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Design-Build Approach to Project Delivery: The Checks and Balances in the Overall Construction Process

Abstract

In the late 1990s, the author conducted a Survey of some of the top Owners listed in the Engineering News Record (ENR) to ascertain the prevalent construction contracting practices in the United States. Among the several questions asked of the Owners, one of the Survey questions dealt with the topic of ‘Project Delivery Systems.’ In response to the question, “Which of the following project delivery systems do you use most?” Owners overwhelmingly said, “Design-Bid-Build,” but some did say that they used Design-Build on occasions when fast-tracking was needed. However, the number of responses in favor of Design-Build was significantly small. But over time, Design-Build as a project delivery system, has significantly matured and more and more owners are opting to utilize this system either to shorten the project cycle, or to develop a smooth flow between the design and construction phases of the project. Today, Design-Build is no longer limited to complex industrial projects such as oil refineries and power plants but is also being used to build public projects such as prisons, office buildings, industrial facilities, etc. Based on data gathered from the owners, architects, engineers, and the contractors, this paper describes the advantages and disadvantages of Design-Build approach to project delivery and cites actual cases where Design-Build did prove to be a successful approach. Case histories are an important learning tool for students of construction, and should be used in the delivery of construction curriculums with caution and sound professional judgment.

Introduction

In 2000, one of the civil engineering alumni of the University of Florida assumed the role of the Project Manager for the $700 million design-build contract for the Cooper River Bridge Replacement Project on behalf of the South Carolina DOT. The $540 million design-build contract for the construction of the new Cooper River Bridge has delivered the longest cable stay bridge in North America. The new bridge is the replacement for the two old bridges, one being the 1929 Grace Bridge, and the other 1966 Pearman Bridge. The $60 million contract for demolition and dismantling of the existing bridges was also a part of the overall $700 million design-build contract for the replacement project. The application of design-build project delivery system to this new and old construction for the Cooper River Project is a success story and a huge positive step for the acceptance of Design-Build as a highly viable project delivery system. It is also a success story that needs to be told to construction engineering and technology students that as ‘constructors’, they have the same opportunities for building such mega structures as do graduates from the discipline of civil engineering.

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What is Design-Build?

Why is there so much interest in Design-Build (DB) today?

How does it differ from Design-Bid-Build (DBB)?

According to Design-Build Institute of America² (DBIA), “Design-Build is a method of project delivery in which one entity (design-builder) forges a single contract with the owner to provide for architectural/engineering design services and construction services. Design-Build is also known as design/construct and single source responsibility,” though not as well known in that terminology.

“By contrast, with the ‘traditional’ design-bid-build approach, the Owner commissions an architect or engineer to prepare drawings and specifications under a design contract, and subsequently selects a construction contractor by competitive bidding (or negotiation) to build the facility under a construction contract.”

This paper discusses the pros and cons of Design-Build as a project delivery system and provides some case histories. It encourages construction educators to provide an in-depth understanding to students of Design-Build as a method of project delivery alongside the other two methods namely Design-Bid-Build, and Construction Management.

Design-Build Approach to Project Delivery

Design-Build construction delivery system is considered to be the fastest-growing project delivery system in the United States. In the 1990s, the Design-Build method of contracting grew steadily. From the early 1980s to late 1990s, the Design-Build contracts grew from $6 billion to $56 billion in the United States, and represented nearly 25% of the non-residential U.S. construction market. As per DBIA, and according to ZweigWhite’s 2004 Design Build Survey of Design and Construction Firms, the following data speaks of the popularity of DB Contracting:

a. Seventy percent of firms surveyed believe that design-build projects are more profitable than ‘traditional’ projects.

b. Integrated design-build firms expect eighty percent of their revenues to be from design-build projects in ten years. Consulting firms estimate that number at fifty percent.

c. Eighty percent of all firms surveyed predicted an increase in the use of design-build over the next five years.
Additionally, the American Society of Civil Engineer’s Continuing Education Department\(^3\) has sponsored Design-Build seminars in the past, and has provided the following information.

i. Both private and public owners are using Design-Build Contracting method to accrue savings in both costs and time by streamlining the project delivery process. The Department of Defense Non-appropriated Fund projects showed savings of 18\% in costs and 14\% in time (DBIA, 1996).

ii. A Florida DOT study found that DB projects change order costs were reduced to only 1.99\% of award costs compared to DBB cost growth of 8.78\%. The study also showed that average DB construction time was 21.1\% shorter, and most strikingly, actual DB procurement times (i.e. from concept to turnover) were 54\% shorter than conventional projects.

iii. Compared to traditional DBB contracting, as per Design Build Institute of America, DB enjoys the following advantages:\(^4,5\)

- Savings in unit costs of at least 6.1\%
- Construction speed at least 12\% faster
- Overall project delivery speed at least 35.5\% faster
- Cost growth at least 5.2\% less
- Schedule growth was 11.4\% less
- Quality equal or better

To gain the value-added returns noted above from adopting an appropriate project delivery system such as Design-Build, it is important that all the parties involved in the project fully comprehend the DB project concept, and that the “design process must be totally coordinated with the construction.”\(^6\) In an attempt to educate owners, designers, and contractors about the ins and outs of the DB project delivery system, the construction industry must play a major role in developing and delivering educational seminars on Design-Build Contracting. One such effort to educate contractors, engineers, architects, city officials, etc. was made by AGC of Indiana to help construction industry personnel stay on top of a new Indiana State Law (Senate Enrolled Act 244) which allows the use of Design-Build contracts between design-builders and public agencies for certain public projects. “The new law authorizes state agencies, state educational institutions, counties, cities, towns, townships, and certain other bodies, to enter into design-build contracts for public works projects, and establishes procedures for solicitation and award of design-build contracts. The new law took effect on July 1, 2005.”\(^7\)

**Ins and Outs of Design-Build**

Many of the improvements in the construction industry have come from outside the construction industry. In the past owners have had to intervene to solve problems between designers and builders. To avoid that, design-build contracting was devised as a procurement method to bring accountability for both design and construction under a single entity (a design-build firm). The organizational chart of DB v/s DBB looks as shown below.
From the above organizational charts of the two very different project delivery systems, it is quite clear that the owner has to deal with a single entity of Design-Builder firm under the DB contracting, while under the DBB contracting, the owner has to deal with architect/engineer to design the project, and with the general contractor to build the project. In theory, DBB may appear to be the most economical method of constructing a project but it does not always end up being the most economical method due to change orders and several other factors. DB provides a better alternative because the owner gets to utilize the expertise of the contractor during the design phase to eliminate some of the constructability problems that the project may face at a later date.

**Checks and Balances in the Overall Construction Process: Some Case Studies**

The author has analyzed below three local design-build projects located in metropolitan Kansas City area to illustrate Checks and Balances in the Overall Construction Process utilizing design-build contracting.

**Project X (A Machine Shop Project):**

Design-Builder Firm : General Contracting Company located in Missouri  
Building Sq. Ft. : 12,000  
Estimated Cost : $ 1 Million  
Fee: : 9%
The owner negotiated with the General Contractor. The Contractor hired the architect. The job was completed without a problem. The contractor said that he would have made less money had he bid on the job and been selected as the lowest bidder. The contractor helped the owner get financing for the project.

**Project Y (A Manufacturing Plant Project):**

- **Design-Builder Firm**: General Contractor located in Kansas
- **Building Sq. Ft.**: 5,500
- **Estimated Cost**: $550,000
- **Fee**: 10%

The owner negotiated with the General Contractor. The Contractor used some in-house staff to design, and also contracted with an architect to produce drawings and specifications. Progress payments to the Contractor were a problem with less definitive and well-defined outcomes on the progress of the project. But there was no real problem.

**Project Z (Head Quarters Building Expansion Project of an Insurance Company):**

- **Design-Builder Firm**: General Contractor/Construction Management Co.
- **Estimated Cost**: $19 Million
- **Fee**: 6-9% (Not exactly Known)

The owner picked this Contracting/CM company. The contractor hired the architect that he was comfortable with, and had worked with him in the past on many projects. The architect advised steel frame construction with composite floor slabs over reinforced concrete frame and post-tensioned floors thus saving $7.50 per sq. ft. to the owner. One of the floors is to be finished in future. It is an expansion project in which existing building will be renovated to look like the new buildings. It is a complex project, and in the words of the Contractor, the progress payments are somewhat convoluted. But he has no complaints because the money he is making on the project is good. They used the AIA contract forms with some deletions and additions on advice from their attorney.

**Disadvantages of Design-Build Contracting**

In design-build contracting the contract drawings are not usually complete but the construction of the project is proceeding. Because of the lack of fully-developed plans, uncertainties can lead to over-design of some structural elements, and some changes in design may have to be made as the work progresses. In majority of cases, the contractor takes full responsibility of the project and provides the payment and performance bonds to the owner. With the contractor playing the dominant role in the design-build contract, the designer could be over-ruled in decision-making and quality could be compromised to save costs. Nevertheless, “The growth of the design/build approach has been good and bad for engineering firms. On the downside, owners now rely much more heavily on contractor-led teams to help them with their capital projects. As subcontractors on those teams, engineering firms face the financial risks that go along with that position in the
food chain. On the upside, many engineers report that they make more money and have fewer claims when they work in a design/build relationship with contractors.”

**Teaching Design-Build Contracting to Construction Students**

Among many project delivery systems, DBB, CM, and DB are the three most fundamental and primary contracting methods that must be taught in depth to students of construction. With the DB contracting approach of project delivery systems growing at a fast rate, construction educators need to put extra time into teaching DB and the philosophy underlying DB contracting. Just as Work Breakdown Structure (WBS) is important in construction estimating, so is the breaking down of the DB decision-making.

Students need to be taught very specifically the following:

- a. How to implement a DB system to save construction time
- b. How to implement a DB system to save construction costs
- c. Differences between DBB and DB in terms of Contract Administration
- d. Owner’s Risk using DB v/s DBB
- e. Owner control of the Project
- f. DB Request for Proposal (RFP) Preparation
- g. DB Scheduling
- h. DB Proposal Evaluation

Additionally, students should be required to do research on one DB construction project and one DBB construction project, and evaluate checks and balances utilized in construction process in each.

**Conclusion**

When Construction Management project delivery method of contracting evolved in the 1970s, the construction industry experienced its first major shift away from traditional design-bid-build and the resulting impact on the management of contracts. In the 1990s, and more recently, design-build has emerged as a significant option, and it could be a second major shift from the design-bid-build approach. A few years from now, we will be able to gauge more accurately the impact of design-build on the management of contracts in the construction industry as a whole. The data presently available from DBIA and other studies certainly points to distinct advantages of DB over DBB in many cases. For the owner, DB contracting is more appealing because it gives a single point of contact for both design and construction. In the past DB was utilized for complex projects such as industrial power plants and oil refineries but now is being utilized for all kinds of private and public sector projects. It is therefore imperative for schools of construction to include DB programs in their curriculums and devote a significant amount of time in teaching DB philosophy alongside DBB and CM project delivery systems. Students should also be required to submit a research paper on the advantages and disadvantages of all three major project delivery methods so that they have an in-depth understanding of each. Furthermore, all construction students should demonstrate understanding of checks and balances in the overall construction process by analyzing a construction contract of their choice.
Bibliography