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Selection Criteria Utilized By Large Private Sector Commercial Owners In Design-Build Method Selection

presented by

Jeffrey John Pfeifer

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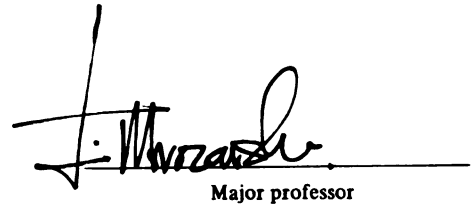

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SELECTION CRITERIA UTILIZED BY LARGE PRIVATE SECTOR COMMERCIAL OWNERS IN DESIGN-BUILD METHOD SELECTION

by

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ABSTRACT

SELECTION CRITERIA UTILIZED BY LARGE PRIVATE SECTOR COMMERCIAL OWNERS IN DESIGN-BUILD METHOD SELECTION

by

Jeffrey John Pfeifer

The goal of this research was to identify and evaluate the selection criteria that private sector owners use in selecting design-build as their project delivery method. A portion of this thesis explored owner background information, construction activity and experience, project budgets and construction methods utilized by private sector owners.

This research collected data from owners in order to better understand their criteria for utilizing design-build. Data on design-build performance criteria was collected through a series of interviews. The purpose of the interview survey was to collect data for use in development of a Design-Build evaluation form. The owners can reference the form with their project information to decide whether the design-build method may be a procurement solution. The form will allow potential design-build users to evaluate their project and better understand the criterion that best matches this method. The owner's question of whether design-build may be a viable solution for their project may now be a more informed and educated decision, based on specific project information.

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1.0 INTRODUCTION

1.1 STATEMENT/ PROBLEM AREA

Private sector owners interested in project procurement have various construction methods available to them, and each of these methods has various selection criteria. The goal is to create a union between the needs of the owner and the selection criteria of the construction method. Criteria selected by the project owner needs to be identified for the potential success of future projects. It is important to keep accurate historical records of past projects, and then use that information and attempt to repeat success on future projects. This research explores the criteria that large commercial and industrial owners use in the private sector when selecting design-build as a construction method.

Design-build is quickly becoming a process that many owners are selecting for project procurement. Research by Keith Molenaar (Molenaar 1995) indicates that owners believe the primary advantage of design-build procurement is that it shortens duration, but they judge its success more in terms of budget than schedule. Molenaar explained that a project is considered successful if the budget is controlled, but owners will use design-build for its repeated success in controlling the length of a project. This repeated successful selection criteria of design-build is examined further in this research paper.

When examining construction procurement methods, it is important to determine what defines a successful project, in order to determine whether the selected method will succeed. Victor Sanvido (Sanvido, 1992) has identified four critical activities in organizing a successful construction project; as follows:

1. Assemble a cohesive team to plan, design and construct the project.
2. Put together contracts that encourage team behavior and allocate risk fairly.
3. Recruit experienced personnel in all project phases, from design through construction, to avoid problems due to inexperience.
4. Make information concerning designability, constructability and operability for the project available to the project team. This information is critical to the assembled team for a successful project; without it the project will have insufficient direction.

Owners have expressed that main determinants of a successful project are projects that are on budget, that conform to users' expectations, and that are on schedule (Molenaar, 1995). Success, as defined by owners, is considered project-specific and will be explored in this research. The success of the design-build method is attributed to an increased interest in meeting the owner's needs, which include better quality, continuous improvement in project delivery and within the final product, allocation of risks and responsibilities to one capable party, with better access to highly specialized, project specific experience and expertise (Kwaku, 2000). Understanding the owner's needs should be the

project team's main concern, along with assembling a plan for following through on those needs.

In order to understand an owner's needs, it is important to look into the owner's capability to express his or her design-build needs properly. Public sector design-build success is impacted by the following project characteristics crucial to project success (Molenaar, 1995): well-defined scope, shared understanding of scope, construction sophistication of owner, adequate owner staffing, an established budget and a completion date. The criteria by which public sector owners initially judge project success is based on whether the project stays within the budget, conforms to the user's expectations and adheres to a schedule.

Definition and understanding of project scope is the most important element for design-build project success, but the factor most important in the public sector when choosing design-build is to shorten duration (Molenaar, 1995). Duration is defined as the overall time in the schedule to complete the project's construction; this time may include design. Design-build may be used for fast-tracking a project because it allows the design process to continue while the project is being constructed, rather than having to complete one step before the other. The real benefit in this process is the ability to involve the construction entity in the design phase, for early procedural input.

1.2 GOALS/ OBJECTIVES

The goal of this research was to identify the criteria private owners use in selecting design-build as their project delivery method. To date, there has been limited research into private sector design-build criteria selection. Most information that has been gathered has been in the public sector, while the following research addresses large private sector owners.

In a recent quantitative study by Douglas Gransberg (Gransberg, 1999) concerning costs and schedules on public works in Massachusetts, Indiana, Texas and Florida, Massachusetts had higher costs and longer schedules. The state of Massachusetts insists on using the design-bid-build method. Compare the situation in four states: Massachusetts, a unionized state with some of the most restrictive contracting requirements in the nation; Indiana, a unionized state that permits the use of an alternative project delivery method with A+B cost and schedule bidding; Texas, a right-to-work state that allows limited use of another alternative method with design-build; and Florida, a right-to-work state that permits using almost any project delivery method on state public works. This data was collected from 10 Massachusetts agencies on 926 projects totaling $1.1 billion to construct during the years 1988-1997. This information was compared to similar data on 463 projects worth a total of $2.5 billion in Indiana, Florida and Texas. Comparing escalations in project costs from the time of bid to completion, the cost growth in Massachusetts averaged 1/3 more than Florida, 3 1/2 times higher than Texas and 9 times higher than Indiana. Comparing the

percent expansions of construction schedules, time growth averaged 55% in Massachusetts, 17% in Florida, 12% in Texas and 6% in Indiana. The public arena is still evolving from state to state, and this information is evidence that when state construction agencies change their construction methods, the taxpayers benefit.

Public officials must concentrate on their voters' interest when supplying facilities, since major concerns of their projects are cost related. Private sector method consideration is channeled through company owners, rather than public officials. These ownership differences provide a base for examining characteristics in the private sector.

Objectives for this research include identifying and evaluating method selection criteria. This information is valuable to the present industry in supporting procurement decisions. This is also helpful to owners considering design-build and its effectiveness for their personal needs. A portion of this thesis explored owner background information, construction activity and experience, project budgets and construction methods utilized by private sector owners. The building types supporting design-build are recorded, such as industrial, office, highway, and commercial building types. Aspects of design-build and selection decisions, which make it an attractive method, are important pieces of information to owners. These characteristics and the respective reasons for utilizing design-build have been recorded and made available to owners interested in the design-

build construction method to determine whether it is the right method for their project. Customers have reasons for making purchases, therefore matching the customer with the product is essential for success. This thesis identifies the selection criteria used by private sector owners in utilizing design-build.

This first chapter indicates that this research will explore the criteria that large, private sector commercial and industrial owners use when selecting design-build. Research has proven that owners find the primary advantage of design-build procurement is to shorten project duration, which is defined as the overall time in the schedule to complete the project. Owners have expressed that they determine a project's success by its ability to be on budget, conform to the user's expectations and be on schedule. These are all results that design-build can provide, but it is important to have a well-defined understanding of the project's scope, which is established by the owner. Objectives for this research include identifying and evaluating method selection criteria. Through this identification of selection criteria of design-build, owners can make better decisions in their selection of design-build as a procurement method.

2.0 LITERATURE REVIEW

2.1 HISTORY:

Construction, as we know it, was based on the premise of the master builder, which combined the architect and builder into one entity. This process was seen on some of the world's earliest and most renowned projects, such as the Parthenon and the pyramids. In time these two professions separated. The primary cause of this divergence of disciplines was the growing complexity of projects, which resulted in the need for increased specialization and expertise (Kwaku, 2000). Our society has become one of constant change in technology, causing a need to split the architecture and construction entities. By breaking into smaller pieces, each profession is better able to specialize, this trend can be seen in construction, as well as many other professions. This separation allows each profession to specialize as technology progresses.

In the past 20 years, contributing factors such as declining productivity, huge cost overruns, increased disputes and litigation, and major construction failures (some with great loss of life) have resulted in lower quality construction (Pocock, 1996). These factors, as well as others, have caused the construction industry to reevaluate its project delivery methods. With the recent utilization of alternative construction methods, design-build has been a repeat performer among those gaining popularity. The design-build method of delivery has seen an increased

resurgence of interest over the last decade and is the fastest growing project delivery method in the construction industry today (Kwaku, 2000).

The traditional method of construction procurement, known as design-bid-build (dbb), utilizes a contractor and architect separately. This construction method was used almost exclusively until the 1960's, when owners wanted more control of project time and cost (Branca, 1988). This need for control pushed owners to search for solutions to these problems. During the 1970's, scheduling delays led to legal problems. Separation of entities involved in the project increases gaps in responsibilities and leads to potential litigation (Pocock, 1996). When the architect and builder are separate, communication is lost between the two, and they now act on their own, protecting themselves from liability and pointing fingers elsewhere in the event of discrepancy.

New alternative methods, such as partnering, construction management and design-build, are gaining popularity as alternatives to the traditional method of project delivery. Today, there are three main types of project delivery methods: design-bid-build (traditional method), construction management and design-build. Owner's demands for higher quality, innovative and cost-effective designs, less risk, fewer delays, less litigation, and faster schedules are leading professionals to seek these alternatives (ASCE, 1992). Due to the continued success of these methods, the owners are increasingly utilizing them. The concept of "time is money" rings true daily, and production processes must respond. Driven by new

technologies, competition and costs, the construction industry has evolved to improved building design and construction methods, thereby adapting to the current needs of the client (Zak,1999).

Pocock (Pocock, 1996) examined the performance of various project delivery methods. This research examined the Degree of Interaction (DOI), which is defined as the extent of interaction among designers, builders and project team members during a project's planning, conceptual design, detailed design, procurement, construction and start-up phases. Alternative construction methods, such as partnering and design-build, have higher average degrees of interaction than traditional methods. DOI scores are ranked on a scale of zero to one, with zero representing no interaction, and a one representing the most interaction possible. Construction processes averaged the following ranking: partnered .58, design-build .31, combination projects .60 and the traditional method (design-bid-build) with a low score of only .086 (highest recorded for the traditional method was only .27). Pocock showed that projects using alternative approaches have significantly better performance than traditional projects. Performance was measured in terms of cost growth, schedule growth, modifications per million dollars, and modifications due to design deficiencies (Pocock, 1996). Design-build is a leader among alternative approaches and is continuously gaining popularity with owners.

"The general trend (for design-build) now is in the public sector," stated Jerry Novacek (ENR Sep 1999), an associate in Zweig Whites Overland Park, located in their Kansas office. He indicated that there was a five to six year cycle where design-build took off in the private sector, and that cycle is found in the public sector. Further work by Zweig White and Associates resulted in finding that design-build clients are split evenly between public and private sectors. This information leads to the understanding that the private sector was open to the benefits of utilizing design-build before the public sector. Perhaps the "red tape" of the public sector, and the general conservative nature, held it back. Once the benefits could be seen, public officials were encouraged to utilize it as well.

Public and private owners want to maximize the success potential of their project, but they also want to be sure that the final product serves its intended purpose. The premise is that private sector owners are looking for the same general results as public sector owners; both want projects on time and within budget. Design-build is selected and utilized because of its repeated success. Brice Hill, president and CEO of Dallas based Centex Construction Group, who has turned almost exclusively to design-build, had this to say of it: "it encourages certain definitive behaviors, as well as corporate behavior and culture, to create a better working environment. These behaviors provide us with a tremendous opportunity and new ways of looking at these opportunities and qualifying them. We use our relationships to discover what a client wants, and what his needs are for a successful project." (DBIA Conference, 1999) Directing owners towards

new trends for project procurement generates new thought processes and creativity for producing at accelerated rates, which in turn produces higher revenue. If the construction industry is to provide products created to benefit user's needs, then understanding and delivering quality products should be a top concern.

According to DBIA, design-build is expected to account for half of project deliveries, both in the private and public sector, by the year 2005 (Dixon, 1998). DBIA has petitioned the U.S. Department of Commerce to create a Standard Industrial Classification code for design-builders, which is estimated to constitute a $60 billion annual market (DBIA Conference 1999). This emphasizes the need for setting standards in the design-build industry and understanding the growth potential of design-build as well as other methods gaining interest. Many problems have arisen from a lack of understanding, due to the relatively quick switch from the traditional way of thinking. Perceptions have been formed, giving these methods a bad reputation, as in this example by Sir Norman Foster of Foster and Partners, a renowned architectural firm, who spoke of design-build delivery as:

> "The image which design-build conjures up is that of the worst possible building, low in quality and of little or no architectural merit. The only priority being the "bottom-line cost". This image is the opposite of what I believe the process of design-build should be delivering. Basically, the best design skills should be combined with the best of construction, acting

in the client's interests to produce a product of shared value for the community and the users." (Bennett, J., Pothecary, E., Robinson, G. 1996)

Design-build requires a cultural change from the defensive posture and "us versus them" mentality of the traditional method (CII, 1991). This attitude is slowly changing, and the change is needed for successful projects and satisfied customers in the future.

2.2 DEFINITION / BACKGROUND:

Various researchers have defined design-build in similar ways. The University of Reading Design-Build Forum has defined it as:

> "Procurement routes that enable clients to employ one firm that takes single point responsibility for delivering the required building and associated services in accordance with defined standards and conditions."

This definition emphasizes the importance of entering into one contract, which is called "one-stop shopping", for the owner, who handles complete project oversight. Along with the benefits, there are also problems of now leaving the owner without representation, which is explained further in this review.

Depending on the project, there are four general types of design-build contracting accepted in the construction industry: builder as prime contractor, architect/engineer as a prime contractor, a joint venture of the architect/engineer and builder, and a design-build organization with in-house design and construction expertise. The last type defines the basic concept of design-build,

having all team members in-house and working together; this also creates a single point of responsibility for the owner. Some other combinations can create tension, since one party has hired another, generally the contractor hiring the architect. The contractor in this case controls the project, as well as having the final design decision. This situation leads to the previous quote by Sir Norman Foster, in that there is little architectural merit, since the builder financially controls the project.

The greatest factor for using design-build is the single-point of responsibility (Bennett, J., Pothecary, E., Robinson, G. 1996). This factor ties into the continued pursuit in the modern industry to utilize total quality management and its focus on the "team" approach. The principles of total quality focus on the customer, involve everyone, continuously improve, are simple to understand and represent common sense (Evans,1999). To meet the demands of building owners, the industry has evolved into what we have today: A full team approach, with professionals capable of establishing budgets, project scope and realistic time lines at the very onset of the project (Zak,1999). These demands are coming from owners, who are being pushed by their markets and demands in the manufacturing arena. Due to such highly competitive markets, owners products are being developed along side the facilities where they will be manufactured.

In the traditional method, the architect is hired by the owner and has a responsibility to provide a design to best suit the job. However, with design-build,

the contractor generally hires the architect, rarely the other way around. This leads to the design being controlled by the contractor's Guaranteed Maximum Price (GMP). If the project falls into financial trouble, the design can be modified to accommodate the escalating prices. The owner may have a difficult time following the project closely, without having a contracted representative on his/her side.

For design-build to be successful, it is crucial that the owner issue a comprehensive scope of work, this information that may include some or all of the following: detailed space and equipment requirements, site surveys, soil borings, outline specifications, budget parameters, and scheduling requirements (Kwaku, 2000). This comprehensive scope of work is also needed for competitive bidding between proposals, so that they may remain comparable. The up-front costs associated with design are lost in the bidding process, which pushes many contractors away from competing (*ENR*, April 1999). One solution to this problem has been to compensate the bidder's effort in preparing a bid for the project, some offering incentives to the winning team. Another negative aspect of design-build, according to the engineering firm of Grumman/Butkus, is conflicts that arise from material and equipment specification. The materials and specifications will change in order to compensate for increased prices in other areas of the project, unfortunately to a lesser quality. This becomes a problem for the owner, since the architect and builder are on the same team and are watching out for their best interests.

2.3 SUCCESS

Advantages of design-build correspond directly to the disadvantages of conventional design-bid-build (Tarricone, 1997). Further research by Bennett provides evidence that design-build increases performance over traditional procurement: construction speed by 12%, total project delivery speed by 30%, cost by 13%, and 50% more certain to be completed on time and completed on budget, or within 5% of the anticipated goal. Through a multivariate analysis, Konchar had similar findings concerning the superiority of design-build: Design-build led to a 4.5% lower unit cost than construction management (CM), and design-bid-build by 6%. In the category of construction speed design-build was 7% faster than construction management and 12% faster than design-bid-build. For overall delivery speed the percentages increased to 23% over CM and 33% over design-bid-build. This reduction of delivery time saves project financing for the owner, by reducing overhead costs of the construction. He believes design-build significantly outperformed design-bid-build in every area except unit cost, intensity, and environmental system quality. Design-build significantly outperformed construction management in the areas of delivery speed and in turnover quality, and construction management outperformed design-bid-build in some areas. Design-bid-build failed to outperform the other two systems. Further procurement comparison in the public sector gave the following results in a study that examined the use of design-build and design-bid-build: the Navy reported a 15% cost savings and 12% time savings. A third fewer change orders were

encountered on 209 design-build projects undertaken by the Department of Defense (Gransberg 1999).

Design-build provides superior consistency in aesthetic quality and overall better aesthetic quality than traditional approaches (Bennett, J., Pothecary, E., Robinson, G. 1996). The Construction Industry Institute (CII) research team measured construction speed in terms of square feet of construction per month. It found that design-build produced the highest median activity at over 9000 sq. ft. in one month, and design-bid-build the lowest at 4,500 sq ft. Scheduling with design-build had almost no delays on average, and design-bid-build schedules experienced delays of an average 4.44%. Cost factors had design-bid-build with the greatest median cost escalation at 4.84%, followed by construction management at 3.34% and design-build at 2.37% (Krizan, 1997).

Konchar believes that an integrated team on a design-build project is better equipped to handle complex and aggressively scheduled, technology-driven projects than less integrated teams such as ones found on design-bid-build projects. In contrast, Kwaku has found the design-build model to be used successfully both on extraordinarily complex facilities and on "straightforward" office buildings. These differing opinions seem to be difficult to disprove, since design-build has been found to be successful on both types of construction. There are reasons that support each of these views, and why design-build is better suited for a particular complex or simple building. In a complex

environment, the design-build team may work best on completing difficult tasks and Konchar has concluded that this partnership reduces conflicts between the parties involved. In contrast, this partnership of architect and constructor may find that straightforward, repetitive office buildings become less complicated, due to high volume of production. This will be a continuous debate in the industry, since projects are being successfully completed that are both simple and complex types.

2.4 SELECTION CRITERIA

Owners desire greater value from their buildings, which is the relationship of usefulness or satisfaction to price (Evans, 1999). Bennett presented the following thinking process and what owners hope to achieve through their project. They can achieve a greater certainty of time and cost delivery, as well as improved value by using a design-build approach. Single point responsibility, Guaranteed Maximum Price, and avoidance of design and construction risks are the principal reasons for utilizing the design-build approach. Many see this as a result of single point responsibility, since the architect and contractor work together. Many doors can be opened for process examination, since a partnership has been formed. The two now work together, rather than against each other, as in the traditional method.

Each project will initially present itself with different complications; for example, some may need a project in a shorter schedule than thought possible with

traditional methods, or perhaps within a smaller budget. Private sector owners use various selection criteria when selecting design-build, of which none are specifically focused on design-build alone. Seven criteria were identified by Songer (Songer, 1996) to be common with design-build selection: establish cost, reduce cost, establish schedule, shorten duration, reduce claims, large project size complexity, and constructability/ innovation. These seven criteria were used in this research project's survey questionnaire, as well as an eighth category titled "other", and owners were asked to rank them from most to least important.

Further research conducted by Kwaku (Kwaku, 2000) found three criteria that owners might consider in their determination for utilizing design-build:

- Time constraints for delivery of the project
- The capability and experience of potential contractors with the design-build process
- The capability (or inability) of the owner to manage the project, including having personnel who are familiar with the design-build process to oversee the project.

Kwaku does include the time constraint, but replaces cost concerns with contractor experience and owner's ability to manage. Songer's (Songer, 1996) criteria were selected by the researcher and used in this research for their broad coverage of potential owner criteria. The data collected from this research may be grouped into any of these seven criteria categories. Contractor experience

and owner's ability to manage were utilized in this research, but covered in general demographics of the private sector owner.

When selecting a construction procurement method, it is important to look at what characteristics are involved in the project, and select accordingly. There are three main project characteristics used as drivers for contract method selection (Gordon, 1992). The first are project-drivers, which are characteristics of the project itself, including time constraints, financial constraints, flexibility needs, etc. Second are owner-drivers, defined as characteristics of the owner, including construction sophistication, current capabilities, risk aversion, etc. The final of the three are market drivers, which characterize the market, including availability of contractors, current state of the market, size of project, etc.

A team concept is the primary function of the design-build method; without it problems arise due to the separation of professionals. When architects and builders do not work together toward a project's three primary criteria- a quality project, finished within a specific time frame, at a predetermined cost- the project owner's interest and goals are not met (Kwaku, 2000). These three criteria include both cost and schedule, which are two of the biggest performers that owners look for in completing a project, but these two are useless unless the quality of the workmanship is upheld. The construction industry's main objective is to service and satisfy the client to the best of its capabilities. Without a satisfied customer, the industry has failed in upholding its duties. The separation

of professionals leads to poor communication between parties, which can lead to possible litigation.

2.5 OWNERS – PROCUREMENT METHOD SELECTION

In order to analyze the characteristics of the procurement method, as selected by the owner, we need to look at the owner and his/her influence on the project. Konchar explained that there are multiple variables describing the owner's influence on the facility delivery process, which he has assembled as follows:

- Two types: private and public sector
- Ability to restrain the pool of contractors and to qualify candidates
- Ability to define scope may impact facility delivery process (Molenaar, 1995)
- Experience with the facility type, also relates to their ability to define scope. (Owners with experience and those without)
- Experience with the chosen method of delivery is considered separately from facility type experience.
- Selecting a project team of architects and builders that best suit the facility delivery process.
- Relationship with the project team will have impact. (Sanvido, et al., 1990)
- Capability of the owner to administer and manage the processes just described. (Two contracts in a design-bid-build, reduced to one in design-build.)

- Owner's ability to make decisions. (The facility may stall while waiting for reply or directive from owner's organization)
- Owner's attributes are key in their decisions to select procurement method.

As design-build becomes an important project delivery method, owners should have a clearly defined process of selecting an appropriate method for their project, which is the initial step in the construction process. This process is similar to purchasing a new car; the car must fit the criteria of the owner, such as size, color, mileage, performance and cost. If these criteria fall outside the customer's range, the vehicle will not be an appropriate match. A satisfied customer looks for a product that will satisfy his/her needs, and this satisfaction results from providing goods and services that meet or exceed customer's needs (Evans, 1999). A construction method also has variables. The owner has an idea of what they want in the final product, and the building construction method must supply this product. Many outside factors affect this decision making process, such as facility completion time, design complexity, building type and project cost.

Procurement methods vary, as exemplified in the three dominant types in the market today, the traditional method (design-bid-build), construction management, and design-build. Each has different selection criteria, which owners look for in procurement method selection. This research examines

private sector owners and their selection criteria in selecting design-build for project procurement.

Selection criteria are those utilized by facility owners in construction procurement method selection, and their construction method performance expectations. These criteria may consist of cost or schedule issues, which tend to be heavily selected by many owners. Other criteria may include reducing project claims and litigation, dealing with large project size, complexity and constructability/innovation.

Project owners make method selection judgments based on past performance. Owners will look for different criteria, depending on the project, and what is important. Certain construction methods produce predicted results better than others, and it is important that these needs and the expected results are properly matched for a successful project. In a recent project, a large private sector owner had the following to say concerning early project planning:

> "Development of performance criteria gave everyone a clear focus of the larger picture of the project. The required end result was not simply a facility for a certain amount of money with a certain number of production lines. The level of performance was made more important and well known and better understood."

This project's success was measured by its ability to maintain the performance criteria and complete the work within the time and budget allowed. Design-build

was selected to take the responsibility for delivery and performance criteria, since it was thought there was room for conflicting goals and potential adversarial relationships with the traditional method of design-bid-build (Raco, Nelson 1993).

As stated in the introduction, there were seven criteria identified by Songer to be common with design-build selection: establish cost, reduce cost, establish schedule, shorten duration, reduce claims, large project size complexity, and constructability/ innovation. Songer based these findings on an extensive literature search. The researcher felt they covered a broad range of potential criteria that may be used by commercial owners, and were therefore used on the survey in this research. These seven were found to be common in literature findings, with pieces of each explained as benefits of utilizing design-build. Songer used these seven as a basis for design-build selection and what it is capable of producing. The researcher agreed with these findings and as a result, they became integrated into the survey questionnaire, which examined private sector commercial owners.

3.0 METHODOLOGY

3.1 INTRODUCTION

This research collected data from owners in order to better understand their criteria for utilizing design-build. Data on design-build performance criteria was collected through a series of telephone interviews of large private sector owners based in Michigan. Specific activities were: determination of sample, sample pre-evaluation, survey, survey analysis, development of a project evaluation form, form validation and conclusion.

3.2 SAMPLE SELECTION

The principal method for obtaining data was through interviews with project owners, who are a part of the Michigan Construction Users Council, Inc (MCUC). This group is a collection of Michigan based organizations that facilitate large commercial construction projects. Twenty-one private sector owners were identified from the MCUC membership list.

Members of MCUC address issues on improving the construction process. The MCUC assists in improving the quality and cost-effectiveness of a project by taking action early in the planning stages. The organization is comprised of public, quasipublic and private owners, who have an annual budget for new construction, renovation and maintenance. The owners benefit from the experience of more than forty other organizations across the country, helping in

utilizing the Construction Industry Cost Effective (CICE) principles and obtaining timely information.

3.3 PRE-EVALUATION

Prior to developing the interview script, the researcher randomly selected five members from the list for pre-evaluation. Information was gathered through a brief phone interview concerning the company's interest in participating, and in deciding which interview method would work best for gathering information. This call also aided in obtaining other connections at a company, since in some companies there were multiple divisions within a company that are responsible for construction. The response from all five companies was positive regarding their participation, and some leads to other sources within their company were provided. One contact, for example, had not utilized design-build, but made reference to another contact within the company that had been involved with design-build projects. Through this preliminary investigation, it was concluded that all remaining members would require a pre-questionnaire phone call to introduce the project and confirm that the contact is the correct person to interview, as well as to gain any information not included on the list, such as email addresses.

3.4 DATA COLLECTION

After completion of the pre-evaluation contact, a scripted telephone interview approach was selected for consistency. Because of the small sample size, open-ended interviews were feasible and used to collect data for qualitative analysis. These interviews, lasting approximately fifteen minutes in length, were conducted in person, unless the owner requested a phone interview, following the pre-written phone script. The conversations were recorded if permitted by the respondent; otherwise the researcher relied on written notes taken during the interview. The data collection was targeted toward gathering groupable answers, obtained from controlled open-ended questions. The answers to these questions were later classified into sub-categories, where possible, under their respective general categories. All answers were recorded in Appendix C through Appendix U for review.

The interview had a repetitive, but open-ended format, using the same questions for each owner. The questions were asked in order, but the researcher, at his discretion, asked follow-up questions to probe and fully explore the respondent's answers.

The nineteen predetermined questions in the survey were placed into four categories: general demographics, selected performance criteria, decision-makers and success of the project. Each is explained below:

Category one, demographics, consisted of general owner information questions, such as owner experience in construction, typical building type, experience with facility type, cost of construction and volume constructed each year.
The second category, selected performance criteria, asked owners to indicate the performance characteristics they used in selecting design-build. This may vary between projects, since not all projects constructed within a company are identical.

The third category collected information pertaining to company decision-makers and whether one person, a department or possibly a committee formed for the specific project makes construction method selection decisions. This provided background on the mindset of those involved in choosing design-build.

The last category of the questionnaire investigated the success of the project using design-build and its ability to satisfy the initial performance criteria fully.

This acquired information revealed the quality of this method as applicable to real life situations, as well as the level of owner satisfaction with the chosen method. Each of these four categories asked the owner to supply information concerning their most recent project constructed using design-build, and then asked for comparisons of this project to a typical project, to check for variances.

The voluntary questionnaire contained a statement of confidentiality, protecting both the person giving information and the company they represented. In any reporting of responses or data collected during this interview, the interviewee's name and company name, as well as any other identifying references, were deleted. Information collected during the interview was reported in aggregate with that of the other interviewees.

Results of the data collection survey included responses from all owners contacted, regardless of procurement methods utilized. These recorded responses to the survey are listed in appendixes C through U, which list each question, as well as each respondent's number and answer to the question. The data collection analysis was limited to only those with experience in design-build.

There were twenty-one members on the MCUC list; of those seventeen interviews were completed. The seventeen who completed the survey did so after an initial phone conversation explaining the reason behind the call, which enabled the researcher to get an email or fax number, and to set up a time for a follow-up discussion regarding the questionnaire. All those who did not complete the interview process were contacted in the initial phone call process, and had been sent the survey questionnaire, but failed to respond. Repeated attempts were made to take the data collection through an interview, but no further contact could be made.

The data collection process was recorded on a spreadsheet, keeping track of the last message sent, when the last actual contact was made, the date the survey had been faxed or emailed, the date of the proposed interview, the actual completed interview date, and also a column to note if design-build was not utilized. Each owner's file was updated with each attempt to contact, listing the most recent date. After an interview was conducted, the date was recorded under the correct column heading, and that owner was noted as being completed. This aided the researcher in identifying who was completed, and who required follow-up attention. The recorded dates reminded the researcher when the last attempt had been made to contact the owners, so time could be spaced between phone calls. The researcher did not want to come across as overly persistent, and alienate those owners whom he was asking for assistance. Generally at least two days was left in between attempts; this gave the potential interviewee a day to call back after the message was left.

A second sheet contained all those listed on the MCUC membership list with addresses, phone numbers, fax numbers and member's general information. After the initial contact was made, email addresses and other important owner information, such as secretary's names and contact arrangements, were recorded there. All names on the list have been suppressed to protect the identity of each participant, as well as information supplied regarding their company. Any taping of conversations was used solely for transcribing the conversations, in the event that some information was not clearly written during

the discussion. Tapes were coded and destroyed upon completion of the data collection process. Participants were asked if taping was acceptable; all asked participants gave permission to record the conversations as requested.

Because of the small sample size, a statistical study of the data was not applicable, so a qualitative analysis of the data was developed. The responses were evaluated and placed into categories; the number of categories depended on the given range of responses. All answers were recorded to assist in validating the categories, as well as recording the approaches involved in creating the categories.

All the information collected was written on a survey form for each interviewee. When the interview was set, the date and time were recorded on a copied survey and set aside until that date; this aided in keeping track of upcoming interviews. These completed surveys were kept separate and noted as completed in the order in which the interview took place. The collected information was organized and placed into a spreadsheet. This master spreadsheet contained the data from all the interviews and would aid in comparing information from the different owners.

Each interviewee requested a telephone interview rather than in person, which had many benefits and disappointments. The benefits included being able to conduct more interviews than otherwise possible, in a shorter period of time, due

to no traveling around the state for data collection. Considering the distances from the researcher to the owner's facilities, versus the short duration of the interviews, phone conversations were much more convenient.

This data collection period lasted much longer than originally anticipated, due to the extra number of calls to be made. Downfalls associated with the phone interview process included repeated calls needed to get through to the listed owner representative (interviewee). After an initial contact was made, an email address or fax number was obtained, so that the survey questionnaire could be sent ahead of the follow-up interview. The interview time was arranged at the interviewee's convenience, generally within a week of the call, to allow time to review and prepare for the questions. Many of these scheduled interview times were met with a voicemail recording, so that the interview could not be completed at that time. This meant another call to reschedule, and yet another for the interview. Some second interview times were also missed, for various reasons, which meant repeating the process once again. Numerous follow-up calls had to be made to each owner representative before some questionnaires could be answered. Six of the surveys were completed and emailed or faxed back, due to the time constraints of the interviewee. At that point any further questions could be quickly answered by telephone, rather than running through the entire phone or personal interview process.

3.5 INTRODUCTION OF PROJECT EVALUATION FORM

The purpose of the interview survey was to collect data for use in development of a Design-Build evaluation form (Appendix V). This form can assist other owners and determine if design-build is the best method for project procurement. It was expected that this form would use the following criteria to decide if design-build is the correct method for a given project:

- Owner's experience with construction methods and experience with project type, schedule and cost, complexity of the project
- Simple or complex project type
- Negatives of design-build
- Owner trust
- Uncomfortable with design-build team not including owner
- Partnership and who controls project, team should work together

The form was expected to consist of questions regarding project needs; the owner would then select an answer with an accompanying numerical value. These numerical values were to be totaled at the end of the form and related to an answer key, which would suggest a possible construction method. This will give criteria to judge the suitability of projects considered for design-build. During pre-evaluation of the membership list, the researcher discovered that an automotive company has put together an evaluation form for use in deciding which construction method is best suited for their needs. This form was used as a template form in this research. In this form, a point scale was assigned to the questions, which suggested a method of construction based on the number of

points. The checklist created in this research focused on the possibility of design-build as an appropriate construction method. This form differs from the automotive company's questionnaire, which suggested a variety of construction methods.

3.6 PROOF OF CONCEPT

This form's proof of concept was made through a second contact by telephone with the sample group, respondents were asked for comments regarding the project evaluation form. The form and the validation process were explained as the deliverables of this research during the initial interview. The form was faxed or emailed prior to contacting, so that the respondent could review it. The researcher asked for comments on its effectiveness and how they, in their experienced opinion, felt it could be of assistance to other owners. This would enable the researcher to make adjustments to the form and aid in creating a user-friendly format.

4.0 RESULTS AND SUMMARIZATION

4.1 INTRODUCTION

The sample group consisted of members associated primarily with large commercial organizations, who invest hundreds of millions of dollars each year in construction projects. The owners surveyed had an extensive background in utilizing a variety of project delivery methods and provided an experienced view of these delivery method selection criteria. Due to their ongoing need to construct facilities, they typically track the cost effectiveness of their methods, and have valuable experience to draw from in their successful paths.

Seventeen of the twenty-one members on the MCUC list were followed through the data collection process. The remaining four members, for various reasons, were unable to complete the survey. Those who could not be contacted for an interview had potential for further interaction, but the lack of response on their part led the researcher to believe there was no interest in furthering their commitment. This led the researcher to believe that design-build was possibly a method they failed to utilize and that they simply discarded the survey. Two of the seventeen respondents surveyed had never used design-build, therefore, they could not complete the survey. This resulted in fifteen who had responded and were eligible to complete the questionnaire and follow through the data collection process. Respondents six and seven were representatives of the same owner, which had only constructed one design-build project. Rather than

duplicate this information, only respondent six was used in the analysis, reducing the number used to fourteen respondents. For anonymity, all seventeen respondents were assigned a survey number. This survey number, as shown in the first column heading of the table, will refer to the respondents interviewed. This numbering system will carry through the research, so the reader can easily identify the respondent being discussed. As stated earlier, there were two respondents that had not used design-build for project procurement, respondent numbers four and nine. These respondents utilized other methods for construction procurement, and since this research asks questions regarding their most recent design-build project, their input was not considered in the analysis. Respondent seven was in the same organization as respondent six, and that company has only completed one design-build project, eliminating the need to acquire the same information twice. Therefore, the contact was made, but no information was collected from that respondent, since information on their only design-build project had already been collected. This reduced the seventeen contacted respondents to fourteen, who were eligible for the analysis.

Data from the remaining fourteen respondents was placed onto the spreadsheet. This spreadsheet listed all answers given by an owner and allowed them to be viewed together, for comparison purposes. The survey was broken down into four categories, as explained in the methodology. Category one deals with general demographics of the owner. Category two addresses selected performance criteria, which they used in selecting design-build. The third

category addressed the decision makers in the organization, both for the recent design-build project as well as a typical project. The last category questioned the success of the recent project and compared this to a typical project success.

4.2 CATEGORY ONE

Category one consists of questions one through eight and addresses general owner information. This category gives an owner and project background and identifies project construction types, experience, facility characteristics, method percentages and reasons behind method selection. Comparisons were made throughout the survey between an owner's most recent design-build project and a typical construction project; this category compared facility characteristics.

4.2.1. CONSTRUCTION TYPES

This category started with general project and owner information, including the contact person and email address, for further contact. Following this introductory information was question one (Appendix C), which consisted of seven typical construction types taken from Konchar's research. The owner was asked to select one that best fit their most recent design-build project. By using the most recent project completed, any bias by the researcher or owner can be eliminated, considering the project may or may not have been a success. (Many of the building types recently completed using design-build utilized heavy industrial and high technology as primary construction types.) These projects ranged from automotive production and chemical processing plants, to automated warehouse

space, a research center and a staff-training center. Respondent five discussed the only project that was a simple office addition; all others required a higher level of technological construction knowledge.

In the fourteen useable responses, the respondents listed five of the seven construction types on their most recent project. Seven responded that their project was heavy industrial, three were high technology, two were simple office, with one complex office and one light industrial. Refer to figure 1:

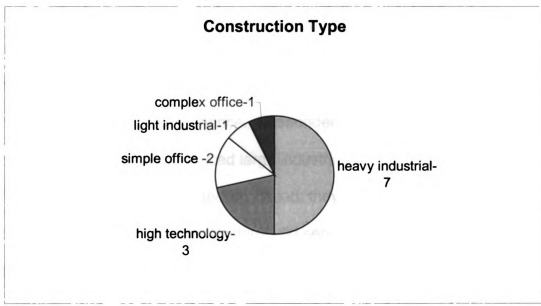

Figure 1

These sample projects will be broken down in this research to explore design-build as a procurement method and its outcome for success.

4.2.2 EXPERIENCE

Question two reviews the owner's experience with the recent design-build projects construction type. This question focuses on the owner's experience with

this selected construction type (Appendix D). All of the companies have been constructing for many years and have a great understanding of the procurement process. Only respondent one had no experience with the construction type of their most recent design-build project, which was a cancer research center. This was a highly technological construction type, incorporating the latest in technology from all major trades. The owner selected design-build for the ability to have the construction entity provide preconstruction services within a controlled environment. Three other owners, respondent numbers five, six and sixteen, had a small amount of experience with their construction type, each one in a slightly different situation. Respondent five generally produces large processing plants and was in need of an office addition, a project type in which it had a small amount of experience. Respondent six was in a similar situation in that his/her firm mainly produced large industrial, but needed a high-tech training facility. This project was financially based; they found the site, which was owned by a developer who provided design-build services. Respondent sixteen was an owner who constructs twenty thousand square foot warehouses using in-house resources, but was in need of a two hundred thousand square foot warehouse. This project was too large to be handled in-house, and they utilized design-build for the low cost capability of a niche firm. The remaining owners were all extensively experienced in the types they listed in the survey.

4.2.3 COMPARISON TO TYPICAL PROJECT

Question three compares the respondents latest project to a typical project type (Appendix E). Respondents twelve and seventeen failed to answer this question. Respondents one, five and six indicated that these were not typical construction types. The remaining nine respondents considered this a typical type.

4.2.4 PROJECT CHARACTERISTICS

Question four asked respondents about the project characteristics of their most recent design-build project (Appendix F). Question five then compared those characteristics to typical project characteristics (Appendix G). These questions asked for information concerning the number of floors, if the construction type was new or a renovation, square footage, and specific building systems, such as foundation and structure type, interior finishes, exterior enclosures, etc. These answers ranged widely but were collected to see if there was any sort of pattern in the make-up of a facility.

Eight of the recent design-build facilities constructed were one floor, with the remaining six at two or more. The average for all was 1.8 stories; this excluded one facility, since it consisted of six story silos and technically not useable floor space. This was only slightly different from a typical project, for which respondents reported five facilities with only one floor and nine with two or more.

In the area of new or renovated construction, the recently completed projects were all new, with the exception of respondent eight, which was a renovation. In contrast the typical projects varied, with six respondents involved in new construction, three in renovations and four respondents constructing both types in equal amounts.

Sizes of these projects ranged from four thousand square feet to six hundred thousand square feet, these responses coming from owners five and ten. The following chart shows a breakdown of square footages into seven categories, each in one hundred thousand square foot increments. Figure 2 shows the breakdown of facility size and the number of respondents that fell into that category:

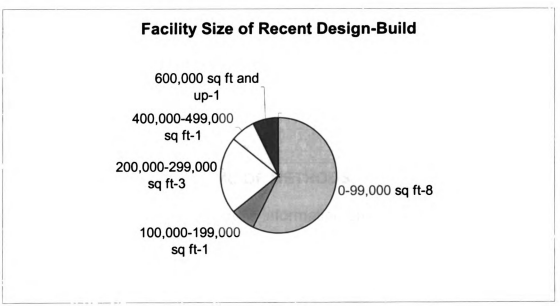

Figure 2

The largest percentage fell under one hundred thousand square feet. There was no pattern in sizes, which was anticipated, since all companies are different and will require various sized facilities to accommodate their needs. This question showed somewhat the same results for the typical facilities, although three respondents had typical facility sizes with a range of up to one million square feet. The remaining numbers all had a wide range.

The specific building systems, which comprise the construction details and assembly methods, varied in their characteristics. Each building system is project specific and depends on the project's needs. Since many of the recent facilities were one story, most were slab on grade. All remaining attributes: foundation type, structure type, architectural interior finishes, exterior enclosures, roofing, environment, electrical systems, controls and site characteristics were examined. These all varied, because the construction types varied from office to industrial. This variation is also caused by decisions of the architect and engineer concerning what materials would be used.

4.2.5 DOLLAR VOLUME OF METHODS

Question six was designed to obtain information about the respondent's design-build experiences and practices (Appendix H). Respondent one failed to answer this question, which addresses the percentage, by annual dollar volume, of each construction method used. Information was sought regarding percentage of project delivery by design-build, construction management, traditional design-bid-

build, or a hybrid method. A follow-up question was asked to determine if this percentage was consistent over the past five to ten years. These percentages allow the researcher to look at how much design-build is utilized in the large commercial market, and if this has changed in recent years. Design-build has become an increasingly important method in recent years, as seen in the literature review section of this paper. The respondent companies' answers were averaged and indicated that, by dollar volume, design-build is currently used 10.5%, construction management with 21.89%, and traditional design-bid-build 64.58%. Hybrids are also utilized, which are various combinations of these three, as well as some others, are also used and constitute 19.15% of the market. Figure 3 compares these responses to each other:

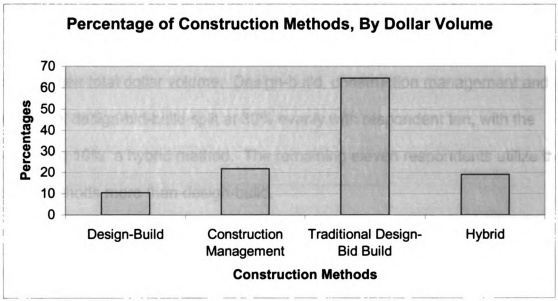

Figure 3

The large commercial market, due to their in-house design and engineering capabilities, uses the traditional method heavily. They handle their construction documents and then bid out the construction. This is due to the high level of

technical complexities in facilities required by the companies for specialized projects. Many of the interviewees said they would use more design-build if they could find firms that handled their needs. This is the situation, in some cases, that led the owner to search for a firm capable of putting together a design-build application. These owners are changing their production processes and need new facility types to accommodate processes which they are not properly suited to handle in-house. Respondents six, sixteen and seventeen have used design-build for the first time on their most recent project. This shows potential for increased future use of design-build, in the event that this first time was experimental and the project was successful.

In researching these four methods of procurement, respondent fifteen was the only one to claim that design-build is utilized more than the other methods, with 33% of their total dollar volume. Design-build, construction management and traditional design-bid-build split at 30% evenly with respondent ten, with the remaining 10% a hybrid method. The remaining eleven respondents utilize the other methods more than design-build.

4.2.6 POSSIBLE TRENDS

Question seven addressed the construction procurement methods used in the past five to ten years, to determine any possible trends (Appendix I). This question included respondents four and nine, since they will use design-build heavily in the future, but they were not included in the remainder of the analysis

due to no experience at present. Respondent one did not answer this question. The recorded trends, for these markets, shows that respondents two, five, six, eight, twelve, thirteen, fourteen, sixteen and seventeen have been consistent in their selections. They generally have been using the same percentage of each method, and have not historically changed their procurement methods. Respondents ten, eleven and fifteen are leaning towards an increase in design-build and construction management, but did not set goals for the increase. Respondents four and nine have stated that their use will increase to 80% in the next five years; this is a rise from zero percent usage for both. One stated that their decision to move into the design-build arena was encouraged by new management, which is looking for new methods of constructing. Respondent three will increase from a design-build usage of 1.5% to 85% in the next ten years, due to an increased need to reduce project costs. Table 1 lists answers given to methods used in recent years:

Table 1: Methods used in the past five to ten years

Respondents Number	Answer
2	Consistent
3	Prefer DBB, next 10 yrs. 85% DB
4	No D/B currently, will use 80% in next 5 years
5	Consistent, using D/B last 15 yrs., a lot of hybrid work
6	Benchmarking of all, typical DBB
8	Consistent, D/B constant
9	No D/B currently, will use 80% in next 5 years

10	D/B and CM have pulled from DBB due to time constraints
11	More D/B in last 5 years, still project specific vs. standard used methods depending on project type.
12	DBB, for large projects (30-50 million and up) use CM to manage project and safety management
13	Consistent
14	Consistent
15	Leaning towards CM and D/B
16	Has always been DBB, this is the first D/B project
17	Consistent

4.2.7 REASONS FOR USE OF DESIGN-BUILD

Question eight asked for factors that led to design-build method selection (Appendix J). The two main reasons behind using design-build on these recent projects were cost and cycle time reduction. These answers were given by most of the respondents; some gave just one of the two, but both prevailed as primary reasons. Respondent one wanted to incorporate the constructor and provide preconstruction services within a very controlled environment. Respondent two normally hires out the design of specialized projects, but in this case used design-build for the whole project. Respondent eleven had a reduction of in-house engineering services, allowing an opportunity to provide new services. To paraphrase respondent fifteen, the selection of design-build is possible only when they have a good job description, meaning a well-defined scope and price. It is very important in the method selection process to look at the job description,

so that the boundaries can be set early, since they change frequently, and this affects price escalations.

The traditional procurement method will work through the project design first before taking it into the construction phase. This will allow the architect to develop rough pricing during the design phase. Price, in this case, seldom affects method selection, due to the need for quick project turnover. The daily cost lost to zero production heavily outweighs construction cost, again due to the nature of their companies and product. In one instance, building costs were roughly twenty percent of the overall product manufacturing costs, a small portion of total product costs. Table 2 includes paraphrases from all those responding to question eight:

Table 2: Reasons that lead to design-build method selection

Respondents Number	Answer
1	Alternate systems due mostly to the need to have constructor providing preconstruction services w/in a very controlled environment.
2	When they must hire out design of specialized projects, D/B isn't utilized
3	Time constraints or some hybrid modification
5	Cost and cycle time reduction
6	Management and reporting of $200 million construction budget
10	Time reduction proven method selection is project characteristics specific

11	Leveraging shrinking internal engineering resources. Focus on core competency. Reduced need for A/E services overall.
12	Cost and speed of completion
13	Hybrid escalated due to new philosophies by owners for quicker project times
14	Lack of in-house experience, found D/B firm who specialized
15	Method selection depends on job description and will utilize D/B if they have a good job description (well defined scope and price).
16	Experienced lower costs for smaller projects
17	Cost effective

4.2.8 SUMMARY OF CATEGORY ONE

This first category covered general demographics, which included owner and project information. This information gives an understanding of the owner's background and their reasons for selecting design-build. A majority of the construction types selected were heavy industrial and high technology, which many of the companies have been constructing for many years, so that they have an extensive understanding of the procurement process. The project characteristics varied depending on the type of project and their site conditions. The typical project was one to two floors of new construction and was less than one hundred thousand square feet. The specific building systems, which included interior and exterior finishes, foundation and roofing types, structure, and etc. varied depending on the construction type and owner's budget for the

project. The respondents put their method usage into a percentage, based on yearly dollar distribution: design-build is currently used 10.5%, construction management 21.89%, and traditional design-bid-build 64.58%. Nine respondents consistently used the same methods; six will increase design-build and construction management utilization in the next five to ten years. The two main reasons behind using design-build on these recent design-build projects were cost and cycle time reduction.

4.3 CATEGORY TWO

Category two consists of questions nine through twelve and addresses owner's performance criteria. This category addresses project characteristics affecting procurement selection, the performance criteria used in design-build method selection, and reasons why it may have not been used on their most recent project. Performance criteria were listed, and owners were asked to arrange them in a numerical order of importance. They were also asked why their highest valued selections were chosen, and asked to explain, if design-build wasn't utilized on their most recent completed project, why it was not used. There were no comparisons made in this category, rather this category addressed instead only recent design-build procurement.

4.3.1 PROJECT CHARACTERISTICS AFFECTING PROCUREMENT SELECTION

Question nine addressed how the project characteristics from question four affected the design-build procurement selection (Appendix K). The project characteristics which affected the design-build procurement method varied among companies, each of which seemed to have different needs. For instance, there was a need for preconstruction input by respondent one for cost estimating, a design to budget requirement, constructability consulting, value engineering to stay within budget and a need to deal with project complexity issues. Other respondents wanted to try a different method for cost reduction, or because in-house resources were lacking, they needed to look into new methods. Respondent eleven felt that their facility fit the "strategy" for design-build. A few of the respondents answered that alternative methods for construction were selected due to their inexperience in constructing a new type of facility. Most of these large companies are phasing out in-house resources and need viable solutions for project procurement. Incoming new management is another reason for these shifts in procurement methods, moving away from the traditional design-bid-build.

These factors compel new decisions that those brought up in the traditional methodology would not have considered. These owners also need to find specialty design-build firms who can accommodate their needs. Table 3 shows

how the project characteristics, as cited by the respondents, affected the design-build procurement selection:

Table 3: Project characteristics affecting design-build method selection

Respondents Number	Answer
1	Preconstruction cost estimating, design to budget requirement, constructability consulting, value engineering to stay w/in budget, project complexity
2	Would like to find Design-Builder who specializes in their needs
3	Wanted to try method for cost reduction
4	No Design-Build
5	Selection process fits procurement by written strategy
6	In-house staff not familiar with this type of project, resources were issue, found site which was developed by design-builder
8	Long term relationship with company familiar with process, people, construction type, no competitive process used
9	No Design-Build
10	No time to wait on large projects, early decisions must be made
11	Multi function office / lab / mini plant building - Fit strategy for design build.
12	None whatsoever
13	If they have resources in-house, Design-Build will not be utilized. If resources are low, Design-Build will be considered, but is not the first choice.
14	No expertise in-house for facility construction, had to out-source to specialty contractor out of state
15	Not at all, must have well defined scope for Design-Build

16	For a recent warehouse project, design-build was selected due to the experience and low-cost execution of design-build niche firms.
17	Contractor selection based upon: demonstrated expertise and track record for successfulness. Items to be considered: safety, cost, schedule, record for managing and working with trades

4.3.2 PERFORMANCE CRITERIA

Question ten asked the respondents to rank performance criteria numerically, according to how they influenced their decision to use design-build on their last project (Appendix L). The seven performance criteria and definitions in the questionnaire are explained below. These criteria were identified in Songer's research. There is one criteria selection titled "other", which allowed owners to fill in their own particular response.

- Establish cost- secure project cost, before the start of detailed design
- Reduce cost- decrease the overall project cost as compared to other procurement methods
- Establish schedule- secure a project schedule before the start of detailed design
- Shorten duration- decrease the overall project completion time as compared to other procurement methods
- Reduce claims- decrease litigation due to separate design and construction entities

- Large project size complexity- the project's magnitude is too complex to be managed through multiple contracts
- Constructability/ Innovation- introduce construction knowledge into design early in the process
- Other- allowed respondents to give answer different from those above

These eight were arranged in order of importance, according to how much influence they had in selecting design-build for their project. The results were averaged and ranked against each other, giving the following order of importance, including their overall average value with lowest value indicating the most influence and highest value indicating the least influence:

shorten duration	2.08
reduce cost	2.55
establish cost	3.18
establish schedule	3.58
constructability/innovation	4.5
large size complexity	5.36
reduce claims	5.67

Figure 4 shows the averaged values, from most important to least important, the numbers along the x-axis correspond to the numbers listed above:

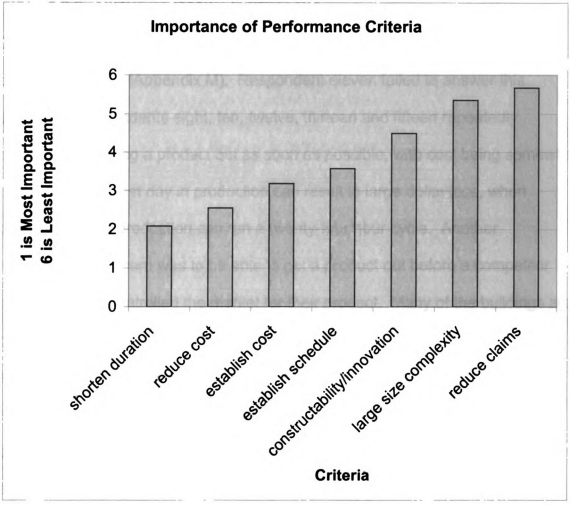

Figure 4

Two respondents, eight and fourteen, filled in the "other" column, indicating different reasons from those listed. The respondents indicated time and cost reduction are the predominate criteria in selection of design-build as a project delivery method. Constructability / Innovation was also an important criteria. Project size / complexity and claim reduction were often cited in the literature review as important reasons to use design-build but were not ranked highly by these respondents.

4.3.3 HIGHEST RANKED CRITERIA

Question eleven addressed why the highest ranked criteria were used in the selection process (Appendix M). Respondent eleven failed to answer this question. Respondents eight, ten, twelve, thirteen and fifteen repeatedly emphasized getting a product out as soon as possible, with cost being somewhat of a concern. A lost day in production can result in large dollar loss, when considering that production can run a twenty-four hour cycle. Another respondent's concern was to be able to get a product out before a competitor stepped in and controlled the market for their product. Many of the buildings are being designed at the same time as the product. Respondent three and five selected design-build for its aggressive schedule and budget constraints, as did respondent six, who was also concerned with the scope management of the project. Respondent five was also interested in having less to handle on their end, rather than having to deal with both parties as in the traditional method. Only respondent fourteen selected the "other" column as most important, because they had no experience in this type, and the qualified design-builder they found was the only specialized company capable of the unique construction they needed. Selection of design-build by respondent one was to perform miracles that the traditional methods won't, and a "miracle" was defined as anything they wanted, whenever they wanted it. Table 5 lists reasons, given by the respondents, as to why they selected their highest ranked performance criteria:

Table 4: Reason highest ranked criteria was used in selection process

Respondents Number	Answer
1	Needs constructor at table to keep project w/in limits and perform miracles traditional methods don't
2	Projects are so large, difficult to get grip on budget and schedule
3	Aggressive schedule and budget constraints
4	No Design-Build
5	Cycle time and cost reduction, faster and cheaper, less to handle on their end.
6	Management of scope, schedule and budget is very important to owner
8	Budget schedule- money allocated to project in a given year, must follow spending schedule. Very important to get product out as soon as possible.
9	No Design-Build
10	Auto industry is based on time, so time of completion is highest priority
12	Speed of product to be manufactured in facility was the reason for fast track design and build delivery method.
13	To expedite process and get product out as soon as possible
14	No experience, only experienced contractor
15	Shorten duration of product manufacturing and get product out as soon as possible.
16	Lower cost is the single biggest reason
17	For small projects or for owners with limited resources

4.3.4 WHY NOT USED ON MOST RECENT PROJECT

Question twelve asks why design-build was not used on the respondent's most recent project, if it was not (Appendix N). Thirteen of the possible fourteen answered this question; respondent eleven failed to answer. Respondents six, eight, thirteen and sixteen replied that their not selecting design-build was due to the availability of in-house resources; this was the most common answer given. Respondents ten, twelve and fifteen responded that there was poor definition in the scope of work for the project, and therefore other methods were selected. Respondents two and five both claimed a difficulty in finding a design-build firm and attributed this problem to the poor marketing of available firms. Respondent seventeen claimed that a higher cost associated with design-build procurement was their reason for rejecting it, although this respondent's criteria for procurement did not include cost concerns; their main performance criteria involved large project size complexity instead. They typically select traditional design-bid-build and will continue to do so. Respondent three also prefers design-bid-build, whereas respondent one typically prefers construction management rather than design-build. Respondent fourteen reported that design-build projects were over budget in past projects and they now use different methods as a consequence.

4.3.5 SUMMARY OF CATEGORY TWO

This category covered performance criteria used by owners in design-build method selection. The project characteristics varied by owner, depending on

their needs. The average top ranking performance criteria were to shorten duration and reduce cost, which were the criteria most often used in selecting design-build. Reasons for this selection were due to the nature of what these larger companies are producing and the need to get their products to the consumers as soon as possible. In cases where design-build was not chosen, it was most often due to adequate in-house resources; other reasons included poor project scope and the difficulty of finding qualified firms.

4.4 CATEGORY THREE

Category three contains questions thirteen through fifteen, which address the decision makers involved with construction procurement methods. These questions ask who decided to utilize design-build, who typically would make a method selection decision, and what is their experience in construction.

4.4.1 DECISION MAKERS

Question thirteen addresses who in the company decided to use the design-build method for their most recent design-build project. This question is divided into two categories, groups and individuals (Appendix O). In four of the fourteen responses, from respondents three, ten, thirteen and fifteen, the decision makers were individuals. The remaining ten respondents reported team or group decisions.

In question fourteen, which addressed who typically makes the method selection decision, five of the fourteen respondents reported that individuals made their selection decisions (Appendix P). Three of the respondents in question fourteen were consistent with their answers given in question thirteen. The two remaining were respondents one and six, who typically have an individual make their method selection decisions.

In comparing these two questions together, nine of the fourteen reported having the same person or team select the method procurement decisions for their recent design-build project, as well as for typical projects. These questions focused on the decision makers in the procurement process, to examine who was responsible for the design-build decision.

4.4.2 DECISION MAKER'S EXPERIENCE

Question fifteen was designed to obtain information regarding the construction experience of the decision makers (Appendix Q). This provided background concerning their experience and knowledge in the construction arena and revealed a wide range of years in construction project procurement.

4.4.3 SUMMARY OF CATEGORY THREE

This category sought information about the decision makers in the companies. Teams made approximately two-thirds of the design-build decisions, with the remaining one-third made by individuals. These results were very similar to the

typical project selection method. The experience of these people, as reported by all respondents, was extensive. This category investigated the person(s) responsible for the method selection decisions made by the owner. These questions investigated the potential shift from those typically making decisions to the possibility of new decision-makers investigating alternative solutions. Many responded that their traditional method selection was due to older management, and their inability to select alternative methods. This shift towards design-build could be the result of different staffing who were responsible for method selection.

4.5 CATEGORY FOUR

Category four contains questions sixteen through nineteen, which address project success. These answers reported the respondents' views on project success. The answers cannot be supported with documentation. The degree of success was not sought, just a yes or no answer. If their most recent design-build project was a success, this category will compare its success to a typical successful project. Factors that contributed to the success are sought to determine what actually influenced this outcome.

4.5.1 SUCCESS OF PROJECT

Question sixteen addressed project success, and what would constitute project success (Appendix R). Respondent sixteen had not yet completed their design-build project, and thus was unable to complete this category. The respondents

reported a high success rate, with twelve of the possible thirteen answers positive.

Respondent thirteen gave the only negative response to design-build, because the project failed in cost and schedule, owing to the design-builder's lack of technology resources. All positive responses reported the same definition of success, which was that time and budget schedules were met. Although the budget on respondent fourteen's project ran over, they still considered it a success because it came in on schedule. Respondent ten was extremely satisfied, calling this a benchmark project, with the lowest cost per square foot built within the organization. Some other qualifications were used in defining success; respondent one commented that it was a design everyone loved and it utilized quality construction. Respondent two also commented on the exceptional quality, with high jobsite safety and zero claims. Respondents five and fifteen used no recorded OSHA violations and overall safety as a definition of success. Table 5 lists the responses to this question:

Table 5: Evaluation of project success, and what constitutes project success

Respondents Number	Answer
1	Yes, under budget and ahead of schedule, everyone loved design and constructed quality
2	Yes, on time and budget, exceptional quality, safe jobsite (no accidents), no claims
3	Yes, on time and budget, acceptable project
4	No Design-Build
5	Yes, on time and budget, zero OSHA recordables, operability- plant start up and run properly
6	Yes, completed on schedule and within budget
8	Yes, on time and budget, no disruptions to ongoing operations, meeting job requirements
9	No Design-Build
10	Yes, extremely, time was met and was available for next process. Cost per square foot was one of lowest. Benchmark project
11	Yes, on time and on budget, customer pleased with the functionality.
12	Somewhat successful, Lessons learned will be utilized for further successes with Design and Build in the future
13	No, failed in cost and schedule. Reason for failure was a lack of technology resource by design-builder.
14	Yes, but with problems. The facility came in on schedule, but over cost.
15	Yes, on time and under budget, as well as quality and safety.
16	Initial project utilizing D/B not yet completed.
17	Yes, on budget, on time, facility provides return on investment that the funding analysis stated

4.5.2 COMPARISON TO TYPICAL PROJECTS

Question seventeen was asked to determine how the success of this recent design-build project compared to that of a typical project (Appendix S). . Responses were broken down into three categories: more successful, typical and less than typical success. Respondent seventeen failed to answer this question.

Six respondents, of the thirteen eligible responses, said that their design-build project was a typical successful project. Five other respondents claimed that their project was more successful than a typical success, and two responded that their project was below the typical level of success. Respondent one stated that utilizing design-build, which was a project type with which they had no experience, was extremely trouble free and highly successful. Only respondents thirteen and fourteen said that this project was not up to a typical success. Respondent thirteen had both cost and schedule overruns, and fourteen said that this was a little less than typical, due to cost overruns, but was successful in meeting schedule requirements. These results show that of the thirteen respondents, eleven are as successful or more successful than a typical project. Table 6 compares their most recent design-build project success to a typical project success:

Table 6: Comparison of recent project success to typical successful project

Respondents Number	Answer
1	High- extremely trouble free
2	More successful
3	Tracks well
4	No Design-Build
5	typical
6	Bigger deal than with most projects
8	typical
9	No Design-Build
10	time and cost are typical
11	typical
12	About the same; although the delivery method has a small impact, the quality of the individuals on the team is the ultimate reason as to whether the project is a failure or a success.
13	Should come within cost and schedule
14	A little less than typical, due to cost overruns.
15	Never miss the schedule, must be able to react to changes
16	Better results in regard to cost and schedule

4.5.3 CONTRIBUTING FACTORS TO SUCCESS

Question eighteen asks what factors contributed to the success of this recent design-build project (Appendix T). There were three respondents who failed to

answer this question. Respondents one, five, six, eleven, twelve and seventeen responded that a strong team and teamwork between members contributed to the success of this project. Respondent eleven commented favorably on daily interaction throughout the duration of the project between the owner's project team and the design-build contractors. Respondents five and eleven also mentioned early scope definition as a contributing factor to the team performance. Two respondents, eight and fifteen, stated that the relationship between the owner and constructor contributed to the success, as well as the experience of the contractor in previous work completed for that owner. Answers from respondents two, three and ten were the following: less responsibility for the owner, close procedural follow-up, and being able to accommodate changes contributed to project success. Table 7 lists the factors that contributed to their recent design-build project success:

Table 7: Factors contributing to success

Respondents Number	Answer
1	Outstanding PM and engineer
2	Own personnel weren't walking jobsite, less for owner to supervise
3	Follow procedures closely
4	No Design-Build
5	Strong project team, followed global strategy, scope locked in early
6	Users acceptance, management of S/S/B

8	Close interactions with owner, understanding requirements, history and experience w/ contractor
9	No Design-Build
10	Ability to reach items in cost effective manner, changes were made to process and had to accommodate flexibility and reaction time
11	Project Team & Design Build contractors' daily interaction for the duration of the project. Same definition of success factors listed above for both. Monitoring progress as job progresses & reporting.
12	Good quality designer and builder
13	Was not a success
15	They have limited their General Contractor list to six, these all have a good knowledge of how they operate and are well adapted.
17	Good scope definition in sufficient detail for good cost estimating, good team work between owner and project team

4.5.4 PROJECT CRITERIA CHANGE

Question nineteen asked if the criteria changed through the course of the project (Appendix U). Two of the respondents did not answer this question. Ten of the possible twelve responded that the criteria did not change through the course of the project. Respondents ten and thirteen both reported criteria changes. Respondent ten stated that there were adjustments in the structural loading, which in turn changed the project's characteristics. Respondent thirteen, who

also stated that the project was unsuccessful, said that the criteria changed from schedule to cost criteria.

4.5.5 SUMMARY OF CATEGORY FOUR

This last category has given information concerning project success, and what constitutes project success to the respondents. Twelve of the thirteen responded that their recent design-build project was a success, and that schedule and budget were the leading factors in this definition of success. In comparing this project to a typical successful project, eleven were found to be as successful or more successful than a typical project. Leading contributing factors to this success were strong team and teamwork, early scope definition, relationship between the owner and constructor, and prior experience of the contractor.

4.5 CHAPTER SUMMARY

This chapter presented the data collected from this research, which sampled large commercial owners in the private sector and addressed their understanding of utilizing design-build as a construction procurement method. This data gave insight into owners' project types and characteristics, their performance criteria, the decision-makers' experience and project success. This collective information establishes project indicators useful to owners considering design-build as a procurement method.

There appears to be a positive future for design-build, considering that six of the fifteen respondents claim that they will use it increasingly in the next five to ten years. Another contributing factor is the high success rate of these recently completed projects, since twelve of thirteen respondents considered their project to be a success, with eleven of thirteen responses being as successful or more successful than a typical project. All these respondents had extensive experience in construction and therefore had knowledge in procurement methods.

The information collected in this chapter has been broken down into four groups of responses that accounted for owners' selection of design-build. Reasons for not selecting design-build were considered equally important, since these reasons will also assist owners in understanding what is needed for design-build to be effective. The groups were formulated after examination of the survey responses. Categories one and three of the survey gave general owner and decision maker's information, which assisted the researcher in understanding the respondent's background. Categories two and four supplied information that assisted in putting together the evaluation form. These reasons will be utilized in the Design-Build Criteria Evaluation Form, which is addressed in chapter five.

5.0 DESIGN-BUILD CRITERIA EVALUATION FORM

5.1 INTRODUCTION

This chapter introduces the Design-Build Criteria Evaluation Form, and explains its purpose. This form was designed to assist owners who were interested in utilizing the design-build procurement method. It evolved from the data in this research, which was collected from large commercial owners in the private sector.

This form will aid owners interested in using design-build as a procurement method of construction. The owners can reference the form with their project information to decide whether design-build may be a procurement solution. The purpose behind this form is to allow potential design-build users to evaluate their project and better understand the criterion that best matches this method. This form will not make a design-build procurement decision, but rather allow the owner to understand the performance criteria that design-build may be more successful at completing. The owner's question of whether design-build may be a viable solution for their project may now be a more informed and educated decision, based on specific project information.

It was decided that this form should take on the attributes of the survey and respond to the data collected from the owners, which reflects the respondents' needs and what has previously been successful on recent projects. The form

includes criteria that are based on the results given in the data collection, which are further discussed in this chapter.

5.2 PRESENTATION AND DISCUSION

The form, as seen in Table 8, is comprised of two sections, which consist of project characteristics and organization information. The form is preceded by an introduction that explains the purpose, content and evaluation process involved in its utilization. These are all concerns for owners interested in utilizing design-build as a procurement method. Criteria, such as, project scope and definition, single point of accountability, schedule and budget were addressed in this form. The information contained in this form is explained following Table 8. This form was sent to the owners who responded to the survey for their response regarding its effectiveness in their organization.

Table 8, Design-Build Criteria Evaluation Form

Introduction

This form has been divided into two sections, which include project characteristics and company information, which will both aid in indicating if design-build is a favorable construction procurement method. This form has been designed to assist owners, who have an interest in design-build, but are unsure if they can benefit from its use.

Section One:

Section one of this form utilizes project characteristics found to be useful in the procurement of design-build projects. Please review each item of this form and

indicate the importance level. Responses are based on a scale ranging from one to five, five being the highest level of importance. Please select one that relates to your project characteristics for the design-build criteria listed.

Section Two:

Section two of this form utilizes information concerning your organization, such as general demographic and procedural methods. There are five responses ranging from strongly agree to strongly disagree. Please select the response that best reflects your organization.

Please complete both sections, and then evaluate your answers. If your answers tend to group on the left side, design-build may be a favorable method for your project. If the answers group more to the right side an alternate method, such as construction management or design-bid-build, may be more effective. If answers are a balanced response of both sides, it is up to the owner to decide which items are more important and what method will accommodate their needs, based on an informed decision.

The form is intended to act as a guide, however the person evaluating should decide for him or herself whether their criteria tend to favor design-build. It is assumed that persons filling out this form understand and have experience in different construction procurement methods.

SECTION ONE:	Highly important				No importance
Project Characteristics:	**5**	**4**	**3**	**2**	**1**
1 Reduce project duration					
2 Prepare overall project schedule early in design phase					
3 Early procurement of critical materials with long lead times					
4 Ability to fast track (start construction before construction documents are finished)					
5 Integration of construction expertise with architectural expertise early in the project					
6 Single point of accountability (by hiring one firm to handle design and construction)					
7 Constructability reviews during design phase					
8 One team working together on specialized and technical project types					
9 Established working relationship between architects and contractor					
10 Reduced number of communication lines between parties involved in project					
11 Ability to proceed with project prior to having a completely defined project scope and definition					
12 Incorporating value engineering, life cycle costing and innovation by construction entity early in development					
13 Establish early, and more accurate project budget					
14 Ability to lock into Guaranteed Maximum Price before architect finishes documents					

Design-Build Criteria Evaluation Form

SECTION TWO:

	Organization Information	Strongly Agree	Somewhat Agree	No Opinion	Somewhat Disagree	Strongly Disagree
1	Owner is qualified to act as organization's representative for design and construction process					
2	Owner utilizes experienced in-house construction department					
3	Owner can make decisions based on extensive construction experience					
4	Owner has formal interview process to qualify design-build firms					
5	Owner has strong design scope and detailed project specifications					
6	Owner does not require third party project oversight					
7	Owner feels comfortable with design-build team constructing facility without third party supervision					
8	Owner policy does not restrict use of design-build					

Table 8, Design-Build Criteria Evaluation Form

Section one contained project characteristics. These are the characteristics that owners use in considering design-build as a construction procurement method. The first four project characteristics on the form address project schedule. These include reducing project duration, preparing a project schedule early in the design phase, early procurement of critical materials with long lead times and the

ability to fast track. Reducing project duration was the highest ranked performance criteria found in this research. The responding commercial owners are generally constructing heavy industrial and high technology facilities, with quick construction turnover needed for efficient development of products. The manufacturing market is designing products at the same time the facilities for their production are designed. Design-build is a method capable of producing at this accelerated pace. Another important design-build criteria was the ability to prepare a project schedule early in the design phase, due to the construction entity being incorporated early in the project. This also allows critical materials to be ordered, which are known to have long lead times in procuring. There are no job delays associated with traditional methods, since materials are ordered before construction documents are completed and put out to bid. Fast tracking the project, which is a method of completing a portion of the design and starting construction even before the rest of the project is finished. For example, completing the foundation plans and starting to dig before the remaining packages are finished would be fast tracking. Design-build can accomplish this since the contractor is already on the job and ready to begin.

Items five through nine addressed both parties involvement in the project. This included the following criteria: the integration of construction expertise with architectural expertise early in the project, single point of accountability, constructability reviews during the design phase, one team working together on specialized and technical project types and an established working relationship

between architects and contractor. Integrating both parties was discussed in the scheduling portion of the form, due to its ability to reduce schedule, but there may be other reasons an owner would want to have both teams working together from the start. The construction entity brings their expertise together with the designer's expertise during the design phase, allowing them to work as a team and understand each other's concerns for the completed project. On projects of technical and specialized nature, this early integration can also be a benefit. This also allows the contractor to address constructability issues associated with the design, reducing expensive construction methods and materials later in the construction process. This integration also creates a single point of accountability for the owner, who now has one contract for the project's completion, rather than the traditional two. An established, long term working relationship between the architect and constructor reduces conflicts that can later develop between the two.

The next characteristic addresses the importance of reduced communication lines between those parties involved in the project. Design-build is a combined contractual agreement between the architect and the builder. This union removes some communication lines typical of a traditional method, by eliminating the separate contract between the architect, builder, and project owner. Reducing these communication lines can produce a more efficient process for project procurement.

Criteria thirteen addresses owners considering design-build and their need for well-defined project scope in early project stages. This was found in the literature review, as well as from the survey responses as to why design-build was selected and what contributed to the success of the project. Owners stayed away from this method if scope and project definition were not clearly defined early, and stated that traditional procurement worked better in that situation.

It may also be a benefit of the owner to incorporate value-engineering, life cycle costing and innovation into the project early in the design phase. This is one more element that design-build is able to incorporate due to the assistance of the contractor at an early stage. The value engineering and the construction innovation will assist at the current stages by adding value to the design and construction method expertise. Life cycle costing examines the money needed to maintain the facility in the future, long after the construction has been completed. It may be wise to invest more funds now in the project cost due to the overall savings further through the course of building operations.

The last two project characteristics addressed project budget. Item fifteen was the ability to establish an early project budget, followed by the ability to lock into a Guaranteed Maximum Price (GMP) at an early stage. Data collected indicated scheduling to be slightly more utilized than budget, which the researcher feels may be different in the smaller commercial market, where companies need to also be conscious of the project budget.

This concludes section one, which addresses project characteristics, and the range of importance each item had on an owner's project. This range, from high to no importance, will assist the owner in making a project specific decision, this differs from section two, which allows the owner to address the organization's characteristics. It could be argued that many of the items listed could achieve similar results by using an architect/engineer (A/E) or a construction manager (CM). This research is based on a typical situation, and not using special circumstances in which the A/E or CM is contracted to accommodate a particular item for the owner, such as an early project budget or constructability reviews during the design phase. This typical situation consists of an architect following a traditional scope of work, including design and construction drawings, which focus on producing documents for the builder to construct.

The second section contains eight items, which address organization information. This information describes the owner, and whether they agree or disagree on those listed, as to how these items pertain to their organization. This range varies from strongly agrees to strongly disagrees, as well as a "no opinion" category placed in between them. The first item addresses the owner's qualifications to act as his or her own representative for the design and construction process. By hiring a design-build firm, there becomes a need for owners to oversee the design-build team and be able to address problems that

take place during the course of the project. This requires experience in construction that allows them to direct and resolve.

The second item addresses the utilization of experienced in-house construction staffing. This may depend on whether or not the owner has the availability of these staffing resources. In many cases, this in-house staff is responsible for overseeing the project on behalf of the owner. If the owner does not have in-house staff to utilize and must answer no opinion, then the following item indicates that the owner can make decisions based on an extensive construction experience, in order to direct the construction team.

A formal interview process is needed in selecting a design-build firm, since this will be the one team to put the project together. This is also needed in a traditional method, but the owner will have the assistance of the architect in selecting a qualified constructor for project completion. Owners must be knowledgeable in design-build, in order to correctly interview a design-build firm.

In order to protect themselves during the construction process from costly change orders, an owner must put together a well-defined project scope and detailed specifications. This lays a strong foundation for the project and gives the architect and builder project direction. Without a well-defined scope, there are many gaps in what the owner may expect as a final outcome. These inconsistencies will require changes to be made, which generally are costly. In

the accelerated schedule of design-build, the owner should go into the project knowing exactly what he/she wants, allowing nothing to be left out.

Owners may not require third party oversight, which they are able to utilize in a traditional method, since the owner has contracts with both parties and can direct their actions. The architect, in a traditional contract, will also act as a representative for the owner, who is knowledgeable in the construction process. The owner may contract with a consulting party, perhaps a construction manager, for project oversight and to represent the owner.

Although the third party oversight may not be a requirement, the following item addresses the owner's comfort level with the design-build team constructing without the owner having third party supervision. If the owner fails to feel comfortable with the design-build team working without their supervision, due to the single contract with both parties, then a more traditional approach may work better, unless the owner feels comfortable with hiring a separate third party overseer, such as a construction manager. There needs to be trust between the parties, if the owner fails to supply supervision, for a solid relationship.

The last item addressed that the owner does not restrict the use of design-build. Design-build is a method gaining in recent popularity, but some companies are using the same methods they have been for many years. This may be the result of seasoned managers not interested in considering alternate methods. This

may not be a written policy, but if management will not consider it, for whatever reason, then it may take some time before an opportunity will present itself.

Section two addressed organizational information, and asked the owner to agree or disagree with the items presented. This asked the owner to evaluate his or her own organization, and decide if design-build may work in their working environment, based on their own information. Design-build can work in a variety of environments, but may be better suited for specific purposes.

5.3 VALIDATION

The eligible respondents who responded to the initial survey questionnaire were asked to review this form. Upon completion of the survey, the interviewee explained to the respondent how their answers would be used in developing a project evaluation form. This design-build evaluation form would become a tool valuable to owners interested in utilizing design-build, as well as to design-build contractors. This form would assist owners in deciding if design-build is a potential procurement method for their project, also for design-build contractors The form was created and pre-evaluated with two vice-presidents of a large Detroit, Michigan based construction company, who also handle architectural and development services. The form was given to them without verbal instructions, just as the respondents would be receiving it. The idea was that the forms introduction would explain how the form is to be filled out and evaluated upon completion. Both made comments on their comprehension of the form's

instructions, as well as the content of the form's body. These comments gave the researcher outside opinions of the form before distribution to the sample group. Revisions were made based on these comments, which included sentence structure and grammar, form content and evaluation instructions. One project characteristic was eliminated, since it was too similar to another characteristic already listed. Two other items on the form were reworded, since their intended meaning was unclear.

After the form was revised, it was sent out to the fourteen survey respondents by email and fax. Of those fourteen, seven responses were received by email. Only respondent six had changed jobs and left no forwarding address, this resulted in undeliverable email, and was sent back to the researcher. The remaining six reviewed the form and commented on its content and ability to assist owners. The researcher received these comments, and incorporated them into the final draft. Follow-up phone calls were made to those who were unresponsive, one week after the reviews were due. One response was received as a result of these phone calls. The following responses were received from the survey respondents, and are listed in the order the researcher received them.

Respondent two claimed that the overall form was a "good set of documents". A comment was made in regards to number fourteen in section one. It was further stated that, "In addition to guaranteed maximum price, it is extremely important

for us to have a guaranteed completion date and a guarantee that whatever is build will work right the first time." This was considered, although design-build is the only method that can lock into a guaranteed maximum price before the architect finishes the construction documents. The traditional method can guarantee the project cost, but only after the documents are completed and they are brought onto the project. A construction manager can budget the project, but cannot guarantee a final cost. The key to that characteristic is the timing of the price guarantee. The guaranteed completion date was added to the form, since design-build can also provide schedule before the architect finishes, since they are already part of the team and familiar with the project's requirements. This respondent passed the form onto others in the company for their input as to how this might benefit them as well.

Respondent fourteen stated that the form looks "fine", and said that "section two might be better than section one, answers to those questions would make you move to design-build as an option." This was somewhat confusing since the sections were separate due to their content, section one addressed project characteristics and section two organization information. The two were both needed for understanding the owner and their specific project needs, and the order in which they were listed had no bearing into their design-build decision-making process.

Respondent eleven asked if the researcher had considered using a weighted scoring system to numerically value an answer. This was thought to potentially

rank answers and assign appropriate values to the answer, which might "automate" the decision making process. This technique had been considered early in the forms development, but it was felt that the evaluation system selected would better assist, and not be as direct as a numbering system. In this evaluation, the owners can easily identify answers that may not support design-build, or follow the pattern of other answers. The researcher wanted to stay away from automating answers, and rather allow the respondents to decide the importance of the listed item, and decide how answers compare to others listed.

Respondent thirteen reviewed the form and stated, "they do serve the intent as a guide to aide in the decision-making process." This response gave no criticisms to the form, but did find the document to be of assistance.

Respondent ten reviewed the data and stated, "I think it looks good. I am looking forward to trying it out on our next real life project evaluation. I will also be reviewing it with our purchasing department as soon as time allows." This was another positive response, but without criticism. Many of these large companies rely on their purchasing department for funds for their projects, and having them incorporated into the decision making process can be very useful. These departments are knowledgeable in construction processes, and may also find this type of document useful.

Respondent one stated, "It would seem that only questions 6, 8 and 10 have any merit in terms of selecting D-B over CM. All of the other questions have the ability of being equally provided with D-B and CM. I think your real question is how do these desires compare with the same abilities in a traditional design-bid award-construct environment." The form introduction stated that this form may assist owners in deciding if design-build may be a favorable method for their project, and that construction management and the traditional method are available as other sources of project procurement. The researcher would agree that project characteristics six, eight and ten are design-build specific, but would disagree that the remaining characteristics are of equal merit in selecting design-build and construction management. Construction management shares many attributes with design-build, but there are also many differences between the two. The main difference found in design-build is that the contractor, responsible for constructing the project, is brought into the project during the design phase. This allows for early procurement of materials that the contractor will need, construction can start without having a completed set of drawings, the project has an established team early in the project and there is a maximum guaranteed price or schedule early in the project.

The introduction further explained that the form is intended to act as a guide, and that the person evaluating the form should decide for him or herself whether their criteria tend to favor design-build. It is assumed that persons filling out the form understand and have experience in different construction procurement methods

and can sort through the attributes of both. This form introduces criteria that design-build utilizes, but the criterion is not limited to design-build only.

6.0 CONCLUSION

6.1 SUMMARY

When constructing facilities, owners can select from various procurement methods. This research addressed the performance criteria of large commercial owners in the private sector who have utilized the design-build method. By understanding the performance criteria utilized in this selection process, owners may be assured a successful design-build experience. Design-build is quickly gaining popularity among both public and private owners, who are looking for alternative solutions to their traditional procurement methods. One of the main reasons behind this increase in popularity is design-build's ability to shorten project duration, because it incorporates both the design and construction teams into one entity.

The main goal was to identify the criteria that owners use in design-build method selection. The respondents were to numerically rank the seven criteria taken from Songer's research, which included the following: establish cost, reduce cost, establish schedule, shorten duration, reduce claims, large project size complexity and constructability / innovation. The highest-ranking criteria, which was an average of all respondent's answers, was to shorten project duration. Reducing project cost was selected as the second highest ranked performance criteria.

Project success was also addressed, to indicate whether the performance criteria were properly selected. Respondents were asked for their definition of success and also if their most recent design-build project fit this description. Success was defined as a project that was both on time and within budget, by all those responding. With the exception of two, all remaining projects utilizing design-build were found to be successful under this description. One project failed in both areas, and another project failed in budget, but was still considered as successful since it met the schedule requirements. There were other definitions of success that accompanied these two, which are shown in Appendix R.

To understand an owner's ideas of success, it is important to also know the needs of the owner. This information was addressed in several ways, first in gaining a general knowledge of the owner and his or her background, as well as his or her project background. Molenaar specified several project characteristics that were crucial to project success: well-defined scope, shared understanding of scope, owner's sophistication in construction, adequate owner staffing, established budget and completion date. This research addressed these characteristics in the survey questions. Budget and schedule were answers found repeatedly in the following categories: the highest-ranking criteria for owners selecting design-build, the majority of reasons leading to design-build method selection and the respondents' definition of a successful project. Defined scope and project definition were also used as reasons for design-build method selection, as well as factors contributing to project success. Each of the

respondents had extensive backgrounds in construction, which enabled them to make knowledgeable procurement decisions.

6.2 CONCLUSIONS

This research concluded that the highest ranked performance criteria utilized by the respondents interviewed was to shorten duration. The second highest ranked criterion was reduction of project cost. These were both utilized in selecting design-build as a construction procurement method. These criteria, as well as others identified in design-build method selection, were used in completing the design-build criteria evaluation form.

The design-build criteria evaluation form was developed to assist owners interested in design-build, who may be inexperienced in different construction methods. This form addresses performance criteria of design-build useful in making a procurement selection decision. Owners can review the questions on the list pertaining to design-build and evaluate their answers by their answer location on the importance level of the form. This form used items consisting of project characteristics and owner's organization information. Owners whose answers group to the left side of the form are favorable for utilizing design-build, based on the conclusions from the collected data in this research. Answers grouping toward the right side of the form may want to consider alternate methods, such as construction management or traditional design-bid-build. These alternate methods have their own performance criteria, not examined in

this research, which may be more beneficial in successfully completing project needs.

Once the process of procurement has been selected, it is important to understand some difficulties associated with utilizing design-build. Problems were addressed regarding the ability to locate qualified design-build firms with the staffing resources to handle the type of project an owner needs, while performing technical project design and construction. Firm specialization is essential for many technical projects, which were identified by many of the respondents in this research. An extensive search to find suitable firms to select from, with the experience to successfully complete the project type, may be required. It was stated by respondent two that there was little marketing by design-build firms that specialize in technical project types. This has potential for further research, which can address methods for locating the appropriate firm with specific project requirements.

There were other identified results not incorporated into the method selection form, but were important pieces of information for potential design-build users. This information is addressed below and should be considered if design-build is a potential procurement method.

Owners lacking a clear project scope would be encouraged to utilize a more traditional method, where the architect and owner can work together to develop a

defined scope of the project, before sending documents to bid. Bidding documents are critical for project pricing, therefore, it is crucial to list project requirements in the specifications prior to design. This will eliminate high change order costs that will come up later in the project, since these issues were not considered early in the project. If the owner was still insistent on utilizing design-build, it would be beneficial for him or her to hire a consultant, whether this person is within the design-build firm or from an outside source to assist in organizing the owner's ideas and assembling the project program.

Firms should be qualified for the project type they are being considered to construct, which is an important process for owners in search of potential firms. Finding qualified firms, that have completed similar project types, will ensure an understanding of the owner's criteria and the firm's ability to complete the project type desired. The potential design-build team should have an understanding of the detailed project scope and definition, which will aid in reducing potential problems.

Many owners utilize the traditional design-bid-build construction method due to the availability of in-house staff to provide design and engineering services. These staffing resources had difficulty accommodating any projects outside of their typical scope. Many felt that their own staff was the best qualified for their own work and would not consider outsourcing the work unless it was absolutely necessary. Today, many of these companies are downsizing these engineering

and construction divisions. They are looking for alternate solutions which provide similar results. Many traditional method projects are performed with in-house staffing, which may include architects, engineers or construction personnel. At times, this in-house staff may not be available, since they are needed on other projects. Design-build was utilized for its ability to perform without in-house staff support. Although other methods can be utilized without availability of in-house staff, the single point of accountability found in design-build reduced the number of contacts needed and reduced the complication of maintaining projects.

Other repeated in-house problems were, in-house inability to handle project size and their lack of experience within an unfamiliar project type. In-house staff were also unable to perform on larger scale projects, thus causing a need to outsource to design-build firms. Typical projects were smaller in scale and easier to handle with current staff. In-house staffing also lacked the experience to construct new project types, such as high technology and heavy industrial, since they are knowledgeable in a specific project type typically constructed by the company.

6.3 RECOMMENDATIONS

Throughout this research, the researcher came across many opportunities for further investigation in other areas related to this topic. These opportunities presented themselves as this research progressed and were collected separately.

An area of future research would involve conducting a statistical study approach. Major insights can be identified for later studies utilizing random sampling and statistical methods. Future research might involve a follow-up of this qualitative research with quantitative statistically based research. This research dealt with a small sample group, which was not conducive to quantitative study. More statistical analysis would support the findings of this research, which lacked numerical results.

Another area of research addresses the high number of respondents who stated that it was difficult to locate appropriate design-build firms to accommodate their project types. These owners are constructing new facility types with new technology, with which their in-house resources are unfamiliar. Due to poor marketing by the design-build firms, it is difficult to locate specialty firms for producing these high technology projects. Somehow these two groups, owners and design-build firms, need to find each other. The design-build firms must market themselves better so that customers can find them. Research can then be done to find out what types of specialty firms are available and what marketing approaches they are currently using. The deliverable would be to describe the various specialty firms and put together marketing ideas for them to pursue, based on owner's needs and their past locating practices. The owners of one company in the survey that failed to find design-build a success said it was due to a lack of technology on the design-builder's part. Many of those firms are

not fully qualified and fail to produce in a true essence of the capabilities of what design-build has to offer. The researcher's opinion is that there are many firms claiming to be design-builders, but are doing so just to jump on the "bandwagon" of success that design-build is creating. Both builders and owners in the industry need to be properly educated, to ensure claims match what is expected.

Further difficulty in this research was defining the complexity of the projects used in answering the questionnaire and how this affected the design-build process and its success. Research can analyze owners' projects and the level of difficulty involved in each project's procurement. Results could perhaps give insight into the success of design-build with respect to a specific building type with varying complexities.

This research focused on the design-build criteria selection of large commercial owners. Additional research can explore smaller commercial companies and compare the collected data with those presented here. The researcher feels that the performance criteria of smaller owners may differ from those of the larger owners, due to the available resources associated with large commercial companies. These resources would be in-house engineering and construction staff, financial support of large projects, as well as the turnover time of producing an entire product. Time was an extremely important element in start to finish production, which was handled with large construction budgets. This may not be

possible in smaller companies, where the budgets for production do not allow accelerated schedules.

This research addressed owners in the private sector and their concerns for method selection. Potential research lies in the investigation of public sector concerns for construction procurement and the comparison of the two sector's needs. Public officials and private sector owners have different concerns for project procurement, mainly due to the ownership of the facility. Public officials spend money allocated to their projects, whereas private owners are spending their own money, and overspending can draw from their personal profits. These differences of public and private may be directly related to the selected performance criteria.

6.4 LIMITATIONS OF RESEARCH

This research was limited by the geographical location of the sample group. This sample was taken from the Michigan Construction Users Council, which is a Michigan-based organization of large commercial owners who invest sizeable amounts of money in each construction year. This group was selected because it is comprised of owners, which was the targeted audience for this research. The group is found from state to state, but the Michigan chapter was utilized due to the location of the researcher. Respondents in other geographic regions may respond differently to this survey, due to varying conditions that would change their selection criteria. The 21 companies were some of the largest commercial

companies in the state, with the exception of a few. These large companies included automotive manufacturers, chemical manufacturers and pharmaceutical companies. Due to the size of these companies, their answers may be different than those of smaller, privately held companies.

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APPENDIX A

Phone script

Hello, my name is Jeff Pfeifer. I'm currently working on my thesis research in construction management at Michigan State University in the area of design-build.

I received your name through the membership list of the Michigan Construction Users Council. The purpose behind this phone call is to request an interview to collect information. This research focuses on owner's selection criteria used in choosing design-build to construct their projects.

I would like to set up an interview with you, at your convenience, and go through the questionnaire. The interview would preferably be in person, but could be covered over the phone. I could also email or fax you a copy of the questions, so you can look it over and know what to expect.

The questions are primarily open-ended and shouldn't take more than fifteen minutes of your time. It will consist of four general parts, and with your permission I would like to record the session. Your responses will be used with other owner's answers to put together a project evaluation form.

In any reporting of responses or data collected during this interview, your name and company name, as well as any other identifying references, will be deleted. Information collected during the interview may be reported in aggregate with that of the other interviewees, or may be reported as quotations or paraphrases with all names or other identifiers deleted.

Do you have time early next week?

-No personal interview is possible, continue with text following for phone interview possibilities:

Since the personal interview is not possible, can we set up a time at your convenience to go through the survey over the phone, it would be very helpful for this research.

-Phone interview script, describing questionnaire:

The purpose behind this interview is to collect information. This research focuses on owner's selection criteria used in choosing design-build to construct their projects. This questionnaire shouldn't take any more than fifteen minutes of your time and is of no financial cost to you.
Your participation is voluntary, you may refuse to answer certain questions or discontinue at any time. In any reporting of responses or data collected during

this interview, your name and company name, as well as any other identifying references, will be deleted. Information collected during the interview may be reported in aggregate with that of the other interviewees, or may be reported as quotations or paraphrases with all names or other identifiers deleted.

If you should have any questions regarding participation in this study, please contact David E. Wright, University Committee on Research Involving Human Subjects (UCRIHS) chair at 517-355-2180.

The data collection will be in the form of a structured interview, targeted toward gathering groupable answers. The answers to these open ended questions will be later classified into sub-categories under their respective general category, condensing them down from all received answers.

The questions will be placed into four categories:
1. general demographics
2. decision-makers
3. selected performance criteria
4. results of the selection

The goal of this interview survey will be to develop a project evaluation form. These recorded results can assist owners in the private sector for determining if design-build is the best method for project procurement, given owner and project needs.

I would now like to go into the questionnaire, is it OK with you if I record this phone call? Taped information will be destroyed following transcription.

Survey Questionnaire

APPENDIX B

SURVEY QUESTIONNAIRE

Forward:

The purpose behind this interview is to collect information. This research focuses on owner's selection criteria used in choosing design-build to construct their projects. This questionnaire shouldn't take any more than fifteen minutes of your time and is of no financial cost to you.

Your participation is voluntary, you may refuse to answer certain questions or discontinue at any time. In any reporting of responses or data collected during this interview, your name and company name as well as any other identifying references will be deleted. Information collected during the interview may be reported in aggregate with that of the other interviewees, or may be reported as quotations or paraphrases with all names or other identifiers deleted. If you should have any questions regarding participation in this study, please contact David E. Wright, University Committee on Research Involving Human Subjects (UCRIHS) chair at 517-355-2180 or Tim Mrozowski, project advisor, at 517-353-0781 for questions.

This survey will be used to obtain comparable information from the private sector owners and allow the researcher to explore "other" relevant leads.

Same question format will be asked of all owners, but different follow-ups can be used at discretion of the researcher.

Category one
Demographics, will consist of general owner information questions, such as owner experience in construction, typical building type, experience with facility type, cost of construction and volume constructed each year.

Company (Owner) Name:
Contact person: email address:

Note: The following questions are for your most recent project completed using design-build, followed by a comparison of a typical project completed. If this is your only project using design-build, please indicate and move onto the next question.

From the following construction types, select the one that would describe your project:

Typical construction type (developed from Konchar through process result):
1. Highway and road
2. Light Industrial- repetitive, low unit costs, fewer and smaller cost overruns
3. Heavy Industrial
4. High technology- aggressive schedule and flexibility for handling changes, high unit costs
5. Multi story dwelling
6. Simple office
7. Complex office

Please describe your experience with this construction type:

How does this construction type compare to your typical project?

Please complete the following facility characteristics of your most recent design-build project. (Konchar 1997):
number of floors
construction type (new or renovation)
size (gross building square footage)
specific building systems (foundation type, structure type, architectural interior finishes,
exterior enclosures, roofing, environment, electrical systems, controls and site characteristics).

How do these characteristics compare with your typical project?
number of floors
construction type (new or renovation)
size (gross building square footage)
specific building systems (foundation type, structure type, architectural interior finishes,
exterior enclosures, roofing, environment, electrical systems, controls and site characteristics).

What percentage of your construction projects, by dollar volume, uses the following methods?

Methods Used	Dollars Spent each year
Design-Build	
Construction Management	
Traditional Method (Design-Bid-Build)	
Hybrid or other (describe)	

Methods used in the past five, ten years (to record possible trends)?

Were there reasons that led to this method selection?

Category Two

Selected performance criteria will ask the owners to indicate the performance characteristics they used in selecting design-build.
This information is from your most recent project utilizing design-build described above.

How did the project characteristics from above affect the design-build procurement selection?

Please numerically arrange the following performance criteria according to how their influence was used in selecting design-build for your project.

Rank from 1-8, (1 is most important, 8 is least important).
(Selection factors taken from Songer)

- ☐ Establish cost- secure a project cost before the start of detailed design
- ☐ Reduce cost- decrease the overall project cost as compared to other procurement methods
- ☐ Establish schedule- secure a project schedule before the start of detailed design
- ☐ Shorten duration- decrease the overall project completion time as compared to other procurement methods
- ☐ Reduce claims- decrease litigation due to separate design and construction entities

- ☐ Large project size complexity- the project's magnitude is too complex to be managed through multiple contracts
- ☐ Constructability/ Innovation- introduce construction knowledge into design early in the process
- ☐ Other

Why were the highest ranked criteria used in the selection process?

If design-build was not used on your most recent project completed, what were the reasons for not using it?

Catergory Three

Gives information pertaining to the company decision-makers. Method selection decisions may be made by one person, a department or possibly a committee formed for the specific project. This will give background on the mindset of those involved in choosing design-build, and perhaps some information on their thoughts.

Who in your company decided to use the design-build method for this project?

Who typically makes the method selection decisions?

What is the decision-maker's experience in construction?

Category Four

These questions will address the success of the project(s) using design-build and did design-build satisfy the initial performance criteria correctly. This will be the details of the initial criteria and how well it worked to accomplish the desired results.

Was this project a "success", and what constitutes project success?

How does the success of your most recent project compare to a typical

successful project?

What factors contributed to this success?

Did the criteria change through the course of the project? (cost became the focus, rather than schedule)

If so, is this project still considered a success?

APPENDIX C

Question 1.
Typical construction type

Respondents Number	Answer
1	High technology
2	Heavy Industrial
3	Simple office -educational
4	No D/B
5	Simple office
6	High technology
7	Repeated Answer
8	High technology
9	No D/B
10	Heavy Industrial
11	Complex office
12	Heavy Industrial
13	Heavy Industrial
14	Heavy Industrial
15	Heavy Industrial
16	Light Industrial
17	Light and Heavy Industrial, High Technology

APPENDIX D

Question 2.
Please describe your experience with this construction type:

Respondents Number	Answer
1	None
2	30+ years
3	30+ years
4	No D/B
5	Small amount of office construction, most construction projects are chemical plants
6	Little experience, decision based on financial
7	Repeated Answer
8	110+ years in high tech for company
9	No D/B
10	Many years, used number of times
11	Typically utilize/leverage in house engineering for production facilities / process engineering. Utilize local design build firms (2) for architectural work supporting office / lab complexes.
12	Extensive experience in this type, although this is the first manufacturing facility that we have utilized Design-Build.
13	15 years, 98% heavy industrial
14	31 years
15	27 years

16 Extensive experience constructing smaller facilities, no experience with greater size of this facility.

17 Utilizing design-build for steel manufacturing and processing facility had not been done before.

APPENDIX E

Question 3.
How does this construction type compare to your typical project?

Respondents Number	Answer
1	Not typical, administration and educational facilities are typical
2	typical
3	typical for administration
4	No D/B
5	Not typical, chemical plant work is typical
6	Not typical, renovation to equipment buildings is typical
7	Repeated Answer
8	typical
9	No D/B
10	typical
11	typical
12	No Answer
13	typical, this type of facility is 70% of what they construct
14	typical
15	typical
16	Lower unit cost, due to economy of scale, lower complexities in design standards (typical is much smaller in scale).
17	No Answer

APPENDIX F

Question 4.
Please complete the following facility characteristics of your most recent design-build project:

Respond. Number	Answers: number of floors	construction type	size (S.F.)	specific building systems
1	5	new	75,000	steel frame, precast panels, soph. MEPs, expensive finishes, b/u roof
2	1	new	200,000	warehouse, flat floor, slab on grade, pre. Engin. Structure, single memb. Flat roof, high tech automation
3	2	new	44,000	strip footings, slab on grade, gyp. Part., brick, steel studs, strip windows
4	No D/B	No D/B	No D/B	No D/B
5	1	new	4,000	standard office type- block exterior on slab
6	2	new	44,000	slab, structural steel and brick, painted gyp., carpet, 6 acre site
7	NA	NA	NA	NA
8	1	renovation	100,000	slab on grade, terrazzo floors, roof- single membrane, new air handling
9	No D/B	No D/B	No D/B	No D/B
10	1	new	600,000	caissons, metal siding, heavy steel frame, concrete sill wall, electrical substations, energy management system

11	2	new	70,000	spread footing, slab on grade, stucco and brick ext. w/ metal siding, skylights, office/lab and mini plant facility
12	1	new	408,000	spread footings, single ply roof, steel siding, complete electrical system with back-up transformers, complete energy management system
13	5	new	44,000	spread footings, steel structure, no interior finishes
14	6	new	10,000	mat foundation, 7' concrete slab foundation, 6 story silos were slip formed, metal sided conveyor building
15	1	new	250,000	spread footing, steel truss and column, precast concrete and metal siding, b/u roofing
16	1	new	200,000	tilt up concrete panel construction, minimum architectural finishes, 45 mil EPDM roof, light industrial zone, low voltage transformer for city power, good soil
17	1	new	15,000	foundation-reinforced concrete, steel frame, metal stud with drywall

APPENDIX G

Question 5.
How do these characteristics compare with your typical project?

Respond. Number	Answer			
	number of floors	construction type	size	building systems
1	5			
2	30+	both	varies	varies
3	3, varies	both	large powerplants	Brick and structural steel, with metal skin
4	No D/B	renovation	500-200000	varies
5	1	No D/B	No D/B	No D/B
6	1	new	varies	Typical office construction
7	NA	renovation	5000-50000	Existing communication equipment buildings
8	1-2 per project of floor renovation	NA	NA	NA
9	No D/B	renovation-90%, new-10%	1000-1mill. buildings	Sophisticated control system, high tech, stainless steel and glass piping, automated valves
10	1	No D/B	No D/B	No D/B
11	multi-floor process./prod. facility	Both, primarily new	20000-1 mill.	industrial bldg. system
12	One	Both	varies	Equipment varies due to large scope of processing and production

13	3-4 floors	new	varies	Spread footings, single ply roof, steel siding, complete electrical system with back-up transformers, complete energy management system
14	5-6 floors	new	5000-6000	Spread footings, steel structure, no interior finishes, cooregated metal, membrane roof, extensive electrical systems
15	1	new	10000	Spread footings, structural steel frame, b/u roof or poured deck
16	multi-story (varies)	new	100000-1 mill	Foundations depend on site conditions
17	small facilities-varies	both	20000	Tilt-up conc. panel const., min. arch. finishes, 45 mil EPDM roof, light ind. zone, low voltage trans. for city power

APPENDIX H

Question 6.
What percentage of your construction projects, by dollar volume, uses the following methods?

Respondents Number	Answer			
	Design-build (D/B)	Construction Mgmt (CM)	Traditional (DBB)	Hybrid
1				
2	1%	35%	35%	29%
3	1.5%	2%	95%	1.5%
4	No D/B	No D/B	No D/B	No D/B
5	10%	< 2%		90%
6	Zero, only D/B project	5%	90%	5%
7	NA	NA	NA	NA
8	10%	90%	0%	
9	No D/B	No D/B	No D/B	No D/B
10	30%	30%	30%	10%
11	20%		80%	
12	15%		85%	
13	6%		80%	14%

14	10%	10%	70%	10%
15	33%	25%	10%	32%
16	0%	0%	100%	0%
17	0%	0%	100%	0%
Average	10.50	21.89	64.58	19.15

APPENDIX I

Question 7.
Methods used in the past five, ten years (to record possible trends)?

Respondents Number	Answer
1	No Answer
2	Consistent
3	Prefer DBB, next 10 yrs. 85% DB
4	No D/B currently, will use 80% in next 5 years
5	Consistent, using D/B last 15 yrs., a lot of hybrid work
6	Benchmarking of all, typ. DBB
7	Repeated Answer
8	Consistent, D/B constant
9	No D/B currently, will use 80% in next 5 years
10	D/B and CM have pulled from DBB due to time constraints
11	More D/B in last 5 years, still project specific vs. standard used methods depending on project type.
12	DBB, for large projects (30-50 million and up) use CM to manage project and safety management
13	Consistent

14	Consistent
15	Leaning towards CM and D/B
16	Has always been DBB, this is the first D/B project
17	Consistent

APPENDIX J

Question 8.

Respondents Number	Answer
1	Alternate systems due mostly to the need to have constructor providing preconstruction services w/in a very controled environment.
2	When they must hire out design of specialized projects, D/B isn't utilized
3	time constraints or some hybrid modification
4	No D/B
5	Cost and cycle time reduction
6	Management and reporting of $200 million construction budget
7	Repeated Answer
8	No Answer
9	No D/B
10	Time reduction proven, method selection is project characteristics specific
11	Leveraging shrinking internal engineering resources. Focus on core competency, Reduced need for A/E services overall.
12	Cost and speed of completion
13	Hybrid escalated due to new philosophies by owners for quicker project times
14	Lack of in-house experience, found D/B firm who specialized

15	Method selection depends on job description. Will utilize D/B if they have a good job description (well defined scope and price).
16	Experienced lower costs for smaller projects
17	Cost effectivenes

APPENDIX K

Question 9.
How did the project characteristics from above affect the design-build procurement selection?

Respondents Number	Answer
1	Preconstruction cost estimating, design to budget requirement, constructability consulting, value engin. to stay w/in budget, project complexity
2	Would like to find D/B who specializes in their needs
3	Wanted to try method for cost reduction
4	No D/B
5	Selection process fits procurement by written strategy
6	In-house staff not familiar with this type of project, resources were issue, found site which was developed by design-builder
7	Repeated Answer
8	Long term relationship with company, familiar with process, people, construction type, no competitive process used
9	No D/B
10	No time to wait on large projects, early decisions must be made
11	Multi function office / lab / mini plant building. Fit strategy for design build.
12	None what so ever
13	If they have resources in-house, D/B will not be utilized. If resources are low, D/B will be considered, but is not the first choice.

14	No expertise in-house for facility construction, had to out-source to specialty contractor out of state
15	Not at all, must have well defined scope for D/B
16	For a recent warehouse project, design-build was selected due to the experience and low-cost execution of design-build niche firms.
17	Contractor selection based upon: demonstrated expertise and track record for successfulness. Items to be considered: safety, cost, schedule, record for managing and working with trades

APPENDIX L

Question 10.
Please numerically arrange the following performance criteria according to how their influence was used in selecting design-build for your project.

Respond. Number	Est. cost	Reduce cost	Est. sched.	Shorten duration	Reduce claims	Large size complexity	Construct -ability / Innov.	Other
1		1	5	2	na	4	3	
2	1	3	2	4	6	5	7	
3	2	1	3	4	6	7	5	
4	No D/B							
5	5	2	4	1	6	7	3	
6	4	2	5	1	7	6	3	
7	NA							
8	1			2				3
9	No D/B							
10	2	4	3	1	7	6	5	
11	4	4	4	4	4	4	4	
12	4	3	2	1	7	5	6	

13	5	2	4	1			3	
14								1
15	2	5	3	1	4	6	7	
16	5	1	4	2	4	8	6	
17			4	3		1	2	
Average	3.18	2.55	3.58	2.08	5.67	5.36	4.50	2.00

APPENDIX M

Question 11.
Why were the highest ranked criteria used in the selection process?

Respondents Number	Answer
1	Needs constructor at table to keep project w/in limits and perform miracles traditional methods don't
2	Projects are so large, difficult to get grip on budget and schedule
3	Aggressive schedule and budget constraints
4	No D/B
5	Cycle time and cost reduction, faster ands cheaper, less to handle on their end.
6	Management of scope, schedule and budget is very important to owner
7	Repeated Answer
8	Budget schedule- money allocated to project in a given year, must follow spending schedule. Must get product out as soon as possible, very important.
9	No D/B
10	Auto industry is based on time, so time of completion is highest priority
11	N/A
12	Speed of product to be manufactured in facility was the reason for fast track design and build delivery method.
13	To expedite process and get product out as soon as possible

14	No experience, only experienced contractor
15	Shorten duration of product manufacturing and get product out as soon as possible.
16	Lower costs is the single biggest reason
17	For small projects or for owners with limited resources

APPENDIX N

Question 12.
If design-build was not used on your most recent project completed, what were the reasons for not using it?

Respondents Number	Answer
1	Prefer CM over D-B because the parties report to me instead of creating an opportunity to allow a constructor to over bear the A/E and prevent important construction quality or design quality issues to be kept from the owners review and consideration.
2	Used to dealing with contractor, difficult for own people to stay away from job, little marketing for D/B
3	Not considered, prefer DBB
4	No D/B
5	Using d/b on all office projects, cannot find design-builder to handle high tech projects
6	Typical projects are small (<50K). Have selected A/E and GCs that are allowed to do their work
7	Repeated Answer
8	Resources internally to do yourself
9	No D/B
10	Three sided construction, difficult project, needed definition up front, D/B won't allow for up front
11	No Answer

12	Design-Build used as a single point responsibility for an Owner to go to for any and all items. The downside is you have to define as much as you can up front so as not to pay a premium after award. This is difficult for projects that are process (manufacturing) driven or for Owners that are used to or allowed to change the design as they go.
13	Resources were available. Consider themselves to have the best in-house technology resources for their market.
14	Bad experiences in past projects
15	Didn't have a well defined scope for D/B
16	The project was much smaller in scale and is tradionally handled in-house.
17	Generally higher cost

APPENDIX O

Question 13.
Who in your company decided to use the design-build method for this project?

Respondents Number	Answer
1	Facilities organization
2	Warehouse Group-Department
3	District Manager
4	No D/B
5	Project team and procurement function
6	Project team, consisting of finances and eng. Team
7	Repeated Answer
8	Engineering Dept.
9	No D/B
10	Interviewee and boss
11	Project team
12	Projects Group in association with owner
13	Project Manager
14	Operations people, users gave input

15	Interviewee
16	Joint decision in engineering
17	Engineering Dept.

APPENDIX P

Question 14.
Who typically makes the method selection decisions?

Respondents Number	Answer
1	Interviewee
2	Purchasing and Design Eng.
3	Committee team and RVP w/ user
4	No D/B
5	Project team and procurement function
6	Project manager recommends approach
7	Repeated Answer
8	Management of eng. Group, PM or director
9	No D/B
10	Interviewee
11	Project team
12	Project group's project management leadership/supervision
13	Project/ Construction Manager (Combination of both)
14	Engineering Dept.-consists of construction and engin. people

15 Interviewee

16 Engineering

17 Engineering Dept.

APPENDIX Q

Question 15.
What is the decision-maker's experience in construction?

Respondents Number	Answer
1	20+ years
2	Buyers have a lot of purchasing, but no contracting exp.
3	Very extensive
4	No D/B
5	varies, 0-25 years on team
6	20+ years
7	Repeated Answer
8	Minimum 5 years
9	No D/B
10	11 years, prior background in architecture
11	Extensive
12	30-40 years
13	Quite extensive
14	Extensive

15	27 years
16	Extensive
17	Extensive

APPENDIX R

Question 16.
Was this project a "success", and what constitutes project success?

Respondents Number	Answer
1	Yes, under budget and ahead of schedule, everyone loved design and constructed quality
2	Yes, on time and budget, exceptional quality, safe jobsite (no accidents), no claims
3	Yes, on time and budget, acceptable project
4	No D/B
5	Yes, on time and budget, zero OSHA recordables, operability- plant start up and run properly
6	Yes, completed on schedule and within budget
7	Repeated Answer
8	Yes, on time and budget, no disruptions to ongoing operations, meeting job requirements
9	No D/B
10	Yes, extremely, time was met and was available for next process. Cost per square foot was one of lowest. Benchmark project
11	Yes, on time and on budget, customer pleased with the functionality.
12	Somewhat successful, Lessons learned will be utilized for further successes with Design and Build in the future
13	No, failed in cost and schedule. Reason for failure was a lack of technology resource by design-builder.

14	Yes, but with problems. The facility came in on schedule, but over cost.
15	Yes, on time and under budget, as well as quality and safety.
16	Initial project utilizing D/B, not yet completed.
17	Yes, on budget, on time, facility provides return on investment that the funding analysis stated

APPENDIX S

Question 17.
How does the success of your most recent project compare to a typical successful project?

Respondents Number	Answer
1	High- extremely trouble free
2	More successful
3	Tracks well
4	No D/B
5	typical
6	Bigger deal than with most projects
7	Repeated Answer
8	typical
9	No D/B
10	time and cost are typical
11	typical
12	About the same; the delivery method although it has a small impact, the quality of the individuals on the team is the ultimate reason as to whether the project is a failure or a success.
13	Should come within cost and schedule

14	A little less than typical, due to cost overruns.
15	Never miss the schedule, must be able to react to changes
16	Better results in regard to cost and schedule
17	No answer

APPENDIX T

Question 18.
What factors contributed to this success?

Respondents Number	Answer
1	Outstanding PM and engineer
2	Own personnel weren't walking jobsite, less responsible for owner to supervise
3	Follow procedures closely
4	No D/B
5	Strong project team, followed global strategy, scope locked in early
6	Users acceptance, management of S/S/B
7	Repeated Answer
8	Close interactions with owner, understanding req., history and experience w/ contractor
9	No D/B
10	Ability to reach items in cost effective manner, changes were made to process and had to accommodate flexibility and reaction time
11	Project Team & Design Build contractors daily interaction for the duration of the project. Same definition of success factors listed above for both. Monitoring progress a job progresses & reporting.
12	Good quality designer and builder
13	Was not a success

14	No answer
15	They have limited their GC list to six, these all have a good knowledge of how they operate and are well adapted.
16	No answer
17	Good scope definition in sufficient detail for good cost estimating, good team work between owner and project team

APPENDIX U

Question 19.
Did the criteria change through the course of the project?

Respondents Number	Answer
1	No criteria changes, although focus almost always shifts as project is executed
2	No
3	No
4	No D/B
5	No
6	No
7	Repeated Answer
8	No answer
9	No D/B
10	Yes, Structural loading changed, which changed project characteristics
11	No, although budget drove a few decisions late in the project.
12	No, criteria changes (scope of work) but not the reasons for utilizing the design and build delivery method.
13	Yes, started with schedule, resulted in cost criteria

14	No
15	No, keeping the schedule was project driver
16	N/A
17	No, cost and schedule are both important and did not change

APPENDIX V

Design-Build Method Selection Evaluation Form

Introduction

This form has been divided into two sections, which include project characteristics and company information, which will both aid in indicating if design-build is a favorable construction procurement method. This form has been designed to assist owners, who have an interest in design-build, but are unsure if they can benefit from its use.

Section One:

Section one of this form utilizes project characteristics found to be useful in the procurement of design-build projects. Please review each item of this form and indicate the importance level. Responses are based on a scale ranging from one to five, five being the highest level of importance. Please select one that relates to your project characteristics for the design-build criteria listed.

Section Two:

Section two of this form utilizes information concerning your organization, such as general demographic and procedural methods. There are five responses ranging from strongly agree to strongly disagree. Please select the response that best reflects your organization.

Please complete both sections, and then evaluate your answers. If your answers tend to group on the left side, design-build may be a favorable method for your project. If the answers group more to the right side an alternate method, such as

construction management or design-bid-build, may be more effective. If answers are a balanced response of both sides, it is up to the owner to decide which items are more important and what method will accommodate their needs, based on an informed decision.

The form is intended to act as a guide, however the person evaluating should decide for him or herself whether their criteria tend to favor design-build. It is assumed that persons filling out this form understand and have experience in different construction procurement methods.

Design-Build Criteria Evaluation Form

	SECTION ONE:	Highly important				No importance
	Project Characteristics:	**5**	**4**	**3**	**2**	**1**
1	Reduce project duration					
2	Prepare overall project schedule early in design phase					
3	Early procurement of critical materials with long lead times					
4	Ability to fast track (start construction before construction documents are finished)					
5	Integration of construction expertise with architectural expertise early in the project					
6	Single point of accountability (by hiring one firm to handle design and construction)					
7	Constructability reviews during design phase					
8	One team working together on specialized and technical project types					
9	Established working relationship between architects and contractor					
10	Reduced number of communication lines between parties involved in project					
11	Ability to proceed with project prior to having a completely defined project scope and definition					
12	Incorporating value engineering, life cycle costing and innovation by construction entity					

early in development

13 Establish early, and more accurate project budget

14 Ability to lock into Guaranteed Max. Price before architect finishes documents

SECTION TWO:

Organization Information	Strongly Agree	Somewhat Agree	No Opinion	Somewhat Disagree	Strongly Disagree
1 Owner is qualified to act as organization rep. for design and construction process					
2 Owner utilizes experienced in-house construction department					
3 Owner can make decisions based on an extensive construction experience					
4 Owner has formal interview process to qualify design-build firms					
5 Owner has strong design scope and detailed project specifications					
6 Owner does not require third party project oversight					
7 Owner feels comfortable with D/B team constructing facility without third party supervision					
8 Owner policy does not restrict use of design-build					