

**Pickerington High School and Junior High School**  
**Construction Project Delivery Method**

A Comparative Analysis

Prepared by Michelle Mentzer

For

The Pickerington School Board

March 29, 2001

This report compares the strengths and weaknesses of the design-bid-build and design-build methods of project delivery to determine which is more appropriate for this project. The criteria used for comparison are time constraints, costs, quality, organizational impact, aesthetics and firm availability.

## **Introduction**

The Pickerington Local School District is currently developing plans to build a new high school and junior high school building to accommodate the rapid growth in the district. The buildings will be adjacent to one another and treated as one construction project to be ready for use by the fall of 2003 (Claffey, 2001). The plans are still in their preliminary stages and the first big decision that the school board must make is what delivery system to use for the construction project. Two common organizational structures for the delivery of a building project are design-bid-build and design-build. Several aspects of the project should be evaluated to determine which of these methods is more appropriate for this particular project.

The delivery method is “the approach used to organize the project team so as to manage the entire designing and building process” (Gould, 1997, p. 56). It is necessary to choose a delivery method before any part of the construction process begins. The owner cannot begin to hire companies until he or she decides on a delivery method. The method chosen will determine how many separate contracts with different companies the owner must form. For instance, if design-build is chosen, it is possible that the owner will only need a contract with one company, but design-bid-build requires at least two separate contracts (Gould, 1997).

Design-bid-build is the more traditional choice for a project delivery method. With this method, the owner hires an architect or design team to design the entire project before any contractors are officially involved. After the design is complete the owner is in charge of putting it out for bidding. The role of the designers is nearly complete by the time of bidding. In the bidding process, contractors have the chance to bid on the project

by estimating the cost of work. The project is then awarded to the lowest bidder. The contractor who is awarded the bid sees the project through to its completion (Gould, 1997).

The second option for the delivery method is the design-build method. If this process is chosen, the contractor is involved from the very beginning. The contractor and designer work together under one contract with the owner. With just this one contract, the project progresses from the conceptual stage through completion. The contractor has a direct impact on the design and bidding is not required since the contractor is chosen before the design process even begins (Gould, 2001).

There are numerous factors to consider when choosing the appropriate delivery method. While it seems like a somewhat simple decision, it is an important one since it occurs so early in the project. It can have a significant impact on the success of the project. This report analyzes the best delivery method for the new high school and junior high school in the Pickerington Local School District. The criteria evaluated for deciding which method to use are time constraints, costs, quality, organizational impact, aesthetics, and firm availability.

## Objectives

The purpose of this report is to determine the most effective delivery method for the construction of the high school and junior high school building that the Pickerington Local School District is preparing to build.

The first criterion to be considered is the time constraints on the project. The delivery method can have a large impact on the time it takes to complete a construction project. The schools are supposed to be open for the 2003-2004 school year, so time is a determining factor for which method is more appropriate. The two methods have construction starting at different times, and the labor force is more productive in certain parts of the year than it is in others.

Since the schools' construction must be funded by limited tax money from Pickerington residents, the second criterion used for the decision is costs. The price could vary significantly to build the same buildings using one delivery method versus the other. By examining similar projects from the past it is possible to estimate the price difference between the two methods for this type of project. If the price difference is significant in these cases, the cost could be a determining factor for this decision.

The next criterion considered for this decision is the quality. It is important for these schools to be of a similar quality to the other schools in the district. The question arises of how will the delivery process affect the quality of the final product. Does it make a difference? Does one method sacrifice quality for time or cost?

The organizational impact is another important criterion in this decision. The amount of influence the owner has in the design is not the same with the two methods. While one method may be more convenient if the owner already knows what he or she

wants, the other method may allow more of an opportunity to accept or reject ideas.

Does the owner prefer to be involved in every step of the process, or would it be more convenient to hand the project over to an experienced company that can take care of everything on its own?

It is possible for the aesthetics of the buildings to limit the delivery methods that can be used for the project. What does the community expect these schools to look like? Are they going to want to copy an existing design that would force them to use a particular architect who owns the design? Also, if they have a very clear idea of what they want, it may be more conducive to choosing one method or the other.

Design-build is a relatively new idea, so when choosing a method, there is some concern that a certain location may not have companies capable of using this method. If this is the method of choice, it is important to confirm the availability of firms to perform this method in the area before settling on it. How difficult will it be to find someone who can handle a project like this using the design-build method in the Pickerington area?

### **Methods of Obtaining Information**

An interview with Professor John L. Messner from the Construction Management of the Architectural Engineering (AE) department at Penn State provided a good basis for beginning research. He reported, from his experience, which delivery method works best for which projects. He also provided published studies performed by other members of the AE faculty. These studies were presented in the form of a professional journal article and included statistics comparing the two methods under consideration. Additional facts about the two methods came from a textbook on construction management. This source provided clear definitions of terms and comprehensive explanations of each delivery method.

Local newspapers from Pickerington reported what the School Board has in mind and demonstrated some feelings of local residents. Since these papers are only available in print in Pickerington, some had to be accessed online while other articles were collected and contributed by Susan and Richard Mentzer. A survey of current and past students at Pickerington High School helped to further determine what people who would be using the school felt was appropriate for the new buildings as far as the layout and appearance are concerned. This survey included any students who responded to an online survey.

## Results

### Time Required

Design-bid-build is a much slower process than design-build. With design-build, the construction can begin before the design is complete. Since this cannot be done with design-bid-build, using design-build condenses the time frame required to do the same size project. According to Dr. John L. Messner, the project can easily be ready for the 2003 school year using the design-build process, but it may be a bit rushed to complete it in time using design-bid-build. Table 1 shows the time differences between the two methods according to Konchar and Sanvido's studies (1998).

#### *Percentage of Average Difference between Delivery Systems*

Table 1

	<b>Design-Build vs. Design-Bid-Build</b>
Construction Speed	12 % Faster
Delivery Speed	33 % Faster
Schedule Growth	11.4 % less

### Cost

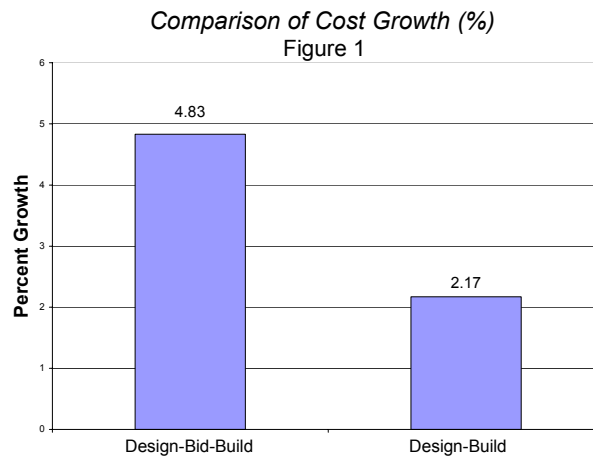
Costs of the two methods were compared in a study compiled by Professors Mark Konchar and Victor Sanvido of the Penn State Architectural Engineering Department. The results show that the cost of design-build is significantly lower than design-bid-build

and the percent of cost growth is lower as well. Refer to Table 2 and Figure 1 (Konchar & Sanvido, 1998).

*Cost Comparison of Design-Bid-Build vs. Design-Build<sub>2</sub>*

Table 2

	<b>Unit</b>	<b>Design-Bid-Build</b>	<b>Design-Build</b>
Unit Cost	Dollars/m <sup>2</sup>	1,291	861
Cost Growth	%	4.83	2.17



## Quality

Studies were performed to measure the quality of different areas of several construction projects using the design-bid-build and design-build methods of delivery. The facility owners were asked to rank the performance of the facility versus what they expected the performance to be. Each project was assigned a score in each area with 10 being the maximum. The facilities were divided into categories based on the delivery



method and the scores in each area were averaged for all of the projects. The mean values in each area are shown in Table 3 (Konchar & Sanvido, 1998).

*Mean Quality Scores by Project Delivery System*

Table 3

	<b>Design-Bid-Build</b>	<b>Design-Build</b>
Start up	5.96	7.5
Call Backs	7.04	7.94
Operation and Maintenance	6.88	7.67
Envelope, roof, structure, and foundation	4.95	5.71
Interior Space and Layout	5.19	6.15
Environment	4.86	5.24
Process Equipment Layout	5.07	5.61

### **Organizational Impact**

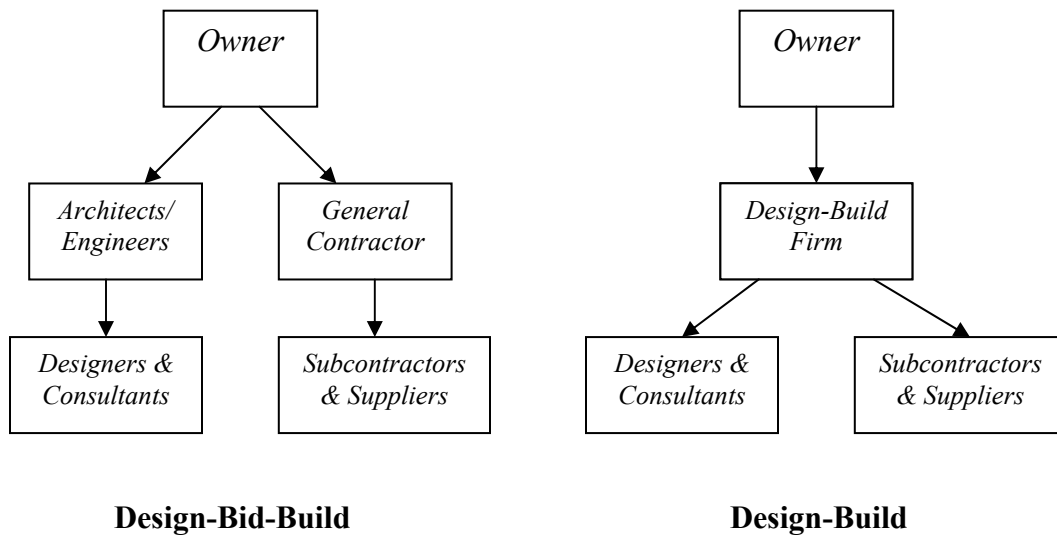
The organizational structure chosen will have an effect on the amount of input the owner has on the final design of the building. With the design-bid-build method, the owner can choose an architect who will design and redesign the building until it meets the owner's approval. This method also allows the owner to compare designs from various architects before choosing one to develop a contract with. On the other hand, the design-build method requires the owner to have a clear idea of what he or she wants before the design process begins. He or she has a less of an opportunity to reject designs

once the process has begun, so the owner must be as precise as possible when forming the initial contract (Messner, 2001).

Additionally, if the owner has a particular architect in mind, it may be necessary for the owner to use design-bid-build in order to use that architect. With the design-build option, the owner does not directly contract with an architect. Instead, the architect is a member of the design-build team, so the owner is not able to choose the architect separately. The organizational structure of each delivery system is demonstrated below in Figure 2 (Gould, 1997).

### *Organizational Structures*

Figure 2



### **Aesthetics**

Based on a survey of current Pickerington High School students and recent graduates, 64 % believe that the new buildings should have similar facilities and layout to the existing buildings but should have a new design. Nine percent believe that the new

schools should be identical to the existing buildings, and 27 % believe that they should be completely different.

In order to make the new schools identical to the old schools, the same architect would have to be used, making design-bid-build the more feasible option. Similarly, if the new schools have nothing in common with the old schools, the school board may not have a clear enough idea of what they want to use design-build. If the buildings are just similar enough to the existing buildings to form a clear project definition, both design-bid-build and design-build are possible options (Messner, 2001).

### **Firm Availability**

According to Dr. John Messner, most design build projects are done through a joint venture. This is “the legal binding of two companies for the purposes of providing a competitive advantage that would be difficult to attain alone” (Gould, 1997, p. 59).

Therefore, a design-build firm is not necessary to perform a design-build project. The same architect and contractor are capable of using either method. The fact that there is such an abundance of construction projects occurring in the area proves that the necessary firms are available.

## **Discussion**

### **Time Required**

Time is a very important issue in this project. The schools are scheduled to open in the fall of 2003, in time for the beginning of that school year (Claffey, 2001). If they do not open in time, it could cause problems for the entire school district. With the rapid rate of population growth in Pickerington, the district can not afford to wait any longer than the time planned for the project. All of the existing schools already have multiple portable classrooms to accommodate the overcrowding and the growth is not slowing down.

Since time is so critical on this project, it makes sense to choose the option that would ensure its most efficient completion. Dr. John Messner predicted that the project would be rushed to complete on time using the design-bid-build method. However, using the design-build delivery method, there would be no problem finishing on time.

Additionally, the weather is beginning to improve and reach the time of year when construction workers can be most productive. It would be a good idea to get the construction underway as soon as possible. With design-bid-build, the entire project must be designed, estimated and bid before any construction can begin. This slow process could cause the contractors to miss working on it during their most productive time of year. On the other hand, construction in the design-build method takes place while parts of the project are still being designed (Gould, 1997). This allows the contractor to take advantage of the good construction seasons.

Time is a very important issue in this project. There are no time advantages for design-bid-build over design-build. Several factors make design-build significantly faster

(Konchar & Sanvido, 1998). Therefore, on the basis of time required, the design-build method is the better option for this project.

### **Costs**

These new schools are being funded by tax money under a limited budget. Therefore, it is important for the project team to come up with an accurate cost and not exceed it. According to Table 2 and Figure 1, both the initial unit cost and the percent of cost growth are lower using design-build.

The lower initial cost will make taxpayers happy and allow the school board to do more with the same amount of money. The comparison is a cost per square foot of building, so it is saying that the cost of an average building delivered by the design build method is lower than a building of the same size delivered using design-bid-build. Therefore, with the same amount of money, the school board can choose to build either higher quality buildings or larger buildings than they could afford to build using design-bid-build (Gould, 1997).

The second statistic given, the percent growth of a project by cost, is a measure of how much the cost increases as the project progresses. At the beginning of the project, all the project team can give to the owner is an estimate of what they think the project will cost. Any unforeseen delays, problems, or additions to the project will result in cost increases midway through construction (Gould, 1997). These types of cost increases are common in all construction projects, but according to the data in Figure 1, they are less substantial under the design-build method than the design-bid-build method. While project cost tends to increase by an average of 4.83% using the design-bid-build method,

it only increases by an average of 2.17% using design-bid-build (Konchar & Sanvido, 1998).

Due to these differences in project cost per square meter and percent growth of project, design-build clearly appears to be the lower cost choice. The school board has limited funding, so cost is a definite consideration for them. Therefore, on the basis of cost, design-build is the better option.

### **Quality**

The construction of these two new school buildings should be the highest quality possible for the size of the project and amount of funds available. Table 3 shows a breakdown of the average scores achieved by each delivery method in seven categories related to quality. The owner of each building decided on the scores for that building, and the scores of all the buildings that used the same method were averaged (Konchar & Sanvido, 1998). With this table, the school board can predict how satisfied they will be with the quality depending on which method they choose. The average of several buildings was taken to more accurately predict how a typical owner would feel. In all seven categories, the design-build method ranked higher than design-bid-build. Based on this study it appears that from a quality perspective, design-build is the better choice.

### **Organizational Impact**

The main difference between the two delivery methods is the organizational structure of the design team. With design-bid-build, the owner contracts with an architect who develops the design drawings. When choosing the architect, they can get proposals

from several different architects, or they can choose one with whom they have worked before. After design is complete, they put the project up for bidding by several contractors in the area. Therefore, the owner chooses both the designer and the contractor. On the other hand, with the design-build process, the owner chooses only one company who takes care of the entire project. Once the owner gives that company an explanation of what he or she wants, that is pretty much the end of the owner's input (Messner, 2001).

The experience of the owner has an effect on which method is more appropriate. It takes an experienced owner to successfully complete a project with design-bid-build (Messner, 2001). Since the district has built two new buildings in the past three years alone, the owner should be experienced enough to use design-bid-build. However, this is the first time for them to do two buildings at once on the same site, which makes it a much larger project. The athletic facilities around the building that will be done at the same time including the stadium and various sports fields add to the project size as well (Baker & Butcher, 2001). Therefore, the school board might have more difficulty using the traditional design-bid-build method and coordinating the project.

Since the school board has completed other school building projects in the past, there is a chance that they have a particular architect with whom they like to work. This is a problem if they choose design-build because of the way the contract works. With design-build, the owner does not directly determine who the designers would be. They could recommend a particular designer to the design-build firm, but it is not in their power to make the final decision. The decision of a designer ultimately belongs to the design-build firm (Messner, 2001).

While the owner probably has a specific architect in mind, the other factors affecting the organizational structure still probably make design-build the better option (Baker & Butcher, 2001). Since no contract has actually been formed with a designer yet, it is not too late to go with the design-build option. For a project of this size, even with a somewhat experienced owner, design-build is the more practical option based on organizational structure.

### **Aesthetics**

Either process can lead to an equally attractive finished product; that is not an issue of concern. However, depending on what the owner has in mind for the building aesthetically, a particular delivery method might be a better choice than the other method.

Generally after a building is built, the architect, not the owner of the building, owns the building's design (Messner, 2001). Therefore, if the new buildings are too look identical to any other buildings in the district the way that the three original elementary schools are identical, there may be no other choice than to use the architect that designed that building and the design-bid-build delivery method. Since only 9% of those surveyed feel that these buildings should be identical to other buildings, it should not be necessary to use any one particular architect.

Design-build is a good choice if the owner has something specific in mind that can be conveyed effectively to the design-build firm (Messner, 2001). Therefore, if the school board chooses to give the new schools similar facilities and layout to the existing schools, it should be easy to use a design-build delivery system. In the survey of students, a 64% majority felt that this would be the most appropriate solution.



If the owner decides to stray completely from any familiar designs, design-build may be more difficult to use. In the case where the owner is unable to clearly define the project, it is best to allow an architect or several architects make proposals to start the process. If a project like this is given to a design-build firm, that firm could create something completely different from what the owner wants, and the owner may not realize this until construction has begun because of the fast pace. Of the students surveyed, 27% thought that the buildings should be completely different from any existing buildings in the district. This would lead to the design-bid-build method as well.

Since the majority of students feel that the new buildings should have some similarities to the existing buildings, a design-build firm should work well for this project. Additionally, reports from The School Bell reveal that the school board has a general idea of what the new schools should look like (Baker & Butcher, 2001). From this information, based on aesthetics, design build is a better choice.

### **Firm Availability**

Firm availability is only an issue when choosing the design-build option. It is clear that there are plenty of construction and design firms in the Columbus area that are close enough to use for this project. The question is whether or not there are design-build firms available, since it is a relatively new process.

The research results reveal that joint ventures and not actual design-build firms do most design-build projects. There are very few actual design-build firms, but that is not important since any contractor can form a contract with an architect and develop a joint venture. The contractor will choose a design company with which they can work well

and generally the contractor will be the one to have a direct contract with the owner.

There are plenty of contractors and designers in the Columbus area, so there is also the potential for plenty of joint ventures in the area. Most contractors would be happy to form a joint venture since that means that they choose the architect. If they choose the architect, there is less possibility for adversarial relationships resulting from conflicting interests. The two companies will be working together so whatever is in the best interest of one is in the best interest of the other as well (Gould, 1997)

The research showed that the necessary firms for either method are readily available. The same companies could perform the work under either delivery method. This means that from the standpoint of firm availability, either method is equally feasible.

## **Conclusions**

The question of which delivery method to use for the Pickerington high school and junior high school construction project is analyzed in this report on the basis of time constraints, costs, quality, organizational impact, aesthetics and firm availability. The first five of these six criteria conclude that design-build is a better option than design-bid-build. Analysis based on the sixth criterion proved to be inconclusive. Studies show that when comparing similar projects constructed with the two different methods, the design-build process is generally faster, cheaper, and of a higher quality than the design-bid-build process. The organizational impact leads to the design-build decision as well. Surveys of former and current Pickerington High School students along with information from local papers show that the community favors an aesthetic design that is ideal for the design-build method. The final criterion, firm availability, was inconclusive since the same companies can be used for construction regardless of which method is chosen. Therefore, it is in the best interest of the school board to choose the design-build method of delivery for this construction project.

### **Recommendations**

- Compile a detailed explanation of what needs to be included in the project and a budget.
- Contact contractors and find out how they feel about design-build projects.
- Research the individual contractors before any official agreements are made.
- Develop a contract and use the design-build method.

**Appendix A**  
**Student Survey**

How much similarity should there be between the old and new high school and junior high school buildings in the Pickerington Local School District?

- a. They should be identical.
- b. They should have similar facilities and layout but a new design.
- c. They should be completely different.

## **Acknowledgments**

Thank you to the following people who contributed to the research for this report:

John L. Messner

Richard and Susan Mentzer

Scott Baumgardner and the students of Pickerington High School

## References

Baker, B., Butcher, B.(Eds.). (2001, March). Pickerington preliminary site and building drawings for new schools. The school bell.

Claffey, M. (2001, March 14). It's official: They'll be panthers. This Week in Pickerington,1-2.

Gould, F.E.(1997). Managing the construction process: Estimating, scheduling, and project control. Upper Saddle River, NJ.: Prentice Hall, Inc.

Konchar, M., Sanvido, V. (1998, November/September). Comparison of U.S. project delivery systems. Journal of construction engineering and management, 435-444.