RELATIONSHIPS IN DESIGN BUILD

By

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Submitted to the Department of Civil and Environmental Engineering
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ABSTRACT

As design build (DB) becomes more popular, different ways of writing contracts and forming relationships with the various parties are being considered. The main point of this paper is to look at the relationships between the various parties involved in the design build delivery method. Contracts are what legally tie the parties together, but there can be many different problems with these contracts. A poor contract can easily strain good working relations. Contracts will divide the responsibility among the contractor and the designer. There are many different ways to mitigate risk for the design build team in a contract. This paper considers several ways to improve the working relations in a design build team. The contractors and designers face a considerable problem when placing a bid for a DB project. Their team could potentially lose a great deal of money if they under bid the project and win. But they risk not winning a project if their bid is high even if it is reasonable. Communication between the owners, contractors, and designers needs to be effective. There are various problems that have been stated by owners that they believe limit design build. The use of a third party has been popular by public project owners to ensure quality and to check the design build team's work. This relationship with third parties needs to be changed so that the project will not be slowed down. There are a few different ways that are discussed to improve the relations between the contractors, designers, and owners and ways to improve many of mentioned problems.

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First and foremost Jesus Christ

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My family for their support

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1.0 INTRODUCTION

Design Build contracts are complex because they change the standard process for project delivery and they combine two different companies from two different sectors into a single entity for a given project. These two companies must join together before answering any type of Request for Qualification (RFQ). They must be united in a common goal, have similar ethics and values, be willing to work as a team, be open to new or different ideas, and be able to compromise on different points. Having the right combination of design skills, scheduling, and cost estimation is vital to all companies in design build. Both companies must have a set quality assurance and quality control (QAQC) process that can be implemented on these quick paced and intense projects. This process must be shown to the owner to help alleviate any concerns or fears. Also, setting up some type of guarantee of work will help with the overall process. All of these complexities can cause problems.

Public project owners (owners) perform somewhat different tasks from design bid build which comes with unique problems and obstacles in design build. Some of the different tasks are that they have a few different responsibilities, their workload is front ended because they have to create a design criteria package, they have less impact on the design once the project is awarded, and their liability is changed significantly. Owners of design build projects are able to take a much smaller amount of risk with a design build method. They must be able to incorporate what they are envisioning for the project into their Request for Proposal (RFP). Design build contracts are set up so that owners do not have a large impact on the project once it has been awarded. This way projects are able to be designed faster and cheaper. If the owner does want to change some aspect of the design, the cost of the project will go up. Many owners are against design build because they refuse to relinquish control of the project to someone else. In the public sector, there are various laws set in place to either limit or prohibit design build.

There are still a few states in the U.S. that prohibit the use of design build delivery system. This is one of the reasons why there are different problems with design build in various parts of the country. The government should allow the public owners to be able to choose what type of delivery system is best. For a project where the government is providing the financing and there are not too many unknowns, design build should be used. Some of the main reasons that design bid build should be used are when there are numerous unknowns, the owner wants to have a large input into the project, and the owner is not sure of what they want. The inexperienced owner sees numerous problems with design build.

There have been various problems stated with design build. Some complain that quality assurance and quality control are lowered with a design build process. Some have suggested that a third party should come in and monitor the project, but this would only slow the project down and increase the cost. Rather, guidelines within a company must be set in place to assure QAQC. If the owner insists on having a third party or having the design build team's work checked, a third party should be hired but work in a different role. The third party should work alongside the design build team so that the check process will be completed as the project moves along. This will provide the owner insight into the project, ensure QAQC, provide a shorter design and construction schedule, and have a higher quality project. This unique solution is discussed in detail later.

One incorrect assumption about design build is that the final product is not able to be aesthetically pleasing. In fact, design build usually offers more alternative designs than design bid build. Another complaint is that the owner gives up control of the project and must have a clear design criteria package (DCP). Design build allows the owner to provide all of their input at the beginning of the project in the DCP. This should be seen as the opportunity for the owner

to specify what they want. If the owner is unsure, they should hire an engineering/architectural firm to aid in compiling the DCP.

The owners are then able to review several different Requests for Proposal (RFP) from various companies. They can pick and choose between the ideas and even combine them and give them to the winning team. The owner has much influence at the beginning of the project and must be assured that they will receive the requested project. These stipulations can be implemented into the design build contract. Having the owner change their mind about a certain aspect of the project during construction is what drastically slows the project down and increases cost. Some of the problems with design build are directly related to the team and therefore could happen on any type of delivery system. The owner should look at whether or not the team has worked together on past projects. Having this past team experience will greatly improve the design build experience. Provided that the owner chose a competent team, the contractor and engineer are highly qualified to design and construct a project. The owner should look at past projects the team has completed. They should also contact the owners of those projects to find out any useful information and if there were any problems. The design build team is responsible for providing safe public infrastructure and is held accountable to the public. Some incentives and disincentives can be implemented by the owner into a project to help the project stay on time and have higher QAQC.

Design build has more advantages than the typical design bid build which will be discussed later. Design build has been becoming more popular and will eventually overtake design bid build in the number of projects won. Some of the hardest problems facing design build are the unwillingness of the government to remove the laws set in place against it and for owners who are stuck in their ways to accept a new process. Most of the problems with design

build can be corrected. Design build can be improved to satisfy the varying demands for it across the world so that it can provide a faster, cheaper, and more reliable structure.

2.0 BACKGROUND INFORMATION

2.1 History of Design Build

Design build has been around for centuries, but has only recently been accepted in the United States. Through its lifetime, design build has seen a downturn during the Renaissance and then has evolved rapidly during the late 20th century. During the 20th century, design build became popular in Europe before it did in the United States. Today, it is well on its way to surpassing the traditional design bid build delivery method.

Design build has been accredited as the delivery method for the Great Wall of China, the Taj Mahal in India, and the pyramids at Giza. During these times, the ruler would appoint someone to be overseer of the design and construction. This overseer was responsible for anything that could go wrong and would be held liable for their own work, which is similar to today. The difference today is the initial bid process and the contract. There were not any companies that would compete for a project; rather, there was only one nation with one common goal that was provided for them by the ruler. Similar to the present, codes were set in place. The Code of Hammurabi was written around 1800 BC and states the consequences of a poor design or construction of house [14].

The Renaissance marked the beginning of the separate disciplines namely architect, engineer, and contractor. This divergence came about because of the need for a more comprehensive understanding of each discipline. Litigation began to increase between the architect and the contractor which separated the two even more [14].

Design build began becoming popular in Europe in the mid 20th century. During this time, the United States had laws set in place that would not allow design build to be used in the public sector. Therefore, the separation among the architects, engineers, and contractors continued to grow [14].

Not until the late 20th century, did the U.S. government loosen the laws on design build for the public sector. However, some states still prohibit the design build method to be used on public projects to this day. The federal division has recently picked up on design build and has been using it extensively since Hurricane Katrina. Design build is the optimal delivery method for most public works, especially for flood protection [1].

Design build has gained momentum over the past few years and is expected to become the most widely used delivery method for the public sector. Its advantages are numerous and its disadvantages are being corrected. The process has been successfully applied to various projects. Some of the main obstacles holding it back are government, special interest groups, and corrupt individuals. However, design build will continue to evolve into the most widely and successfully used delivery method.

2.2 Legal Restraints

Various laws have been set in place to govern or restrict the design build method. In 1972, the Brooks Act essentially outlawed design build by requiring the segregation of design and construction for all public works. This had several negative repercussions. All publicly funded projects were required to use the competitive bidding method which forces the owner to pick the lowest price on a project that has already been fully designed. This does not allow the owner to choose the greenest or highest quality of design nor does it allow the owner to pick the most qualified designers and contractors. This forced the owner to accept more risk [1]. Keeping the design and construction separate is not only tradition but it also stemmed from a

fear of fraud, abuse, waste, and a lack of control. A survey was completed in 1995 of all of the US states to find out their individual responses toward design build. In all of the states, their standard approach toward projects was to always have a completed design before any type of construction bid could be submitted; thus eliminating any chance that design build could be used [2].

The Design Build Institute of America (DBIA) was formed in 1993 to lobby, market, and educate not only the government but also engineers, architects, contractors, and the public. The DBIA played a significant role in the passing of positive legislation toward design build. One of the acts that resulted from the lobbying of DBIA is the Federal Acquisition Reform Act (FARA) in 1996. This act permitted federal agencies to secure design build contracts. Because of this act, the US federal government is now using design build as its prevalent method of contracting for small projects. But the federal government would still not allow any state to use the design build method on any project that had a value over $50 million. They believed that design build could not be used for large or even mega-projects [1].

Finally on January 9, 2003, states and local agencies were permitted to use the full potential of design build. The act that was passed was the Transportation Equity Act (TEA-21) that allowed design build to be used on projects that cost more than $50 million [1].

Even today, several states limit the use of design build. Rhode Island prohibits the use of design build in any of its public projects. Some of the states prohibit design build by stating in their laws that competitive bidding based on price is required which in essence requires that all of the design be completed first [5]. In fourteen states, design build is only a limited option for any of their public works projects. Design build is widely permitted in thirteen states and also in the District of Columbia. Only twenty-two states allow design build to be completely

used by all agencies. Figure 2.1 was updated in October of 2009 which is where this data is based from [13].

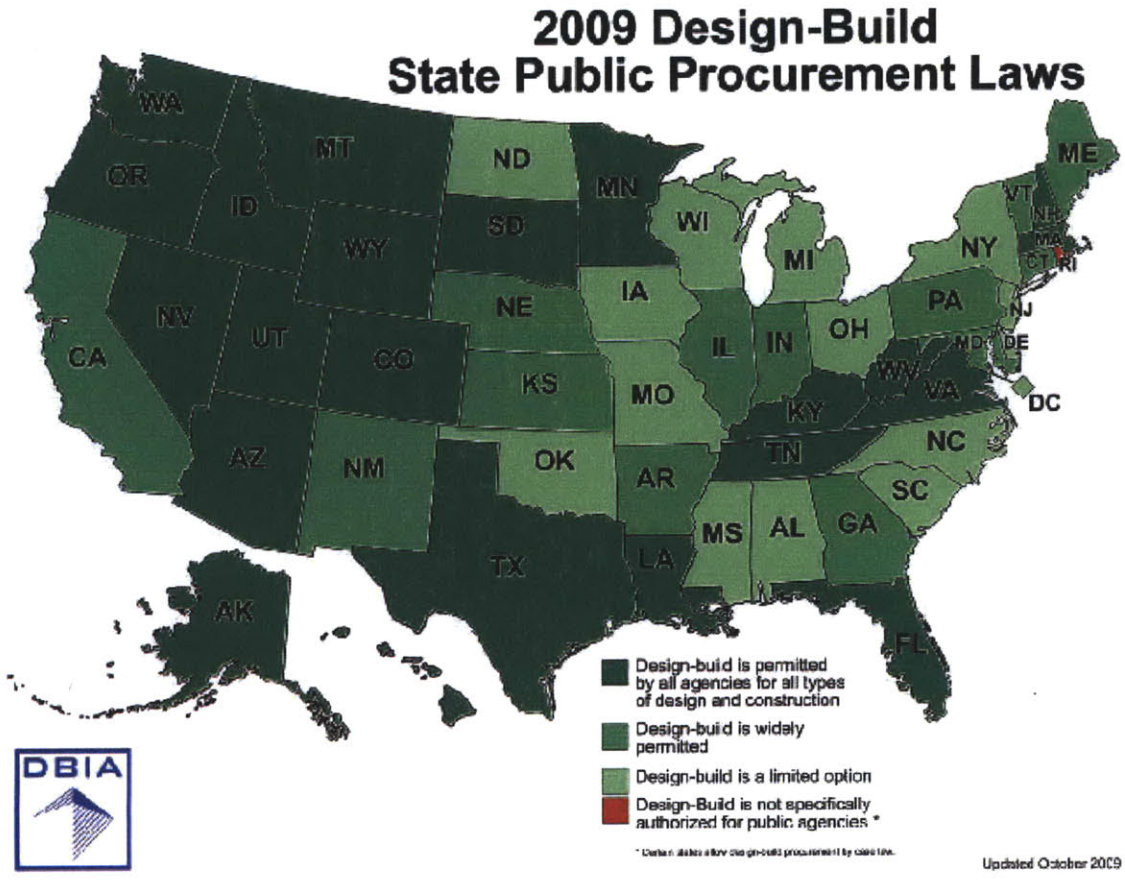

Figure 2.1 – Acceptance of Design Build by all State Agencies (Courtesy of the DBIA)

Several states prohibit or limit the use of design build for any transportation project. The District of Columbia and seven states prohibit the design build delivery method for any transportation projects. Design build is permitted for transportation projects but with several constraints in thirteen states. Thirty states do not hinder design build in any way for transportation projects. Figure 2.2 can be seen for what states fall into which category [13].

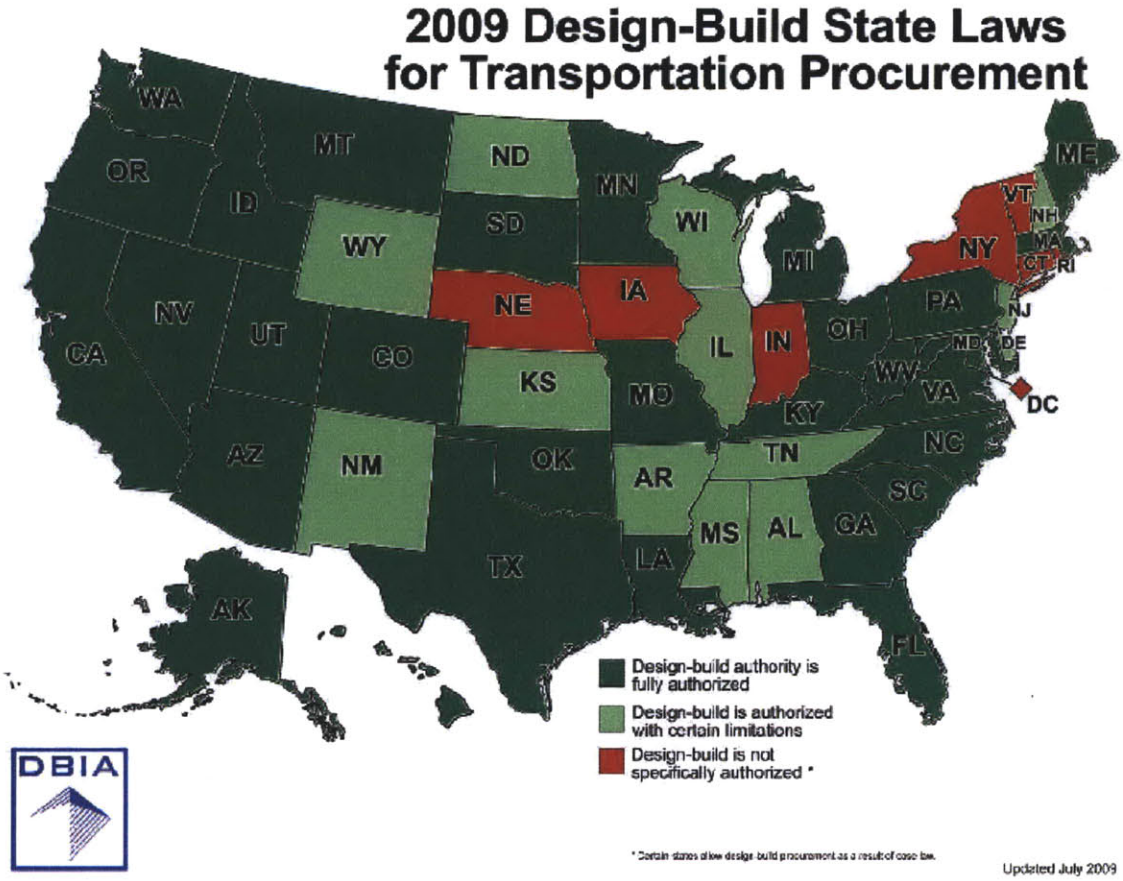

Figure 2.2 – Acceptance of Design Build by State Transportation Agencies (Courtesy of the DBIA)

Some progress has been made in the state legislation for design build in 2009. This progress was shown by either favorable laws or contracts that were awarded. The Alabama Toll Road Bridge and Tunnel Authority has been permitted to engage in design build. Two design build test projects have been approved in North Dakota. In 2010, four design build projects will be started in Vermont. These accomplishments should only spur more effort toward lobbying and petitioning state and federal governments to allow more design build projects [13].

2.3 Advantages

Design build has numerous advantages over other delivery methods. These advantages have helped design build become popular in the public sector in the last few years. Only the major advantages are listed here. The scope of this work is not to go into great detail on the various advantages. Other reports go into depth on this topic.

One of the major advantages of design build is the lump sum cost. This allows the owner to know the total cost of the project before construction. There are not any claims in Design Build; therefore the cost of the project will not go up unless the owner makes changes, then the team is allowed to make a claim. Claims are one of the major issues with other delivery methods, especially with design bid build. Recently, competition has soared which has compelled contractors to low bid a project in order to win. Then to make up for their loss, they will seek numerous claims that will cause the price of the project to increase. This also results in prolonged litigations and delivery time [1].

The schedule and budget are notably more accurate. One of the main reasons that the price is more accurate is that the contractor knows material prices better than the designer. This also stems from the fact that the engineer and contractor are acting as a team for a given project. Also, the engineer and contractor are personally involved with the plans from the conception of the project and are continually updating their schedule and budget [14].

Design build allows the owner to select a team based on multiple variables and not just the lowest price. Design build contracts are usually awarded on Best Value Selection which considers qualification, RFP, price, and more. Design bid build and other similar delivery methods in the US are based solely on the lowest price given by a qualified bidder. Design build allows for having a greener project, having a shorter design and construction time, and having superior design and life expectancy [11].

The cost for a design build project is substantially less than the design bid build or the construction management delivery methods. Also, an immense amount of design and construction time is saved with a design build delivery method. These are accomplished by several other advantages that design build offers. The contractor is working with the designer from the conception of the project. This allows new ideas of design and construction to be used. It also increases the communication between the contractor and designer. Reduction in the amount of design and construction can be accomplished. The contractor is able to shorten the design and construction by value engineering, collaboration with the designer, and the thorough understanding of construction and its stages. The designer will not have to deal with changes from the contractor after the design is complete or detail the drawings to an extreme (because the contractor is working alongside). The designer is able to produce new and fresh ideas for the project because they are able to see the project from a different perspective. Review processes are completed faster and the owner is not hassled with checking designs which slows the design and construction process down considerably. Some owners still require that they or a third party check all of the designs, but this checking process is accomplished much faster in design build. Changes from the owner or elsewhere are practically eliminated once the project is under way [4]. Even unforeseen conflicts or conditions are corrected faster by design build than other delivery methods. Faster collaboration occurs between the engineer and contractor which helps resolve these dilemmas. This process is overall the most time efficient delivery method [3].

The architect and engineer are given a few distinct advantages with design build. They have a greater appreciation of the contractor and gain a better understanding of construction procedures. They are able to provide insight into the construction procedure which increases

the rate of construction. A higher profit can be obtained for the architect and engineer because of this and other reasons [2].

The contractor also has a couple of distinct advantages with design build. Since the contractor is able to provide input from the conception of the project, they are able to suggest more economical materials and construction procedures which will reduce cost. They are also able to provide a better cost estimate since they are more familiar with the project and the required materials. Contractors are also able to have a higher profit with design build [2].

Relationships are greatly improved with design build. The collaboration among the architect, engineer, and contractor provides value engineering and more informed quality versus cost decisions. It allows for a sole source of responsibility which benefits the owner and all other parties involved. Most conflicts are resolved quickly and without litigation [1]. With design build, the owner has a closer involvement with the contractor and engineer during the conceptual stages of the project. This allows the owner to expressly show what they are idealizing for their project. This is merely a few examples of the advantages of design build [14].

2.4 Disadvantages

Many of the disadvantages about design build that are mentioned have been corrected overtime or with experience or pertain to only one particular part of the United States. Some of these disadvantages come from owners or engineers who have never even used design build. Others have had an unsatisfactory experience with design build and typically can only criticize it; though many of these cases were based on a lack of experience in design build or corruption from various parties. The major disadvantages are listed here and ways to correct or avoid these will be discussed thoroughly.

One of the disadvantages is that many owners believe that they need to hire a third party to monitor the QAQC and look out for the owner's interests. Another reason that owners consider hiring a third party is a fear that there will be a substitution of lower quality materials. This substitution can occur on any type of delivery method. This should occur less often in design build if the contracts are written correctly. Clauses in the contract will guarantee the work of the engineer and contractor for a set number of years [1]. A third party should be used if the owner is going to check the team's work or wants some type of assurance that the team is doing an excellent job. This way the owner's checking process will go faster and will show the quality of work that the team is doing.

One of the main complaints from owners is that they must give up control of their project which is why many do not use design build [2]. Numerous public owners do not give up much control of their project; they still check all of the work done by the design build team. Some of these owners take over three weeks in checking the team's work. This drastically slows the project down. Also, many owners also think that to be effective in design build, one must be doing it for many years on various projects.

A detailed design criteria package (DCP) must be provided for the design build team. Many owners see this as a disadvantage because they must do a large part of their work upfront. However if the total work is compared, the owner is doing less work in design build. They also might not have a clear idea or know everything that must be considered for a project. The DCP should be seen as the way that owners have control of their project. Design build can be considered the same way that one would order a new computer or car with custom features and then wait for it to be built and then delivered [1].

Another perceived disadvantage is that aesthetics will not be considered for design build. This stems from the fact that design build has a faster design process and that the architect does not have a direct connection with the owner [4].

One legitimate disadvantage for design build is when there are numerous unknowns for a given project. One such project is the Chunnel between England and France. The cost and schedule soared. This is why design build should not be used for types of projects that have a high degree of uncertainty.

Architects and engineers have their own disadvantages. When responding to a RFP, the architect and engineer could spend millions of dollars. Some of the RFPs require up to 35% design completion. Some owners do offer a one time stipend for the three to five teams that are answering the RFP, but this is typically a small fraction of the actual cost. Another reason that owners provide this is so that they own the designs and ideas of all of the teams that responded to the RFP [2].

The contractor has many disadvantages in design build. With design build, the contractor is accepting more risk and more responsibility. If there are any errors with the design plans, the contractor cannot receive additional pay from the owner. If the project goes over budget, additional funds cannot be obtained. Solutions to most of these disadvantages will be discussed later [2].

3.0 AREA AND LEGAL OBSTACLES

There are a few obstacles to design build that are legal and a few that pertain to the area of the country that the project will be located. Many of the legal issues, that do not pertain to whether or not design build is legal in a given state, have rather simple solutions that can be taken care of

in the contract. The area obstacles are more difficult because they pertain to traditions, lack of forward thinking, and special interest groups.

3.1 Legal Issues

One concern is that in a design build method the designer has allegiance to the contractor and not the owner. Thus if the contractor does not follow the designs exactly, the designer will not point this out to the owner because of the incentives that are given to the designer [5]. This problem is typically not seen in other delivery methods and seems to be a perceived problem. The designer still is responsible to the public and could be brought to court if there are design flaws. Also, the contractor provides warranties on their work and thus does not want any part of the construction to be faulty. As a team, an inferior construction or design will not support any future work from a given owner. There will always be companies that will do inferior work, but this is where the RFQ plays an important role.

Contractors usually offer some type of warranty for their work on any type of delivery method. This warranty covers only the result of the work. For design build, the contractor is required to provide a warranty for the result of the work and the project's performance. Having the contractor cover more of the risk is a benefit to the owner, who only has to cover some of the items such as operation and maintenance. Warranties also simplify project finance for the owner [9].

The number of change orders is greatly reduced in design build. This reduces the overall cost of the project. There are still a few change orders that the team is entitled to. Any changes or hindrance made by the owner will entitle the team to a change order. Force majeure and any unknown subsurface obstacles also warrant the team for a change order; but any design errors, omissions, or uncertainties do not [5].

3.2 Area Issues

States have their own unique labor laws for construction. Many of these laws reduce the effectiveness of design build. They can slow the construction process down by requiring more workers than necessary or for construction to proceed in a slower fashion. The laws can delay the shipping of materials. Cost can be dramatically increased because of these specific laws. Special interest groups can also be a great hindrance toward projects. As much as possible should be done to avoid certain unions and special interest groups whose policies and rules will slow the project down. Research needs to be undertaken to understand the various laws in each region.

4.0 PARTNERING AND TEAMWORK

The design build delivery method is tailored for teamwork among the architect, engineer, and contractor. Having a partner that has the same ethics and high standard of work is important too. Some conflicts could originate if the parties have never worked together or on a design build project. All of this can be solved with research, team training, communication improvement, QAQC monitoring, collaboration, and other means.

4.1 Contractual Arrangements

There are four typical contractual arrangements for the design build team; they are designer led, builder led, in-house, and joint venture. The most common method is builder led design build. Builders, which are the contractors, have more financial access than the engineer or architect. Whoever leads the design build process is responsible for the entire project and therefore takes on more risk and liability. Contractors are usually more willing to accept risk than designers. There are very few projects where the designer is lead for design build projects.

Joint venture is usually between an architect and a contractor which is essentially a new entity for the given project; however, there are very few of these types of contractual agreements [14].

In-house design build is when a company has the capacity to design and construct the project from the resources within its own company. Subcontracts are still permitted for an in-house contract. There are very few companies that have the allotted resources to do this type of contract. The company would have to take all of the risk and liability. They would not be able to share the risk with another company. These two obstacles are the main reason why more companies are not doing in-house contracts. The few companies that do in-house design build are typically for power plants and some infrastructure projects but not for transportation projects [14].

4.2 Risks and Rewards

Two of the primary concerns when entering into a design build contract are risks and rewards. Engineers and contractors must set up the contract between themselves so that the risk and reward is shared between them. If the contract is not set up to the liking of both parties, one or both of the parties could have a lack of incentives which would defeat teamwork and in turn doom the project [6].

There are several compensation issues that must be addressed in the contract between the contractor and the designer. These issues must be defined clearly because the parties cannot typically rely on their past experience like they have done for design bid build or other delivery methods. Also, the compensation issues will vary from project to project and will be more complex since the engineer and contractor act as a team for design build [6].

Many of the compensation tasks will be ones that are typically done by the given party; however, there will be some tasks that could be completed by one member that is typically completed by the other in the design build method. These tasks and other additional

responsibilities must be clearly stated in the team's contract and whether there will be additional compensation for the said tasks. A procedure for any extra work should be stated in the contract that would give advance notice, so that cost, time, and other parameters can be agreed upon. Any upfront and out-of-pocket costs need to be stated on how and when they will be repaid. Also if a sub consultant is required, who is hiring them and how they will be paid should be taken into account in the contract. One last major compensation issue is business origination. Business origination does have a cost and a risk associated with it. This should have a financial reward that is clearly stated in the contract for whoever performed the work. Also, one of the parties usually does a larger amount of work on the RFP; therefore, the compensation should be allocated to reflect this [6].

Sharing profits and losses between the designer and contractor must be discussed in the contract. This is one way to promote teamwork by making each party be concerned for the other team member and the entire project. The designer and contractor must change their way of thinking for design build because it is an entirely different type of delivery system. If there are incentives for the designer to work harder to make the overall construction cheaper and faster, this will help the designers look out for the interests of the contractor. The contractor must work with the designer from the beginning to point out discrepancies in the design. They must get out of the mind set that they can obtain a change order. Incentives for both parties can be written into the contract that will foster teamwork [6].

Losses can be shared in more than one way. The designers usually do not like to accept any part of the loss that might incur from the construction of the project, even though the design of the project might have been the cause. If the designers refuse to take any of the losses, a lack of teamwork and value engineering could ensue. The project's profits and losses could be divided on a ratio with their project revenue; or, the profits could be split evenly and the losses

divided by a ratio. The revenue that the designer receives is much smaller than that of the contractor; therefore splitting the losses could have a drastic impact on the designer. A cap on the amount of losses and profits could be placed for the designer [6]. Another way is to divide the total revenue at the beginning and it is up to each party to stay on budget [Rob Anderson]. It would seem that there would be less incentives on both sides to create a cheaper, faster, greener project this way; but if either of the groups does a poor job, the other might not be willing to team up with them again. This could only work if there is a great amount of trust and if the team has done previous projects together.

There are many different types of losses that need to be discussed in the contract between the designer and the contractor such as force majeure, underestimated costs, delays, equipment malfunctions, claims, miscalculations, and poor construction. The contractor should not take all of the construction risks and the engineer all of the design risks. "The precise ratio by which any particular loss is divided is less important than the fact that as many risks and losses as possible fall on both parties' shoulders so that each has the maximum incentive to assist the other in avoiding such problems" [6]. One way to prepare for human error on either of the parties' part is to have a contingency. This way the problem is covered without coming from someone's pocket. A contingency also reduces the passing of blame which will increase teamwork [6].

4.3 Communication

Communication is vital to any project. The lack of communication could be the downfall of project. Communication can be difficult for a newly formed design build team. The members are not used to working with a different profession that sometimes has a contrary view from their own on any given subject. Working together is important for a design build project.

In design build, the contractor and designer often work next to each other. This way, design can be completed faster and the contractor knows about the project as it develops. It will also eliminate miscommunication. The contractor will be able to inform the designer on any construction issues as the design proceeds. Value engineering and new ideas begin to kindle during this phase. Communication continues from inception to completion. It includes everyone on the design build team. As the team works on more projects together, their communication will improve.

4.4 Insurance

Insurance and contractual loss allocation provisions are the most common way of diversifying risk. Most risks can be covered by insurance. Some of the common types of risk are construction, workers compensation, equipment, property insurance, general liability, and professional liability. There are several insurance companies that will assume these risks and others. It is advisable to pass on a large portion of the risk to someone else. Many companies even have risk managers on their staff [8].

Some special insurance policies for design build are a wrap-around and liability for professional errors. The wrap-around is just a policy that will cover all of the parties involved. Professional error has been used on other delivery methods but only by the designers. For design build, professional error needs to be purchased by the contractor also since they are the primary party. The team must decide who will purchase the insurance, what the coverage will be, what the deductibles should be, and other factors [8].

There are a few additional ways other than insurance to diversify risk. Surety bonds can be purchased that will cover the entire project. These bonds are just slightly altered from other delivery methods. Contractual indemnity and contribution diversifies the risk by either placing the blame on both parties or by placing the blame on just one party. Indemnity places the blame

on just one party; while contribution divides the blame at some pre-determined ratio. Contractual indemnity and contribution is not legal in all states; this should be researched before adding it to a contract [8].

4.5 Improving Teamwork and Contracts

Improvements can typically be made to all contracts and relationships. If both parties do not continue to work at improving these items, they will deteriorate and could end poorly for both the designer and contractor. For this reason, new ideas must be continually made to cultivate a better relationship and contract. After working on numerous projects together, each side will know how to easily antagonize the other. The smallest conflict could escalate and then result in not having any future projects together.

If the contractor and designer enter into a contract together with the thought that they will never work on another project together, they will try to make the largest profit and will not work together as a team. The parties must enter with the mind set that they will continue to do projects together and thus form better bonds. The first design build project together should be where the team is working out the internal disputes and setting standard procedures for future projects and contracts between themselves. Both have many contacts and can advertise for their team on upcoming projects.

Specifying risks and rewards in the contract will provide incentives to both sides. The blame for various problems should be placed on both the contractor and designer as often as possible. This way, each party will look out for the other's interests. This will form teamwork between the contractor and designer.

One option that some of the larger companies should consider is more in-house design build. Currently, the majority of in-house design build is used on utility and power plant projects. Using in-house design build on infrastructure projects should eliminate many potential

problems such as lack of communication, lack of a common goal, contractual disputes, litigation, and much more. The contractor will already be familiar with the layout of the design plans and will know whom to contact if there is a question. The designer and contractor will always be working on the same team; unlike other companies that will partner with one company for a given project and then another company for a different project. This will enable the project to be designed and constructed faster. Doing all of the design and construction could potentially provide an advantage when bidding against other companies for a project. This is based on the fact that owners do look at previous team experience.

There are a few disadvantages with in-house design build, namely that one company will be accepting all of the risk and that not as many fresh ideas from working with other companies could surface. The risk can be reduced by various insurance policies just like any other project. If the company is large, they will have numerous resources to call upon for new ideas and value engineering.

A construction or design company has a few different ways of beginning in-house design build. The hardest and longest way for a company to start doing everything in-house would to be to begin from the ground up. Essentially, the company would begin to hire and/or buy equipment to establish a new division within their company. The optimal solution would be to buy or merge with an existing company. This way all of the designers or contractors and equipment will already be in place. There are various approaches to purchasing a company. A company that is struggling financially could be bought at a reduced price. Size of the company will play an important role when deciding which to acquire. Other important factors such as assets, debt, debt payments, quality of employees, salaries, and experience must also be taken into account when merging or purchasing a company.

5.0 PUBLIC OWNERS

The design build team must understand the owner's point of view and what the owner expects. The main parts of what an owner is looking for in a project is for it to be designed and built faster, greener, cheaper, better, and for it to have a longer life expectancy. Combining all of these is a daunting task for anyone. Then, the design team must sometimes anticipate what the owner is looking for before they even know what it is. This is vital when answering the RFP. All of this makes understanding the owner somewhat difficult.

5.1 The Bid Process

There are a few different selection methods that the owner can choose from. They are the one-step method, the two-step method, and the qualification-based design build. The two-step method is the most common and a brief overview is given here. The other two methods are not mentioned here since it is beyond the scope of this paper, but there are various other articles that articulate the two processes [1].

Owners have a few tools with which to narrow down the competitors for a certain project. A Request for Qualifications RFQ is essentially an advertisement that is looking for any companies that are interested in the project. The design build team must meet or surpass the various qualifications set by the RFQ. There are usually many implied requirements that are stated in order to for the owner to check the experience or thought process of a given team. Design build teams must fully comprehend the scope of the project and also the owner. Much in-depth research into the requirements of the project and the owner should be done before the RFQ is answered. Some of the credentials that the owner is expecting to see are past experience (especially experience that is similar to the project at hand), employee resources, team work, financial assets, equipment resources, and much more that will vary from one project to another [11].

Once the owner has short listed the teams, the RFP along with a more detailed DCP is sent to the remaining teams. During this time, the team will begin design and take it to whatever was specified in the RFP which is usually around 20%. The design build team will submit the designs, price, and schedule. The owner will conduct interviews and answer any questions that the teams might have. Then the owner will select the winning team, provide comments on the design, and negotiate a contract. Any changes that the owner makes will change the price and the length of completion [1].

5.2 Selection Criteria

Before the RFQ is sent out, the owner must have a fixed evaluation plan that has a given weight to each component. This evaluation plan is typically required to be sent out with the RFQ. The plan enables the design build team to know what to focus their efforts on [11].

In the RFP, important issues are brought to light such as: design life, schedule, cost, return on investment, and quality improvements. How these issues are addressed will help the owner decide what team to award the contract [11].

The design build team must understand what items the owner believes is important when answering the RFP. Not understanding this could cause the team to lose the contract. This is where communication is crucial. A survey was taken in 2004 that asked all of the parties involved with the design build method to provide feedback on various parts of the design build process. The survey was completed by 221 participants from all across the US. One of the questions that were asked was to rank five given items from most important to least when answering an RFP. Their reply is given in Figure 5.1. The design build professionals which make up the team provided similar results for only two of the five items. Only the first and last items were nearly identical between the owner and team. Schedule is much more important and the design approach is less than what the team believes that it is. The design build team puts too

much weight on price which is reemphasized in Figure 5.2. Figure 5.2 shows four different weights (10%, 25%, 50%, and 75%) that were assigned to price. The participants chose one of these price weights based on what they believed the owners would have chosen. The results from the owners vary significantly from that of the design build team [11].

Key item	Owners (%)	Rank	DB industry professionals (%)	Rank
Qualifications	23	1	24	1
Price	21	2	24	1
Schedule	21	2	17	4
Technical/design approach	18	4	20	3
Management plans	17	5	15	5

Figure 5.1 – Key Items in a RFP and Their Ranking (Courtesy of Lopez del Puerto)

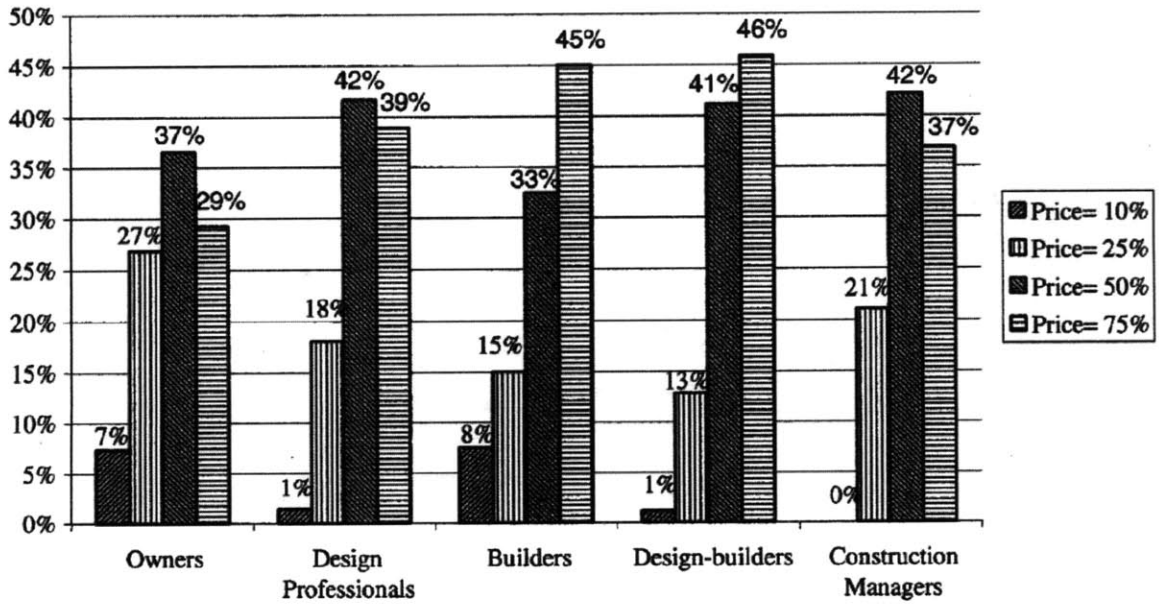

Figure 5.2 – Amount of Weight Assigned to Price (Courtesy of Lopez del Puerto)

Another point that the design build team is missing is how important owners rank previous team experience. The majority of the design build team believes that working with the

same team in past projects is important but not essential; whereas, the owner has placed much more emphasis on previous team experience which can be seen in Figure 5.3 [11].

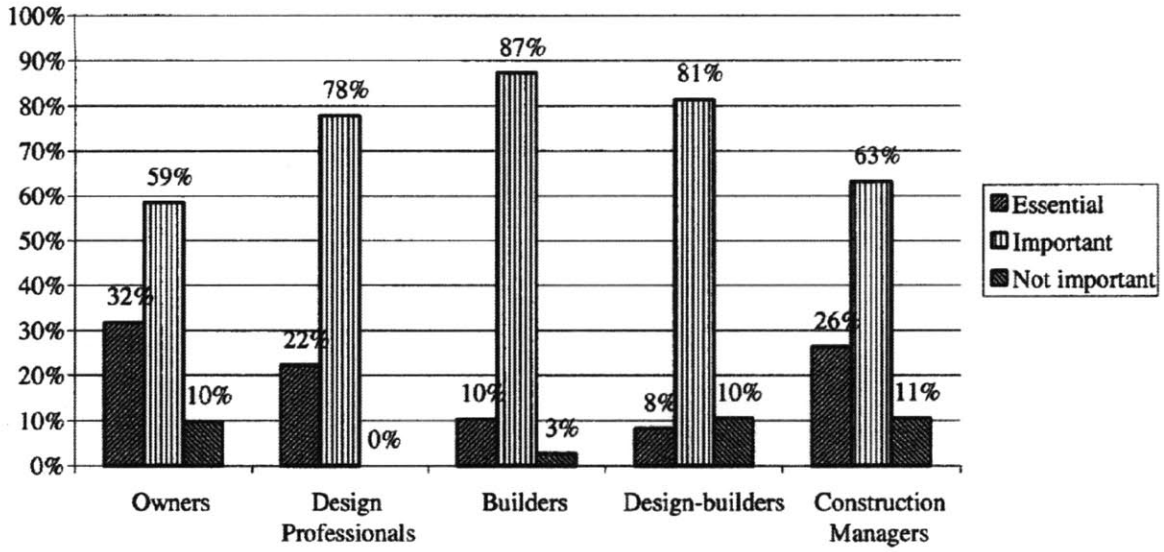

Figure 5.3 – Rankings of Previous Team Experience (Courtesy of Lopez del Puerto)

These misconceptions of the design build team must be corrected. Communication between the owner and the team must be improved. The owner should provide how they rank the various key items when sending out the RFP. This will help the team focus on what is important to the owner and thus provide a better schedule, cost, and design. The team must also realize that the owner does place significant emphasis on whether or not the team has worked together on a previous project. Asserting this point when answering the RFQ could help the team be short listed and even win the entire contract. Overall, the main point is that communication between these groups must be improved.

5.3 Clauses in Contracts

Most contracts have clauses that protect the owner and the design build team. The DBIA has several standard contracts and guidelines for contracts that can be used for various projects. Some of the clauses that are used refer to weather, acts of God, third parties, early

completion bonus, penalties, and delays caused by the owner. The action taken for each of these items varies from one contract to another. More time could be allowed for a project or no mercy will be shown. Funds could be increased or typically all of the financial risk is on the team. One fairly standard clause pertains to owners changing the design once the project is awarded. The clause allots more time for the project to be completed and covers all of the expenses inflicted by the changes that the owner has made. All of these clauses are important and should be included in every design build contract [12].

Penalty clauses relating to a late project delivery are typically seen in a negative manner by the design build team; however, the clauses can actually work both ways. These clauses, called liquidated damages in contracts, have three conditions that must be met for there to be a penalty clause in the contract. They are: "(i) that it is likely that the owner would suffer some damages; (ii) that the owner's damages are not capable of precise calculation; and (iii) at the point of time in which the contract is agreed upon, the liquidated damages sum is a reasonable approximation of the owner's likely actual damages" [7]. The liquidated damages clause can be applied practically toward any Federal or public works projects. This clause represents a sum that is to be paid to the owner for every day, hour, or even minute that the project runs over. The sum is not only the maximum amount that can be recovered but also the minimum. This can work to the design build team's advantage if they are able to secure a reasonable price for the liquidated damage clause. If there is not a clause and the project is delayed by the contractor, the owner has the right to receive damages that amounts to the actual value of the delay. This is where the liquidated damages clause can be used to the advantage of the team because the pre-agreed upon amount to be paid is the maximum that the owner can receive from the team even if it is only a mere fraction of the true value. Here, the liquidated damages clause is actually saving the team a considerable amount of money [7].

5.4 QAQC

Quality assurance and quality control is one of the key items that owners are concerned about. The QAQC process of the team should be presented in RFQ and again in detail in any presentations to the owner. The designer and the contractor should have their own internal QAQC process and then a third process that will check all of the work. Having a senior engineer as the checker and back-checker for the internal QAQC process will drastically reduce the chance of an error. A small group of professionals from both parties should make up the final QAQC process. This will allow everything to be uniform and to be checked multiple times.

Many public project owners are still using a QAQC and quality management (QM) checks from design bid build projects. This mentality needs to be changed. The owners cannot just check the qualifications of the team; they need to explicitly ask for the team's approach in the RFP. If the QAQC and the QM process are not required for the RFP or after the project has been awarded, the quality of design and construction could be low. This is because the quality is constrained by the budget and time schedule for the project. The team must stay under budget and on schedule or they will lose a significant amount of money. Also if the quality processes are not asked for, the extent to which the owner wants them might not be built into the cost or schedule. This is why the QAQC and QM processes must be required in the RFP or after the project is awarded and clearly stated in the contract [10].

The quality expected must be clearly described in the RFP and the contract. There are many different types of quality standards. Just saying that the project needs to be good is merely a relative term. The products that the team will be providing will have various standards that can be required. The quality can be compared to other similar products. It could be an item that does have a precise and measurable level of quality. Much of the construction does have

codes or specifications that the contractor could be required to follow. Theses specifications can even be modified by the owner to request a higher quality [10].

The QAQC and QM plans must be required for the RFP and can be also required or more clearly stated once the project has been awarded. A quality management plan for the design needs to be submitted along with a separate QM plan for the construction. Qualifications of main personnel that will be working on the project are another quality that can be required for the RFP. Also, past team or individual company performance and quality of work could be required. It is vital for public project owners to not apply the same quality procedures to design build as they did to design bid build. They must require that the QAQC and QM plans be in the team's response to the RFP [10].

5.5 Federal Projects

Design build is a perfect fit for most federal projects. Many of the projects such as levee protection must be designed and constructed as quickly as possible. Since design build's cost is less and time to complete reduced, design build is the delivery method that the government should be using. Many of the federal projects do not need to be aesthetically pleasing. Thus, any issues about a lack of architectural input will not be valid. This process is well suited for levees, flood control, pump stations, military bases, infrastructure, utility projects, and power stations. Of course, there will be some federal projects that will require an architect; but design build can still be the chosen delivery method [3].

6.0 IMPROVEMENTS BY AND TO DESIGN BUILD

Design build has many advantages over other delivery methods. Although it is not perfect for every project, design build should be the first delivery method considered by the public and federal sectors. The few disadvantages to design build are discussed here and a solution is

presented. Some of these disadvantages are merely perceived by individuals or have been corrected over the past few years. The main disadvantages are discussed in detail.

6.1 Improvements made by Design Build

Design build has many advantages over design bid build and other similar delivery methods. Design bid build restricts the interaction between the contractor and designer. Design build encourages communication and teamwork. It also allows many arguments to be avoided because of the ability to discuss most of the issues with the owner before entering into a contract. This allows the contractor and designer to have a better understanding of what the owner's expectations are and what the project encompasses [2].

Another impediment made by design bid build is a lack of adaptability to different needs of each individual project. Design build is able to grow and transform into the requirements of the project. Design build is able to adjust toward the trend of public/private partnerships; whereas, design bid build is not capable of making the necessary changes. Design build will continue to evolve and be able to adapt to future necessities [2].

Contractors are able to improve numerous parts of the project with a design build delivery method. The contractors are able to give advice on cost estimates to the designer. Some of these estimates are hard costs which come directly from the subcontractor and material vendors. This greatly improves the accuracy of the estimate since the contractor usually knows more about the material and labor costs than the designer does. The contractor can also provide insight into analyzing data on the project site. Preliminary scheduling can be greatly improved by the contractor. The contractor has sufficient knowledge about construction to enable fairly accurate details for each phase of construction [6].

The design and sequencing of the project can be improved by the contractor in design build. Value engineering is more affective by the contractor's contributions. In a typical design

bid build, value engineering is typically rushed and is from the designers' perspective. Value engineering and the contractor's input will also enable greener designs, faster construction, reduced costs, and a longer life for the project. The contractor will provide feedback on the design; thus eliminating most design errors and greatly improving QAQC. Most of the other delivery methods do not have the contractor checking the designs. In design build, the contractor is able to inform the designer on certain construction difficulties or costs [6].

Fast tracking, which is starting construction before the completion of designs, is typical in design build. This cannot be used on most other delivery methods; because the contractors do not know what the designs are or where the designer is taking them which will result in multiple change orders. In design build, the contractor and designer are working together; thus, the contractor has access to the designs and the future plans and ideas for the project [6].

Designers are also able to improve numerous parts of the project with a design build delivery method. In design build, the project is designed system by system instead of slowly adding elements to the plans. With the system by system approach, each section is passed to the contractor, the subcontractors, and vendors to comment on any of the details in the plans. The designers will then address the disputes, which will greatly increase the rate of construction. Other delivery methods do not have this process which causes change orders and numerous questions to the designer. In design bid build, questions are answered through a Request for Information (RFI) process. The RFI process is a slow written ordeal and usually does not fully answer the contractor's questions. With design build, the questions are asked much earlier in the project and they are often answered in meetings [6].

When the public owner receives the RFP, they are receiving a unique design from each team that they can choose from. This is somewhat equivalent to an architectural competition. The owner is able to see not only the architectural components but also the structural and

operational components. Many of the other delivery methods do not offer this many different designs at the beginning of the project.

Design build improves the number and quality of the designs and also eliminates unnecessary details. In design build, numerous alternative designs are considered and several are even designed. This allows the design build team to find the optimum design in terms of cost, speed, life, aesthetics, and environmental friendly materials and methods. Contrary to common belief, design build does allow a considerable amount of aesthetics and various designs to be considered. In other delivery methods, the engineer and architect try to limit the number of alternative designs "because the alternatives are for the owner's benefit and the design fee is rarely large enough to allow such creativity" [6].

In other delivery methods, an abundance of unnecessary details are inserted into the design documents in order to avoid change orders. These and even some of the necessary details can be eliminated because the contractor is working directly with the designer in design build [6].

Design changes and substitutions are faster and much smoother in design build. With other delivery methods, the designers do not want to change or substitute anything with their design; thus causing delays and cost increases. Some reasons that the designers do not want to change anything is that they do not benefit from the changes and it usually costs the designers some amount of money and time that they had not planned on. In design build, it is in the designer's best interest to work with the contractor and make changes [6].

6.2 Improvements to Design Build

There are a few changes that can improve design build and help it to be accepted by more public project owners. These include an improvement of QAQC, a change in owner involvement, warranties, more aesthetics, and in-house design build. Some of these

implementations have already been addressed in sections 2.4, 4.3, and 4.5, while more of them will be confronted here.

The owner must have a clear and concise Design Criteria Package. The owner can hire an engineer or architect to help draft ideas and assemble the needed documents. The designer that is hired to do this job should not be allowed to compete in the bid process for the project because they would have an unfair advantage over the other companies. Hiring a designer for the DCP will reduce the work of the owner and will provide more of the necessary documents describing the project.

More interaction needs to occur between the owner and the competing companies. This way, the companies will have a better understanding of the requirements of the owner. The owner can be reassured that they will be receiving the type and quality of design that they are looking for in these meetings.

The design build team should present a clear QAQC for the project. They should also provide documents showing the quality of their equipment and materials throughout the construction. The names of the subcontractors should be given along with the QAQC process and how the team will oversee them. The team should also provide the names of the material vendors along with a QAQC process for the materials.

Records of past design build projects, especially ones that the team has done together, should be presented. Having a list of previous projects should prove whether or not the team is capable of completing the project. The owner will also be able to talk to owners of the team's previous projects to ascertain if there were any disputes or project oversights.

The owner should try to use the same team for as many projects as possible, as long as the team is providing excellent service at a reasonable price. This way, the owner will know

what to expect from the design build team. The team will also be able to comprehend and anticipate what the owner wants.

If the owner is not able to use the same team for numerous projects, they should set some standard practices for their projects. This can include regular communication and updates from the team. A standard QAQC process for design, equipment, construction, and sub-consultants could be required. Warranties, guaranties, and incentives could also become fairly standard. Many other parts and clauses of the contract could be standard. All of these will also increase the speed of the entire design build process.

The owners' complaint about losing control and not knowing what is happening can be addressed by providing weekly updates for the owner. In these updates, progress reports and QAQC can be given. Any unique design ideas, greener methods, and value engineering can be described. If there are any major concerns by the owner they should be sent to the team within twenty-four hours. Any major changes that the owner inflicts would still be subjected to a change order by the design build team. With this approach, the owner will still be a part of the project, be able to see the progress that is made, be assured of the QAQC process, and will not need to hire a third party to watch over the team.

If the owner still insists on checking the team's work or having a third party, all of work should be checked in less than one week. If the owner is not able to meet this schedule, then a third party should be hired acting as the owner's representative. The third party can also be the owner's representative if the owner is inexperienced. The third party should however be able to complete their checks within one week so as not to slow the progress down.

Another way to use a third party, so that the schedule will not be slowed down and the owner will be able to have some assurance, is to have the third party work alongside the design build team. The third party will still report directly to the owner and act as the owner's

representative. The third party's work will include checking designs and providing any consultation. Having the third party work in this manner will eliminate slow checks by the owner or a third party. It will allow the owner to know what is going on by an unbiased third party. This unique process will also provide a higher QAQC.

There are several different ways that a contract can be set up with the third party that will be working alongside the design build team. A cost plus contract could be used which simply is the cost of the work plus a stated profit. A lump sum or reimbursable contract could be used.

One of the main parties that has and continues to restrict design build is the government. Lobbying must continue to be implemented so that design build can be used on more public projects. Because of the deteriorating infrastructure, projects must be completed faster and at a lower cost. Design build is the only delivery method that offers both of these.

Unions and special interest groups can have an impact on design build. Representatives need to be sent to these to groups to rework the contracts so that design build can be used to its utmost. Information about design build should be passed on to the public so that they will support its use.

7.0 CONCLUSIONS

For design build to be implemented, several key items must be implemented. The owners must have a clear understanding of what their project is. They must be able to convey what it is exactly that they want. All of the necessary documents and project extents must be in the DCP. Owners need to realize that relinquishing control of the project not only protects them by shifting the risk but it also creates a better project.

Governments should embrace design build and allow their public agencies to use it to the fullest extent. Many of the government officials refuse to change from their traditions. The infrastructure in the United States is in disrepair and must be fixed quickly and efficiently; therefore, "public agencies should be encouraged to develop and utilize alternative methodologies where they increase efficiency and decrease cost" [2].

There are some problems with design build. Some of these problems are directly related to the choice of the company that is selected to be used for the project; but this will occur with any type of project delivery method. The background on each of the companies needs to be checked by the owner and the contracts clearly written. All of the guarantees, warranties, and incentives must be clearly stated to avoid disputes.

A detailed QAQC process is vital to a design build team. This process must be clearly shown to the owner. Weekly updates should be given to the owner. Having worked together on previous projects will increase the chance that the team will win the contract. More companies should consider doing in-house design build.

"There is no reason that design-build cannot be used on most types of construction projects" [2]. Design build can offer more alternative designs than other methods. It is faster, cheaper, greener, and typically offers a longer life for the project. Design build can also be aesthetically pleasing. There are very few types of projects that design build cannot be used on, one of which was the Chunnel. Only the projects where there is a high degree of uncertainty is design build not effective. Design build can and will continue to evolve and be applied to more projects.

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