate insurance and bond coverage.[69] If the DB entity is able to meet the insurance and bond requirements and accepts the job, a contract is signed and the notice to proceed is issued.

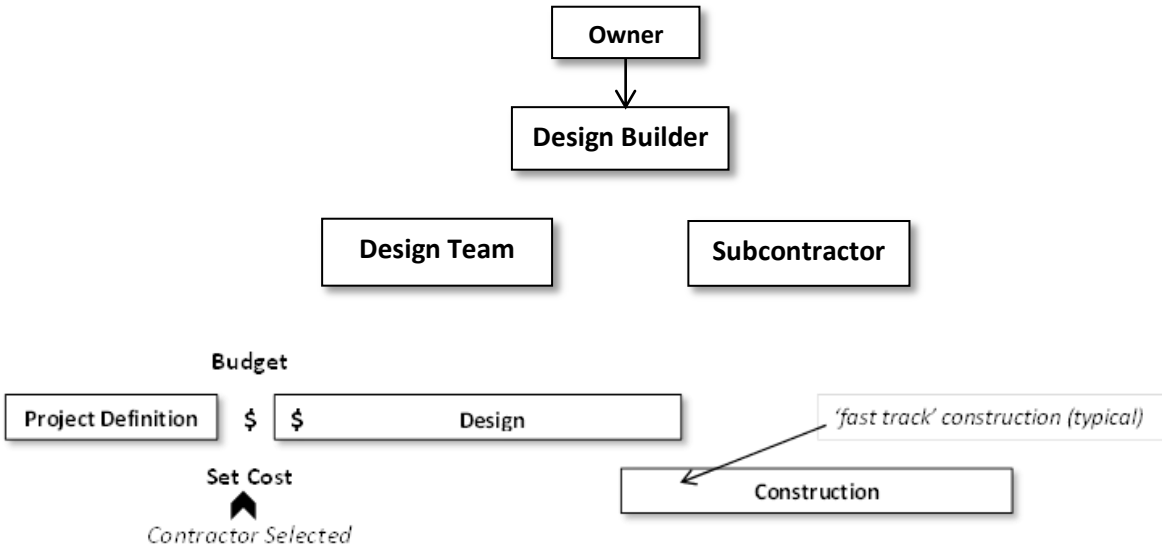
Ultimately, the owner contracts with a single entity that is responsible for the design and construction of the project. Since the DB entity creates the final design and specifications based on the bridging documents, the DB entity is responsible for the design and construction of the project; change orders will not be accepted unless they are owner requested changes. However, in the case of preservation construction, change orders are more common due to unforeseen field conditions. DB project delivery

[68] James David Fernane , "Comparison of design-build and design-bid-build performance of public university projects" (Master's Thesis, University of Nevada, 2011), 7, in digitalscholarship.unlv.edu, http://digitalscholarship.unlv.edu/cgi/viewcontent.cgi?article=2212&context=thesesdissertations (accessed June 4, 2013).

[69] James David Fernane, "Comparison of design-build and design-bid-build performance of public university projects" (Master's Thesis, University of Nevada, 2011), 7, in digitalscholarship.unlv.edu, http://digitalscholarship.unlv.edu/cgi/viewcontent.cgi?article=2212&context=thesesdissertations (accessed June 4, 2013).

reduces costs, compresses schedule, reduces number of change orders, and nearly eliminates 'low-ball' bids. It is critical for DB preservation contractors to investigate the property prior to creating a proposal. Identifying existing conditions and potential unforeseen conditions will decrease change orders.

Table 4.1 DB Structure & Schedule[70]



DB Contracts and Contractors

A DB contract has several key features: requirements, price and roles. The contract includes requirements defining the owner's wants and the scope of the contractor's proposal. The contractor's proposal must include production and design work. The contractor's design input varies depending on the extent of the previous design work completed by the owner's design team. In the case of DB projects,

[70] Crites, Mary K. "Getting the Best Value for Our Construction Dollars; A Primer of Construction Delivery Methods for Owners (from an Owner's Biased Viewpoint)," *Maricopa Community College*. November 2007, http://www.gc.maricopa.edu/adminsvcs/oct_05/insert.pdf (accessed May 28, 2013).

Guaranteed Maximum Price (GMP) is the most common form of pricing. Incentives are established in the contract such as the sharing of remaining balance savings after completion of the project. Finally, DB contracts determine the roles and relationships between the owner and the DB contractor including sub relationships within the DB contractor's scope of work.

The Design-Builder is often a General Contractor (GC), but in many cases a project is led by a design professional (architect, engineer, architectural technologist or other professional designers). In the case of historic preservation construction, the DB can be an architectural conservator, historic architect, or historic engineer. Some Design-Build firms employ professionals from both the design and construction sector. Where the Design-Builder is a general contractor, the designers are typically consulting architects, retained by the contractor. Partnership or a joint venture between a design firm and a construction firm may be created on a long term basis or for one project only.[71] A DB project can be led by a contractor, a designer, a developer, or a joint venture, as long as the design–build entity holds a single contract for both design and construction.

History of DB

Design-Build has roots in the 'master builder' approach, one of the oldest forms of construction. Comparing Design-Build to the Design-Bid-Build system, the authors of Design-build Contracting Handbook noted that: "from a historical perspective the so-

[71] Cushman, Robert Frank and Michael C. Loulakis, *Design-Build Contracting Handbook*, (Aspen: Aspen Publishers, 2001), page 6.

called traditional approach is actually a very recent concept, only being in use approximately 150 years. In contrast, the design–build concept-also known as the 'master builder' concept-has been reported as being in use for over four millennia."[72]

The architects of ancient Egypt were referred to as 'the overseer of the work.' Not only were they responsible for design and engineering but the construction as well.[73] The Ancient Greeks are credited with the creation of the 'master builder.' Greek master-builders were originally known as 'Arkhitekton', translated 'master carpenter,' from which the word architect is derived.[74] Greek stone masons followed the detailed design, known as 'syngraphai,' verbalized by the architect.[75] Roman architect and master builder Marcus Vitruvius Pollio defined the products of 'master builders' to include "firmness, commodity and delight" [76] Vitruvius had extensive experience in both design and construction.[77]

During the Medieval era, craft guilds dominated the building environment. However, the coordinator of construction projects remained the architect/master builder. Architects of the era rose through the ranks of craftsmen, familiarizing

[72]Robert Frank Cushman and Michael C. Loulakis, *Design-Build Contracting Handbook*, (Aspen: Aspen Publishers, 2001), page 6.
[73] Spiro Kostof, *The Architect: Chapters in the History of the Profession*, (Los Angles: Oxford Press, 1977), page 10.
[74] Banister F. Fletcher, *A history of architecture on the comparative method for the student, craftsman, and amateur*, (New York: Scribners & Sons, 1905), page 65.
[75] Spiro Kostof, *The Architect: Chapters in the History of the Profession*, (Los Angles: Oxford Press, 1977), page 12.
[76]Robert Frank Cushman and Michael C. Loulakis, *Design-Build Contracting Handbook*, (Aspen: Aspen Publishers, 2001), page 6.
[77] Spiro Kostof, *The Architect: Chapters in the History of the Profession*, (Los Angles: Oxford Press, 1977), page 38.

themselves with all aspects of construction.[78] Medieval architects shared design and build responsibilities with the major tradesmen and craftsmen. Despite the architects' position, craftsmen greatly influenced or determined designs based on individual expertise and experience.

During the Italian Renaissance, two schools of thought emerged in construction leadership. The master builder concept (essentially DB) continued with such projects as the Dome of the Florence Cathedral by Capomaestro Filippo Brunelleschi. Brunelleschi was the father of mathematical perspective rendering and favored the established role of architect as builder. Leone Battista Alberti introduced the idea of 'architect as artist.' Alberti's designs include the Santa Maria Novella and the Palazzo Rucella, both located in Florence. [79] The 'architect as artist' concept, favored by Alberti, emerged from a pervasive desire of architects to separate themselves from the building trades. Architects sought to align the discipline with professional academic fields such as Art and Law. Architects continued distancing themselves from the building trades after the Italian Renaissance. Public perception of architects followed this trend as well.[80]

The American influence on Design-Build began in the 1700s. Several early influential leaders were also master builders, responsible for the design and construction of historically significant structures. According to architect Richard Swett,

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[78] Spiro Kostof, *The Architect: Chapters in the History of the Profession*, (Los Angles: Oxford Press, 1977), page 61.
[79] Carlos J. Cardoso and Martin Sell, "History and Introduction to Design-Build" (PowerPoint slides, A Continuing Education Webinar of the American Institute of Architects, April 16, 2009) http://www.aia.org/groups/aia/documents/pdf/aiab090075.pdf (accessed May 23, 2013).
[80] Carlos J. Cardoso and Martin Sell, "History and Introduction to Design-Build" (PowerPoint slides, A Continuing Education Webinar of the American Institute of Architects, April 16, 2009) http://www.aia.org/groups/aia/documents/pdf/aiab090075.pdf (accessed May 23, 2013).

"Thomas Jefferson was an architect, a problem solver and a master builder"[81] It was common for wealthy men to pursue unpaid design jobs as academic challenges. These individuals were known as 'gentleman amateurs.' In the 1800s, the 'master builder' concept continued, the architect maintained control of the design and construction phases of projects by providing construction services under a single contract with the client. Prior to the nineteenth century, payment for the design and construction was based on post construction measurements, calculated by independent 'measurers.' "In the early part of the present century (1800's), and for many years before, the architect was commonly the principal contractor for the building … the only way to include whole building in one contract was to make an agreement with someone outside the trades and let him make sub-contracts with the trades."[82] Design-Build was influenced by the concept of the architect/master builder cooperating with trade contractors.

Modern DB

Early twentieth century construction followed the format used in the 18th and 19th centuries: architects and contractors formed a team and combined roles under one 'master-builder. However, newly formed professional societies such as the American Institute of Architects (AIA), founded in 1857, and The Associated General Contractors of America (AGC), founded in 1918, promoted the differentiation between the design

[81] Carlos J. Cardoso and Martin Sell, "History and Introduction to Design-Build" (PowerPoint slides, A Continuing Education Webinar of the American Institute of Architects, April 16, 2009) http://www.aia.org/groups/aia/documents/pdf/aiab090075.pdf (accessed May 23, 2013).
[82] Carlos J. Cardoso and Martin Sell, "History and Introduction to Design-Build" (PowerPoint slides, A Continuing Education Webinar of the American Institute of Architects, April 16, 2009) http://www.aia.org/groups/aia/documents/pdf/aiab090075.pdf (accessed May 23, 2013).

and construction trades.[83] Increasingly, architects removed themselves from the construction process and the corresponding responsibility and liability. Increasingly, project delivery systems, such as Design-Bid-Build, began filling the void created by the progressive separation of design teams and construction contractors. The United States Government began favoring DBB systems with legislation such as The Miller Act of 1935.[84]

Today, many architects in the United States and elsewhere provide integrated design and construction services-also known as Design-Build. Despite resistance from professional organizations, designers and general contractors have increasingly offered DB services. Until 1979, AIA's code of ethics and professional conduct prohibited their members from "providing construction services."[85] However, the AIA has recently acknowledged that Design-Build is becoming one of the main approaches to construction. In 2003, the AIA endorsed "The architect's guide to Design-Build services", which was written to help their growth number of members acting as DB contractors.[86]

Recently, the DB project delivery system has been growing in popularity in the public sector. Following the private sector's lead, Congress passed a law in 1996

[83] Carlos J. Cardoso and Martin Sell, "History and Introduction to Design-Build" (PowerPoint slides, A Continuing Education Webinar of the American Institute of Architects, April 16, 2009) http://www.aia.org/groups/aia/documents/pdf/aiab090075.pdf (accessed May 23, 2013).
[84] Carlos J. Cardoso and Martin Sell, "History and Introduction to Design-Build" (PowerPoint slides, A Continuing Education Webinar of the American Institute of Architects, April 16, 2009) http://www.aia.org/groups/aia/documents/pdf/aiab090075.pdf (accessed May 23, 2013).
[85] Carlos J. Cardoso and Martin Sell, "History and Introduction to Design-Build" (PowerPoint slides, A Continuing Education Webinar of the American Institute of Architects, April 16, 2009) http://www.aia.org/groups/aia/documents/pdf/aiab090075.pdf (accessed May 23, 2013).
[86] Carlos J. Cardoso and Martin Sell, "History and Introduction to Design-Build" (PowerPoint slides, A Continuing Education Webinar of the American Institute of Architects, April 16, 2009) http://www.aia.org/groups/aia/documents/pdf/aiab090075.pdf (accessed May 23, 2013).

permitting the use of the Design-Build (DB) project delivery method in procurement and construction, including preservation projects.[87] A study from the US Department of Transportation stated:

> Design-build delivery has been steadily increasing in the U.S. public building sector for more than 10 years…The primary lessons learned …relate to the types of projects utilizing design–build, the use of best-value selection, percentage of design in the solicitation, design and construction administration, third-party risks, the use of warranties, and the addition of maintenance and operation to design–build contracts.[88]

AIA recognized Design-Build continues to rise in both Public and Private Business Sectors and by the end of year 2006 over 50% of all construction projects were delivered by the Design-Build system.[89] A 2011 study by the Design-Build Institute of America (DBIA) analyzing the DB project delivery method in the United States showed that Design-Build was used on more than 40 percent of non-residential construction projects in 2010, a ten percent increase since 2005.[90]

Design-Bid-Build (DBB)

Design-Bid-Build (DBB), also known as 'hardbid' or "traditional method,' is a type of project delivery system where the owner holds two separate contracts, one with the

[87] USDOT - Federal Highway Administration, "Design-Build Effectiveness Study" (Washington D.C., USDOT, January 2006) http://www.fhwa.dot.gov/reports/designbuild/designbuild.htm (accessed May 23, 2013).
[88] Carlos J. Cardoso and Martin Sell, "History and Introduction to Design-Build" (PowerPoint slides, A Continuing Education Webinar of the American Institute of Architects, April 16, 2009) http://www.aia.org/groups/aia/documents/pdf/aiab090075.pdf (accessed May 23, 2013).
[89] The Construction Management Association of America, "An Owners Guide to Project Delivery Methods" (2012). Page 6.
[90] Design-Build Institute of America, "Design-Build Project Delivery Method Used for More Than 40 Percent of Nonresidential Construction Projects, Report Shows" (June 7, 2011) http://www.dbia.org/news/press/rsmeans110606.htm (accessed May 23, 2013).

designer and another with the contractor. The designer assists the owner in developing the program and is responsible for design and the development of drawings and specifications. The contractor is responsible for means, methods, and actual construction of the project. There are three main sequential phases to the Design-Bid-Build delivery system: the design phase; the bidding (or tender) phase; and the construction phase. The bidding phase is unique to DBB. The most common type of DBB is 'Multiple Primes' where an owner contracts directly with separate trade contractors for specific and designated elements of the work, rather than with a single general or prime contractor.[91]

DBB Management Process

In the design phase, the owner selects and retains an architect or design firm to design and produce tender documents on which various general contractors will in turn bid. The architect will work with the owner to identify the owner's needs, develop a written program documenting those needs, and then produce a conceptual or schematic design. The drawings become the foundation of the construction drawings and specifications.[92]

Construction drawings include scaled plans and elevations with dimensions, measurements and specifications. After the design is completed, the project drawings become the contract documents. These documents are then coordinated by the project

[91] The Construction Management Association of America, "An Owners Guide to Project Delivery Methods" (2012). Page 6.
[92] American Institute of Architects, "Defining the Architect's Basic Services," http://www.aia.org/aiaucmp/groups/ek_members/documents/pdf/aiap026834.pdf (accessed May 24, 2013).

manager. When the designer completes the contract documents, the project manager advertises and/or delivers the tender documents to selected companies. This begins the bidding/tender process for general contractors.

Bids, or tenders, can be 'open', in which any qualified bidder may participate, or 'select', in which a limited number of pre-selected contractors are invited to bid. During the bid phase or tender process, General Contracting (GC) companies acquire the contract documents and meticulously go through the plans and specifications to note all materials and work that need to be completed. The various general contractors bidding on the project obtain copies of the tender documents, and distribute the documents to multiple subcontractors for bids on sub-components of the project. Questions may arise during the tender period, and the architect will typically issue clarifications or addenda. From these elements, the contractor compiles a complete 'tender price' for submission by the closing date and time. Unit prices for tasks are determined by time and material costs to the contractor. These prices can be requested by the owner, identified in the RFP. These costs are the reflected in the bid. Tender documents can be based on the quantities of materials in the completed construction.[93] Then the GCs prepare their final cost for all labor and materials, and submit this to the owner.[94] This is considered their

[93] American Institute of Architects, "Defining the Architect's Basic Services," http://www.aia.org/aiaucmp/groups/ek_members/documents/pdf/aiap026834.pdf (accessed May 24, 2013).
[94] The Construction Management Association of America, "An Owners Guide to Project Delivery Methods" cmaanet.org, http://cmaanet.org/files/Owners%20Guide%20to%20Project%20Delivery%20Methods%20Final.pdf (accessed June 3, 2013).

'bid' for the job. Typically, the GCs' bids must be submitted to the owner at a specific time and place.

Once bids are received, the architect typically reviews the bids, seeks any clarifications required of the bidders, ensures all documentation is in order, and advises the owner as to the ranking of the bids. If the bids fall in a range acceptable to the owner, the owner and architect discuss the suitability of various bidders and their proposals. The owner is not obligated to accept the lowest bid, and it is customary for other factors including past performance and quality of other work to influence the selection process.[95]

After the bids are accepted, opened, and reviewed by the owner, the GC with the lowest bid and/or best quality value is offered the job, contingent on their ability to provide accurate insurance and bond coverage. If the GC is able to meet the insurance and bond requirements and accepts the job, a contract is signed and the notice to proceed is issued. Since the design is considered as the contract document, and was completed and issued by the owner, any changes that need to be done after the work begins are documented in change order requests submitted to the owner.[96] These changes are then determined to be justified or not and additional costs are agreed upon.

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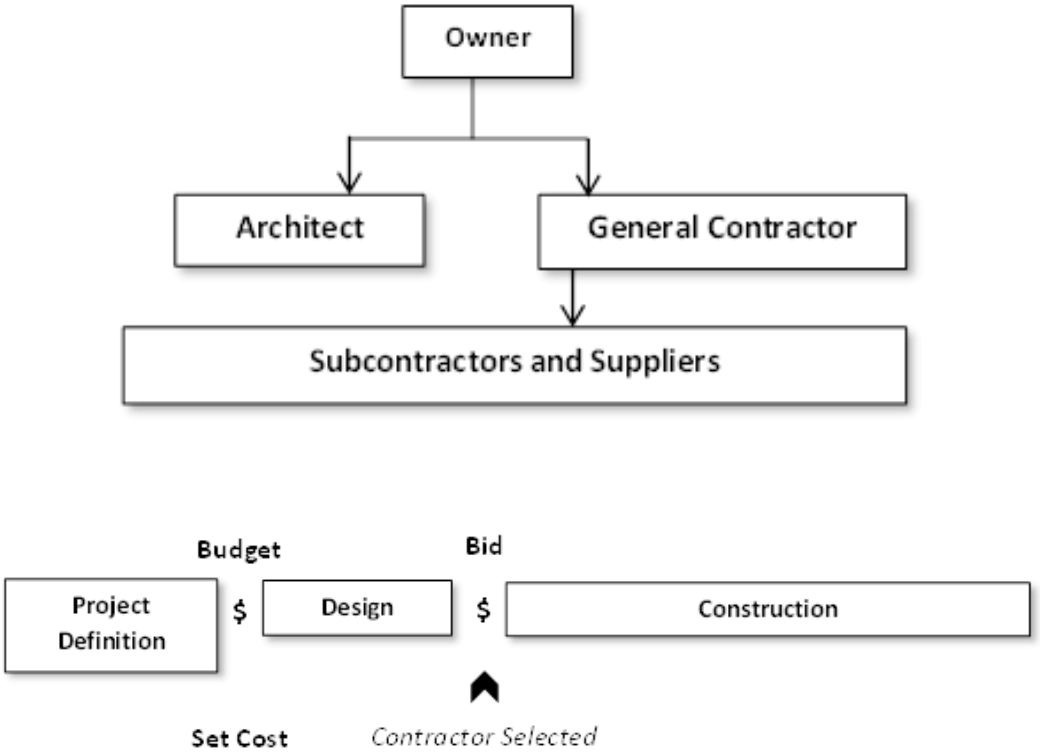
[95] The Construction Management Association of America, "An Owners Guide to Project Delivery Methods" cmaanet.org, http://cmaanet.org/files/Owners%20Guide%20to%20Project%20Delivery%20Methods%20Final.pdf (accessed June 3, 2013).

[96] The Construction Management Association of America, "An Owners Guide to Project Delivery Methods" cmaanet.org, http://cmaanet.org/files/Owners%20Guide%20to%20Project%20Delivery%20Methods%20Final.pdf (accessed June 3, 2013).

After the project has been awarded, the construction documents may be updated to incorporate addenda or changes and they are issued for construction. The necessary approvals, such as permits, must be received from all jurisdictional authorities for the construction process to begin. The construction phase begins once all components and aspects of the design phase are complete. During the construction phase, the GC coordinates the trades and communicates with the design team. The architect's design team acts as project manager on behalf of the owner, performing all quality assurance and quality control duties and progress inspections.[97]

[97] The Construction Management Association of America, "An Owners Guide to Project Delivery Methods" cmaanet.org, http://cmaanet.org/files/Owners%20Guide%20to%20Project%20Delivery%20Methods%20Final.pdf (accessed June 3, 2013).

Table 4.2 DBB Structure & Schedule[98]



DBB Contracts and Contractors

In DDB, two entities (or contractors) hold separate contracts with the project owner. One contract is held with the design team, usually an architectural firm, and one contract is held with the construction team, usually a general contractor. In the case of historic preservation construction, the design contractor can be an historic architect or engineer and the construction contractor can be an architectural conservator. Multiple sub contracts are held between the construction contractor and trade contractors (or subcontractors). The subcontractors are responsible for completing the individual trade

[98] Crites, Mary K. "Getting the Best Value for Our Construction Dollars; A Primer of Construction Delivery Methods for Owners (from an Owner's Biased Viewpoint)," *Maricopa Community College*. November 2007, http://www.gc.maricopa.edu/adminsvcs/oct_05/insert.pdf (accessed May 28, 2013).

tasks. Unit prices for individual tasks are determined by the subcontractors based on time and material costs and are reflected in the bid.

In a typical DBB delivery system, the owner enters into a contract with an architect or engineering firm. Based on the requirements provided by the owner, the firm creates construction documents including plans and specifications for the implementation of the project. These documents are then used by the owner as the basis to make a separate contract with a construction contractor. The construction company will then build the project based on the documents produced by the architect or engineering firm. Two separate contracts, with two separate entities, are utilized to complete one construction project, including two solicitations and procurement steps.[99]

History of DBB

The Design-Bid-Build project delivery system originated during the Italian Renaissance. Beginning around the 15th century a movement started within the building industry advocating a separation between design and construction fields. The basic tenant for the separation was that the designer's sole responsibility should be providing pictures, sketches and models of the design, and the leader of the construction effort was to be responsible to carry out the designer's intent. Leone Battista Alberti led the separation movement and introduced the idea of 'architect as artist.' The 'architect as artist' concept emerged from a desire of architects to separate themselves from the building trades and to align architects with the professionalism of

[99] Hale, Daren Russell "An Empirical Comparison of Design/Build and Design/Bid/Build Project Delivery Methods," Master's Thesis, University of Texas, Austin (2005), page 6.

academic fields such as Art and Law.[100] Professional architects began distancing themselves from the building trades, and public perception of architects followed this trend as well. As a result, the design phase started to become distinct from the construction phase, an early form of the DBB system. The attempt to separate design from construction occurred very sporadically during the next two hundred years until the beginning of the Industrial Revolution.

The Industrial Revolution marked the next step in the separation of design and construction entities. The division of labor was a paradigm shift emphasized during the Industrial Revolution increasing the use of Design-Bid-Build systems. The distinctions between the intellectual process of design and the physical act of construction became a natural place for division. Furthermore, the need for capital caused constructors to rely upon nonparticipating owners, such as stockholders or banks, to be able to purchase and operate the necessary equipment and employ the large number of laborers required for the new type of construction. The design firms did not require such capital, economically isolating architects from construction contractors.[101] The use of integrated design and construction services declined. Design-Bid-Build grew to meet the requirements of large scale projects.

[100] Carlos J. Cardoso and Martin Sell, "History and Introduction to Design-Build" (PowerPoint slides, A Continuing Education Webinar of the American Institute of Architects, April 16, 2009) http://www.aia.org/groups/aia/documents/pdf/aiab090075.pdf (accessed May 23, 2013).
[101] Carlos J. Cardoso and Martin Sell, "History and Introduction to Design-Build" (PowerPoint slides, A Continuing Education Webinar of the American Institute of Architects, April 16, 2009) http://www.aia.org/groups/aia/documents/pdf/aiab090075.pdf (accessed May 23, 2013).

Modern DBB

By the turn of the twentieth century, DBB was the favored project delivery system for both public and private projects. Design-Bid-Build grew as a reaction to the favoritism, corruption, and waste associated with major infrastructure projects in the 19th century. Federal contracting reform separated the design and construction phases in the 1930s. The Miller Act of 1935 favored the use of Design-Bid-Build. The Miller Act required that, "before any contract exceeding $100,000 is awarded for the construction, alteration or repair of any building or public work of the United States, the construction contractor must furnish a payment bond and a performance bond."[102] This act helped separate the role of the design entity from the construction entity by requiring bonds that many design firms could not qualify for, thus favoring separate contracts for design phase and construction phase. As a result, design-bid-build became the 'traditional' procurement method for public agencies. By the 1960s, there was a clear division between design and construction in both the public and private spheres.

Despite historically favoring DBB, both public and private entities recently began using alternative project delivery systems such as Design-Build. DBB requires the full cooperation of several entities to successfully complete a construction project. Multiple contracts are created and signed within a single DBB project. Due to such complicated contractual agreements and organizations DBB has begun to loose favor. However, it is still regularly used with success.

[102] Carlos J. Cardoso and Martin Sell, "History and Introduction to Design-Build" (PowerPoint slides, A Continuing Education Webinar of the American Institute of Architects, April 16, 2009) http://www.aia.org/groups/aia/documents/pdf/aiab090075.pdf (accessed May 23, 2013).

Comparison

The debate of Design-Bid-Build versus Design-Build project delivery systems is long-running. Professional curriculum includes both management systems used in modern construction contracting. Countless studies have compared these two PDSs, attempting to determine the most effective choice for the client. As with any management system, each system has pros and cons. The choice of implementing DB or DBB in a historic preservation construction should be based on factors of the individual project and can determine the resulting product.

Table 4.3 lists the advantages and disadvantages Design-Build (DB) method. This may not include all the advantages and disadvantages known, but highlights the main points for a clearer understanding of this delivery method's strengths and weaknesses.

Table 4.3: Advantages and Disadvantages of the Design-Build (DB) Method.[103]

Advantages of DB	Disadvantages of DB
1. Single entity responsible for design and construction	1. Minimal owner control of both design and construction quality
2. Construction often starts before design completion, reducing project schedule	2. Requires a comprehensive and carefully prepared performance specification
3. Construction cost is known and fixed during design; price certainty	3. Design changes after construction begins are costly
4. Transfer of design and construction risk from owner to the DB entity	4. Potentially conflicting interests as both designer and contractor
5. Emphasis on cost control	5. No party is responsible to represent owner's interests
6. Requires less owner expertise and resources	6. Use may be restricted by regulation

[103] Fernane, James David, "Comparison of design-build and design-bid-build performance of public university projects" (Master's Thesis, University of Nevada, 2011), 6, in digitalscholarship.unlv.edu,

To understand that no one project delivery method is flawless, Table 4.4 describes the advantages and disadvantages of the DBB method. This may not include all the advantages and disadvantages known, but it does highlight the main points for a clearer understanding of this delivery method's strengths and weaknesses.

Table 4.4: Advantages and Disadvantages of the Design-Bid-Build (DBB) Method.[104]

Advantages of DBB	Disadvantages of DBB
1. Owner controls design and construction	1. Requires significant owner expertise and resources
2. Design changes easily accommodated prior to start of construction	2. Shared responsibility for project delivery
3. Design is complete prior to construction award	3. Owner at risk to contractor for design errors
4. Construction cost is fixed at contract award (until Change Orders)	4. Design and construction are sequential, typically resulting in longer schedules
5. Low bid cost, maximum competition	5. Construction costs unknown until contract award
6. Relative ease of implementation	6. No contractor input in design, planning, or value engineering (VE).
7. Owner controls design/construction quality	

Recently, Design-Build has gained favor. The cost and schedule reduction and decreased litigation associated with Design-Build project delivery have been demonstrated repeatedly. For example, Victor Sanvido and Mark Konchar of Pennsylvania State University found that design-build projects are delivered 33.5%

[104]Fernane, James David, "Comparison of design-build and design-bid-build performance of public university projects" (Master's Thesis, University of Nevada, 2011), 6, in digitalscholarship.unlv.edu, http://digitalscholarship.unlv.edu/cgi/viewcontent.cgi?article=2212&context=thesesdissertations (accessed June 4, 2013).

faster than projects that are designed and built under separate contracts (DBB).[105] Sanvido and Konchar also showed that design–build projects are constructed 12% faster and have a unit cost that is 6.1% lower than design-bid-build projects.[106] Similar cost and time savings were found in a comparison study of Design-Build, and Design-Bid-Build for the water/wastewater construction industry, according to a study by the American Society of Civil Engineers.[107] A study by one of the world's largest firms underwriting professional liability and specialty insurance programs, found that, from 1995 – 2004, only 1.3% of claims against architecture or engineering firms were made by Design-Build contractors.[108]

The rise of design-build project delivery has threatened the traditional hierarchies of the design and construction industry. As a result, a debate has emerged over the value of Design-Build as a method of project delivery. Several recent studies bolster the argument against the use of Design-Bid-Build in construction projects. Federal, State, locally and privately funded projects are increasingly relying on DB services rather than the 'traditional method' (DBB). It is important to analyze delivery systems in the context of historic preservation due to the difficulties associated with preservation construction, including pre-design investigation, unforeseen conditions,

[105]Konchar, Mark and Victor Sanvido "Comparisons of United States Project Delivery Systems." *Journal of Construction, Engineering, and Management*, 124, no. 6 (1999), page 442.
[106]Konchar, Mark and Victor Sanvido "Comparisons of United States Project Delivery Systems." *Journal of Construction, Engineering, and Management*, 124, no. 6 (1999), page 443.
[107] Douglas D. Gransberg, James E. Koch, and Keith R. Molennar, Preparing for Design-Build Projects: A Primer for Owners, Engineers, and Contractors. (Reston: American Society of Civil Engineers, 2006), page 231-232.
[108] Konchar, Mark and Victor Sanvido "Comparisons of United States Project Delivery Systems." *Journal of Construction, Engineering, and Management*, 124, no. 6 (1999), page 443.

hazardous, rare, degraded and/or obsolete materials, and outdated construction procedures.

The following case studies of two historic construction projects include the building's histories and treatment reports. In addition, the implementation of Design-Build or Design-Bid-Build systems and the difficulties encountered in each project will be presented. The author was directly involved with both case study projects through his employment with Aeon Preservation Services, LLC. As an architectural conservator, he was able to get access to contract documents, schedules, designs, change orders, and treatment reports. He was also had direct contact with the owner's representatives, contractors and designers.

CHAPTER 5

DESIGN-BUILD CASE STUDY

Project Scope

The author was involved in the rehabilitation of the following project as the architectural conservator and project manager. The Veterans Affairs Administration Building located at 810 Vermont Ave. NW, Washington, D.C., was completed in 1919. Occupying half of a prominent downtown block, the building is flanked by McPherson Square to the north and Lafayette Park to the south. Originally designed as a hotel, the Federal Government purchased it during World War I prior to its completion. The finished building was used to serve the needs of the various veterans' benefits organizations. These groups later joined the Department of Veterans Affairs. The building's architecture is Chicago style/Commercial with neoclassical components, typical for upscale commercial buildings of the era. Commercial structures from this period were typically executed with straight fronts, flat roofs and moderately projecting cornice. The building was built using steel skeleton construction with a non-bearing masonry veneer. Windows, cornice, recessed colonnades, and canopies served as the building's ornamentation.

The preservation construction project was the rehabilitation of the historic cast iron and glass entrance canopies, located over the main entrance on Vermont Avenue and two secondary entrances on H Street and I Street (Figures 5.1, 5.2, and 5.3). The canopies were built concurrently with the building and were tied directly to the

building's structural steel skeleton. The original ornamental cast iron cornice was manufactured by the Flour City Ornamental Iron Works of Minneapolis, Minnesota which produced ornamental cast and wrought iron from 1893 into the early Twentieth Century (Figure 5.4).

Figure 5.1: H St Canopy (existing condition)

Figure 5.2: I St. Canopy (existing condition)

Figure 5.3: Vermont Avenue Canopy (existing condition)

Figure 5.4: Original Ornamental Cast Iron Cornice (note crack repair)

The entrance canopies were greatly modified in the 1970s when they were altered to be solid roofed marquees with lighting and perimeter valences. They were altered again in the 1990s with the removal of these earlier modifications, and their replacement with the existent skylight system. The entire system leaked as evidenced by stained masonry and comments from building users.

The historic cast iron entrance canopies are located at each principal entrance of the Veterans Affairs Building. The Vermont Avenue canopy was a three-bay design that transects the three principal doorways. This canopy measured approximately 46-feet wide and projects 8-1/2 feet from the face of the building. The H Street canopy was over an employee-only entrance and measured approximately 16-1/2 feet wide by 8-1/2 feet. The Eye Street canopy was similar in size to H St., and was located at an employee entrance with handicapped accessibility.

Original historic fabric included ornamental cast iron soffits above each entrance door; iron framed transom windows at H and Eye Streets (but not at the Vermont Avenue transoms); ornamental cast iron fascia at the perimeter of each canopy and at

the underside of the canopy edge (Vermont Ave. only); some structural steel framing; and the hanger rod assemblies and related ornamental cast iron turnbuckle covers. Some of the ornamental cast iron was replaced with new castings during one of the previous renovations. Some structural steel was replaced with new members of different sizes than the originals. No physical evidence of the original glass supports were identified in the areas opened up and no detailed historic information was identified in the preliminary historic research undertaken at the Regional Office Building archives. Modern alterations included new 2”x2” aluminum mullions supporting modern wire glass at a non-traditional slope, modern lighting fixtures, and plain sheet metal wrapping the structural steel.

Project Delivery System

The rehabilitation of the cast iron canopies on the Veteran’s Affairs Building was structured as a Design-Build project. Due to the ornate design of the cast iron canopies, the project was categorized as a ‘building arts’ project by the owner, the General Services Administration (GSA). GSA sent out a Request for Proposals (RFP) in January 2012 and McKay Lodge of Oberlin, Ohio answered along with several other Conservation Contractors.

The canopies required extensive work. An investigation on April 29, 2011 found evidence of compromised structural steel due to rust caused by water intrusion. The decorative cast iron components, including the cornice, soffits, turnbuckle covers, and tie rods, were in poor condition, showing cracks, rust stains, and inappropriate

alterations. Components of the 1990s modifications were also compromised. Wood roof decking was rotting, steel interior panels were rusting, and coatings and sealants were failing. The scope of the construction phase included any supplemental structural steel installation required to handle the loading, abatement of all lead paint, the restoration of the ornamental cast iron components, fabrication and installation of new ornamentation, duplicating lost or damaged historical fabric, fabrication and installation of gutters, pans, and flashing for water diversion and drainage, installation of historically appropriate glass and lighting, paint and sealant application. The original date of completion was set as January 1st 2013.

McKay Lodge's proposal designated Aeon Preservation Services (APS) as the head conservator and Design-Build contractor. APS's initial responsibility was organizing the entire project team. The design team, headed by APS, included the historic engineers (Robert Silman & Associates), waterproofing engineers (Seal Engineering), lighting engineer (Belfour), and metalworkers (Independent Custom Metal). The construction team was composed of trade contractors: scaffolding erectors (Scaffold Resources), masons (Federal Masonry), metalworkers (independent Custom Metal), electricians (City Electric), plumbers (Associated Plumbing of Virginia), hazardous abatement specialists (Southern Insulation), painters (A V Smoot), and glazers (Del Ray Glass).

Once APS coordinated the design and construction teams, each team member determined the cost of their scope of work and submitted estimates to APS. APS created

a proposal based on trade estimates and submitted it to McKay Lodge. Design costs included investigation, historic research, structural and waterproofing engineering, and construction drawings. Management costs included permit acquisition, quality control/quality assurance (QA/QC), scheduling, supervision, conservation, and owner and tenant relations. Construction costs included scaffold erection, demolition, metal fabrication, hazardous materials abatement, paint, plumbing, electrical, waterproofing, glass, and masonry. McKay Lodge reviewed the proposal and then submitted it to the procurement entity the Fine Arts Division of GSA. McKay Lodge's proposal was accepted, reviewed and chosen by the Fine Arts Division. McKay Lodge was awarded the contract given the 'notice to proceed' on July 9, 2012.

Design and Construction Phases

The design phase was headed by APS. The initial task was investigation and documentation of existing conditions. Probes in areas with evidence of water intrusion found the same conditions as earlier investigations (rotted wood, rusted steel, compromised sealant, etc.). Aeon Preservation Services, Robert Silman and Associates, and Seal Engineering inspected, photographed, and dimensioned all three canopies. This documentation was then used as the basis for construction drawings. Silman created drawings and specifications for structural steel and finish metal, and Seal created drawings and specifications for gutters, flashing, and drain pans.

The construction phase was also led by Aeon Preservation services. APS acquired public space permits and after-hours work permits from the Washington D.C.

Department of Consumer Regulatory Affairs and Department of Transportation. Once permits were obtained, Scaffold Resources erected the necessary scaffold and Federal Masonry began demolition of stone, glass, decking, flashing, and finish metal (Figure 5.5). Once all demolished material was removed and recycled, Southern Insulation began abating all lead paint (Figure 5.6). Associated Plumbing of Virginia probed and cleared drain lines and installed parapet drains (Figure 5.7). Independent Custom Metal then installed all supplemental structural steel, repaired historic cast iron, and fabricated and installed drain pans, gutters, missing ornamental components, and finish metal (Figure 5.8, 5.9, and 5.10). AV Smoot then applied marine grade epoxy paint to all metal surfaces (Figure 5.11). Del Ray glass followed with glass and sealant installation (Figure 5.12). City Electric installed marquee lighting (Figure 5.13). Finally, all remaining flashing was installed by APS and stone repairs were completed by Federal Masonry (Figure 5.14). Punch out tasks included additional sealant work and drain repair, all performed by Aeon Preservation Services.

Figure 5.5: Post Demolition – Vermont Avenue

Figure 5.6: Abated Soffit – H St.

Figure 5.7: New Parapet Drain – I St.

Figure 5.8: New Ornamental Steel Soffits

Figure 5.9: New Structural Steel Shear Tabs – I St.

Figure 5.10: Historic Anthemion (duplicated and installed on all canopies)

Figure 5.11: Epoxy Paint Coating

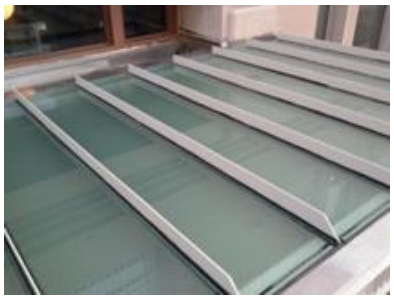


Figure 5.12: New Safety Glass and Sealant – I St.

Figure 5.13: New Marquee Lighting – Vermont Ave.

Figure 5.14: New Counter Flashing

Results of DB Implementation

The end product was approved by the client (General Services Administration) and the building tenants (The Department of Veterans Affairs) on April 15, 2013. The project required one change order covering unforeseen structural issues and an alternate lighting design. Compromised structural steel, identified after initial probes, required additional bracing. Historically appropriate marquee lighting was sourced and proposed as an alternate. GSA approved the change order eight weeks after receiving the request. The lengthy change order approval process, the additional change order

work, and the lead time on the marquee lighting delayed the project a total of twelve weeks.

The implementation of Design-Build system in the case of the restoration of the cast iron canopies at the Veterans Affairs building was successful. Despite the delay, (caused by the client) the project was completed under budget and requiring only one change order. Both GSA and The Department of Veterans Affairs approved the product and enthusiastically recommended all members of the project team for future GSA historic projects.

CHAPTER 6

DESIGN-BID-BUILD CASE STUDY

Project Scope

The author was involved in the rehabilitation of the following project as a documentation specialist and administrator. The National Gallery of Art (NGA) is a national art museum in Washington, D.C., located on the National Mall, between 3rd and 9th Streets, at Constitution Avenue NW. The museum was privately established in 1937 for the people of the United States of America by a joint resolution of the United States Congress. Andrew W. Mellon (1855-1937), an American banker, industrialist, philanthropist, art collector, and the Secretary of the Treasury, donated a substantial art collection and funds for construction. The new gallery was to be effectively self-governing, not controlled by the Smithsonian.

Two buildings comprise the museum: the West Building (1941) and the East Building (1978) linked by an underground passage. The West Building, composed of pink Tennessee marble, was designed in 1937 by architect John Russell Pope in a neoclassical style (as is Pope's other notable Washington, D.C. building, the Jefferson Memorial). Designed in the form of an elongated H, the building is centered on a domed rotunda modeled on the interior of the Pantheon in Rome. Extending east and west from the rotunda, a pair of high, skylit sculpture halls provide its main circulation spine. Bright

garden courts provide a counterpoint to the long main axis of the building. At the time of its inception it was the largest marble structure in the world.

The Gallery's East Building was constructed in the 1970s on much of the remaining land left over from the original congressional joint resolution. It was funded by Mellon's children Paul Mellon and Ailsa Mellon Bruce. Designed by famed architect I.M. Pei, the contemporary structure was completed in 1978, and was opened on June 1 of that year by President Jimmy Carter. The new building was built to house the Museum's collection of modern paintings, drawings, sculptures, and prints, as well as study and research centers and offices. The design received a National Honor Award from the American Institute of Architects in 1981.

The preservation construction project included the restoration of the historic Tennessee Pink Marble façade on the National Gallery of Art West Building. The scope of the restoration included the removal and restoration of damaged, and/or lost masonry (brick and marble) and mortar joints. Issues such as compromised mortar joints, spalls, cracks, failed repairs, deteriorated details, biological growth, asbestos sealant, and damages due to building use were present. The façade was divided into zones of work to be completed in phases during 2012 and 2013. Phase One of the project encompassed the eastern portion of the north façade and was completed in November of 2012. Phase Two, which included the western section of the north façade, began April 2013 and is ongoing (as of June 2013).

Project Delivery System

The project delivery system implemented in the masonry restoration of the National Gallery of Art West Building Phase One was Design-Bid-Build. Unlike the Department of Veterans Affairs project, the NGA operates as tenant and owner and is independent from Federal government agencies, such as the GSA. All procurement, including construction contracting, is performed in house. NGA sent out an RFP for architectural and design services in October 2011. The design contract was awarded to Vitetta of Philadelphia, Pennsylvania. The NGA sent out an RFP for the construction phase in April 2012 and Dan Lepore and Sons (DLS) of Conshohocken, PA responded along with several qualified other masonry specialists.

DLS bid on the position of General Contractor. The bid was a Guaranteed Maximum Price (GMP) with Unit Prices on specified tasks and materials. GMP establishes the maximum cost to the owner and is determined by the sum of all Unit Prices for estimated work. Their bid designated Aeon Preservation Services (APS) as the independent conservation and quality control contractor. APS responsibilities included surveying masonry conditions, assembling construction documentation, conservation consulting, quality control, and quality assurance. Scaffold Resources was an additional contractor listed in the bid package, and was responsible for the design and installation of all project access, scaffold, swing stage, material cranes, staircases, and pedestrian and vehicle access. DLS's bid package was accepted, and Lepore was awarded the contract June 2012.

The project presented difficulties due to the use of the building and the nature of masonry work. The building is a secure repository and an advanced art conservation lab. The masonry work to be performed included tasks that create noise and debris adjacent to sensitive interior spaces. The building needed to operate in full capacity during the work, without significant disturbance from debris and noise. Specifications, created by Vitetta and NGA, were strict and required all materials to be documented and submitted to the NGA before approval. For example, stone units, mortar aggregates and composition, and hardware including bird control spikes and fasteners for dutchmen (masonry patches) all had to be approved by the design team (architect and NGA).

Inherent difficulties of the project included access to the site which was limited by the size restrictions of the property, landscaping, pay parking, and proximity to high security buildings such as the White House and the Capital (Figures 6.1 and 6.2). Scaffolding could not interfere with visitor and vehicle access and could not damage the façade (Figure 6.3). Thus, specialty scaffold engineering, design, and installation was required. The sheer size of the project also increased difficulty. Maintaining cleanliness and an organized site was required by the NGA due to the high visibility of the project and the close vicinity to visitors and pedestrians (Figure 6.4). Abating hazardous materials became an additional challenging task, after the project began.

Figure 6.1: Map of NGA and Surrounding Area (note proximity to the Capital)

Figure 6.2: NGA North Façade Landscaping

Figure 6.3: Scaffold Protection

Figure 6.4: Example of Visitor and Pedestrian Traffic at NGA

Design and Construction Phases

The design phase of the NGA masonry restoration project was headed by Vitetta, an architecture and engineering firm with previous experience working for NGA. The design phase began with a masonry survey performed in April 2012. Despite no access to the roof and limited access to higher areas, the construction drawings were drafted from the condition survey. Vitetta was contracted to perform schematic design, design development, construction documents, and construction management. The construction drawings formed the foundation for the contract documents. Vitetta compiled the material specifications, construction drawings, and performance obligations, composing the bidding documents. These bid documents were then sent to select masonry contractors who had extensive experience in similar scale masonry projects. NGA awarded DLS the contract after reviewing all bids with Vitetta and determining DLS's qualifications.

The construction phase of the NGA masonry project was led by Dan Lepore and Sons. DLS acquired public space permits from the Washington D.C. Department of

Transportation allowing access to the site and restricting public parking to create adjacent vehicle staging areas. Once the permits were obtained, Scaffold Resources erected fixed scaffold and swing stages (Figure 6.5). DLS's crews began removal of mortar and compromised masonry, repair of damaged materials, and repointing of open mortar joints. Grinders and hand tools were used to remove damaged mortar and masonry units (Figure 6.6). All progress, means, methods, and materials were extensively documented by APS and uploaded to a tracking website, accessible by all parties involved in the preservation project (Figure 6.7). Once the project began, asbestos sealant was discovered in several areas (Figure 6.8). Three change orders, in the form of a revolving lump sums, and an eight week delays resulted from the required abatement of the previously undiscovered asbestos sealant.

Figure 6.5: Scaffold

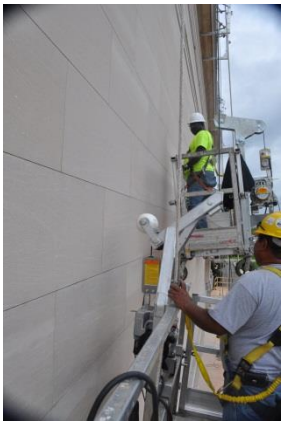


Figure 6.6: Typical Work Scenario

Figure 6.7: Mason Using Hand Tools to Remove Mortar

Figure 6.8: Asbestos Sealant

Results of DBB Implementation

The end product of Phase One was approved by the architect (Vitetta) and the client (NGA) on November 16, 2012. The project required three change orders regarding the abatement of asbestos sealant, not found until after the design and bid phases. The lengthy change order approval process and the lead time required for DLS to contact, bid out, and accept an abatement contractor, combined with the additional abatement work, delayed the project a total of eight weeks.

The implementation of Design-Bid-Build system in the case of the masonry restoration at the National Gallery of Art West Building was successful. Despite the delay, (caused by poor predesign investigation) the project was completed under the GMP, not including the change order costs. NGA approved the Phase One product and immediately offered the Phase Two contract to the members of both the design and construction teams.

CHAPTER 7

RESULTS AND CONCLUSION

Historic buildings provide a tangible connection to the past and contribute to a community's identity and stability. Their preservation through construction allows generations to make connections with their past and creates an identifiable sense of place. Construction management systems contribute to the efficiency and vital to the economic viability of preservation construction. The previous case studies illustrated the intricacies and difficulties of preservation construction projects.

The five factors that influence the choice of PDS are budget, design, schedule, risk assessment, and the owner's level of expertise. Budgets are often determined by the owner based on accessible capital. Design is determined by the schematic vision of the owner, documented by the architect. Schedule is based on the owner's needs and the established requirements of the scope of work. The risks vary based on the size and scope of the project and are financial in nature. Finally, the owners level of expertise is a direct result of previous experience in procurement, design, and construction.

Regarding the previously listed factors, the clients at both the VA project and the NGA project held sufficient funds to complete the project, established design parameters based on remaining historic fabric, scheduled the project based on climate (begun in the Summer) and time requirements of the work, analyzed risk based on

contractor qualifications, and determined the PDSs based on extensive experience. Though limited in scope, the rehabilitation of the cast iron canopies at the Department of Veterans Affairs building and the masonry restoration at the National Gallery of Art illustrate Design-Build and Design-Bid-Build project delivery systems. Both projects endured setbacks, delays, and increased costs. Both projects required additional work due to unforeseen conditions, a common problem in preservation construction. However, the unforeseen conditions at NGA (asbestos sealant) could have been identified and documented by Vitetta had there been sufficient access provided to the entire building. The unforeseen conditions found at the Veterans Affairs project required demolition to be exposed.

The use of DBB system at the NGA project was appropriate due to the completion of the job and client satisfaction. However, implementing a DB system might have uncovered the hazardous material prior to the bidding phase. In the case of the Veterans Affairs project, DB was an appropriate choice because the construction phase began during the design phase (fast tracking). The demolition (part of the construction phase) brought to light critical structural issues before the design phase was complete, allowing both the Design-Build contractor and the client to adapt the increased scope.

The debate of Design-Bid-Build versus Design-Build project delivery systems is long-running. Many studies have compared these two PDSs, attempting to determine the most effective choice for the client, some relevant to preservation construction, whereas others were not. The studies' relevance (or irrelevance) was due to the project

component unique to preservation construction. Such studies include Sanvido and Konchar's Pennsylvania State University study,[109] the American Society of Civil Engineers study,[110] several Design-Build Institute of America studies,[111] etc.

Studies similar to this thesis should be performed on a larger scale, compiling data from the increasing number of preservation construction projects. As with any management system, each system has pros and cons, and upon which future studies should expand. The choice of implementing DB or DBB in a historic preservation construction should be based on factors of the individual project and can determine the resulting product. The choice of PDSs will become increasingly important as DB services are honed.

[109] Konchar, Mark and Victor Sanvido "Comparisons of United States Project Delivery Systems." *Journal of Construction, Engineering, and Management*, 124, no. 6 (1999).
[110] Douglas D. Gransberg, James E. Koch, and Keith R. Molennar, Preparing for Design-Build Projects: A Primer for Owners, Engineers, and Contractors. (Reston: American Society of Civil Engineers, 2006).
[111] Design-Build Institute of America, "Design-Build Project Delivery Method Used for More Than 40 Percent of Nonresidential Construction Projects, Report Shows" (June 7, 2011) http://www.dbia.org/news/press/rsmeans110606.htm.

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