

# Tech Brief

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## Design-Build

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### Summary

Design-build is a method of construction where the design and construction tasks are contracted with a single entity known as the design-builder or design-build contractor. The design-build method is gaining popularity, with some projections indicating that more than half of all non-residential construction projects in the U.S. will be design-build by 2015. This *Tech Brief* discusses some of the aspects of the design-build method and how it might be used for water and wastewater projects.

### What is Design-Build?

Design-build is a construction project delivery system where the design and construction aspects are contracted with a single entity known as the design-builder or design-build contractor. Design-build is more streamlined than the traditional method, often referred to as design-bid-build, where design and construction were clearly separated.

The design-builder is usually the general contractor, but can also be the architect or engineer. By incorporating the designer and contractor, design-build minimizes the project risk for an owner and reduces the delivery schedule by overlapping the design phase and construction phase of a project. Rather than first bidding or engaging an architectural or engineering firm to design the project and then bidding out a contractor to build the project (i.e., the design-bid-build method), the design-build contractor packages the engineering design services in with the construction.

### Historical Precedent

The design-build delivery concept originates from the master-builder model used in the construction of structures such as cathedrals. Under the master-builder approach, a central figure—usually the architect or engineer—held total project accountability. From inception to completion, the master builder was the key organizational figure and strictly liable to the owner for defects, delays, and losses. The design-build system is a return to some of the fundamentals of the master-builder concept.

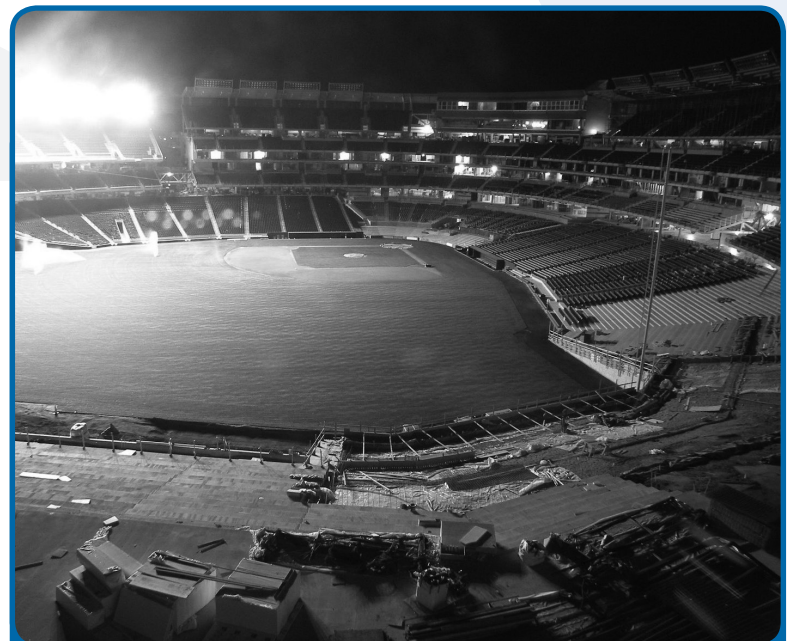


Image courtesy of <http://mats320.blogspot.com/>

The Washington National's ballpark in the nation's capital is one of the best-known examples of a design-build project. Construction on the \$630 million stadium, which also adhered to green-certified building guidelines, was completed in less than two years.

For most of the 20th century, the concept of design-build was classified as a non-traditional construction method in the U.S., which is one of the last countries to embrace the standard of design-bid-build. However, design-build is rapidly becoming the preferred form of project delivery, increasing from approximately five percent of the non-residential development market in 1985 to 40 percent today. By 2015, the Design Build Institute of America projects that this method will be used on at least 50 percent of all non-residential construction projects in the U.S.

## Differences between Design-Bid-Build and Design-Build

With the traditional design-bid-build method, the owner (e.g., a water or sewer system) would advertise for an engineer, adhering to state and local policies and procedures, while also lining up project funding.

After being selected, the engineer would design the project with the owner's specifications, incorporating state and local regulations, and sometimes funding agency specifications, too. The engineer would then obtain the proper permits through the various state and local agencies, including the water or sewer primacy agency.

Next, the owner (occasionally the engineer) would put the project out for bid to contractors, usually via a public advertisement. The contractor with the lowest bid would typically be awarded the contract to construct the project.

If allowed, the chosen contractor has sub-contractors perform some of the construction tasks. From the signing of the contract on, any changes require a change order from the engineer and owner. Change orders almost always occur because of unforeseen situations. They can become expensive if the project has not been planned well.

The engineer is usually responsible for inspection (quality control) during and after the construction process. Once the project is complete, the engineer verifies that the contractor has done everything to project specification, and the owner signs off that they are satisfied, too. Most water and wastewater projects carry a one-year warranty, after which the project is the responsibility of the owner.

With the design-build method, the owner (water or sewer system), after arranging financing, advertises for a contractor or engineering firm to do the entire project from start to finish. The contractor or engineer chosen is not necessarily based on the lowest bid. A selection process is done to determine if the contractor is capable of completing the project. Evaluation factors include:

- Past performance (both the architectural and or engineering and contractor and major subcontractors);
- Technical approach;
- Technical qualifications (specialized experience);
- Capability to perform;
- Other appropriate factors, such as insurance and bonding; and
- Bid amount.

While either a contractor or an engineer can direct a design-build project, they must have the expertise to complete the project. If, for example, a contractor is chosen, they must have a licensed engineer on staff or one sub-contracted for the design. If an engineering firm is chosen, they need a contractor for the construction.

After the contract is issued to the selected company, a notice to proceed is given and the project design is started. Some activity may begin, such as purchasing supplies and materials, as long as it does not require permits. In most states, permits are based on the finished design drawings so that major construction will have to wait for the proper permits. The design and construction may overlap depending on the permits required. The selected company is solely responsible for design, construction, inspection (quality control), and the warranty.

## Benefits of Design-Build

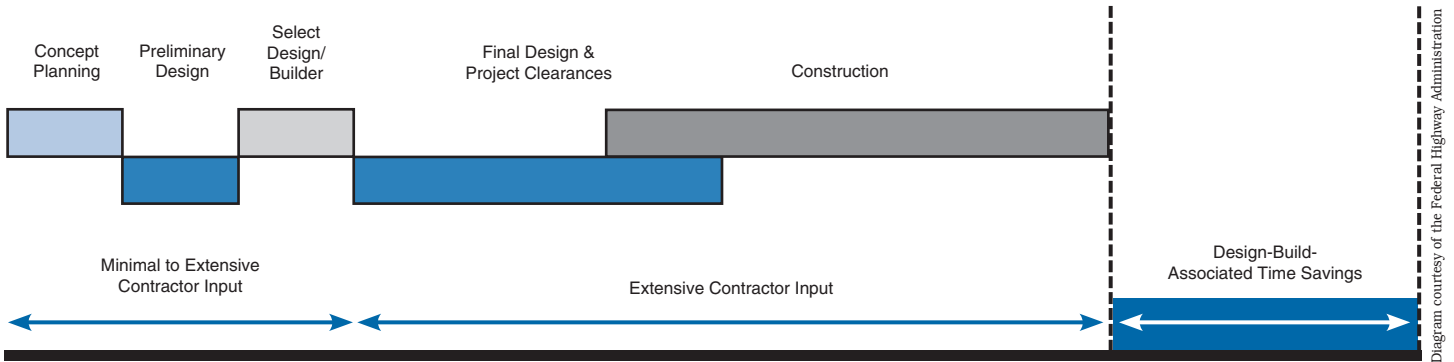
A study covering 351 projects in 37 states performed by Pennsylvania State University in conjunction with the Construction Industry Institute found several benefits associated with the design-build method. For instance, the design-build method reduced total project costs by six percent as compared to design-bid-build. Cost overruns or change orders on the projects improved by 5.2 percent over design-bid-build. And, most importantly, the total delivery time for design-build resulted in an improvement of 33 percent over design-bid-build.

Some key aspects of design-build include:

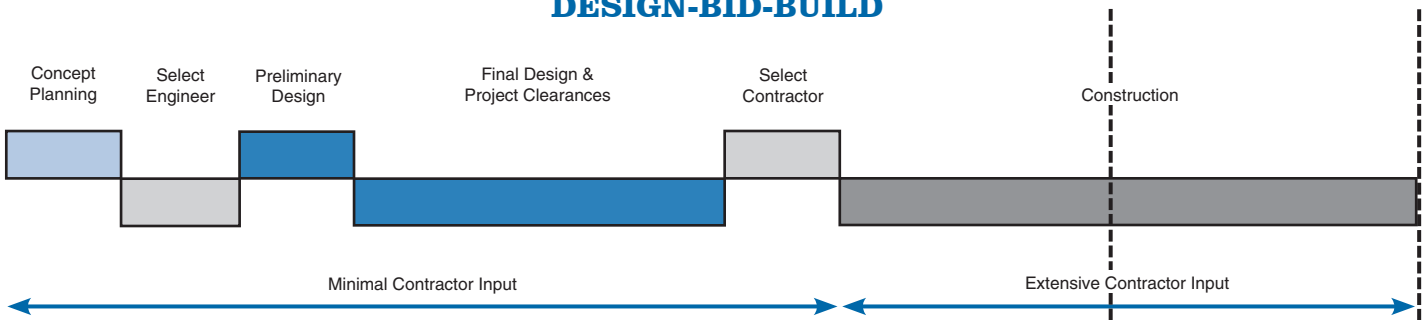
- Singular responsibility—one entity is accountable for cost, schedule, and performance;
- Faster delivery—collaborative project management completes work faster with potentially fewer problems;
- Reducing change orders—design changes that occur because the design did not account for certain obstacles or situations;
- Potential better quality—a design-build meets performance needs rather than minimum design requirements;
- Reduced owner risk—a design-builder assumes the risk to deliver;
- Decreased administrative burden—the focus is on the project as a whole, rather than on separate functions;
- Potential cost savings—an integrated team executes efficient and innovative solutions; and
- Fewer litigation claims—owners can reduce and even eliminate litigation claims by closing warranty gaps.

While large design-build projects have been publicized in the media, this method is gaining popularity in small communities. Maize, Kansas, a rural town of 2,000 people about 10 miles northwest of Wichita, was the largest community in the state without a public water supply. The homes and businesses there relied on shallow wells that had high levels of nitrate. Being close to Wichita, Maize was poised for development, but the lack of a reliable

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## DESIGN-BID-BUILD



public water system hindered the town's potential. To encourage development and provide a safe, dependable supply of potable water, the community set out to construct a complete water system. The community and its design-build partner brought the system online in just 18 months.

### Considerations

Before considering a design-build approach, be sure that your state allows it and that whatever funding source you use endorses it, too.

The most common objection to design-build is the fear that the owner will lose control by delegating too much or suffer from compromises between design and construction. The owner's role simply changes from one of mediating problems between disciplines (design engineer and contractor) to exploring and analyzing options to improve value for the user. Ultimately, with good performance specifications, the design-build team (instead of the owner) becomes responsible for the success of the project.

If the owner is afraid that the quality assurance and quality control will suffer, an independent inspection team can be specified for the project. Also, if a problem is perceived, the funding agency may be able to help. Remember: whoever holds the purse strings has considerable pull.

According to Friedlander's article "Design-Build—Legal Obstacles and Solutions," there are legal considerations with design-build construction, including the relationships and loyalties among parties, the design professional's standard of care, performance warranties, change orders, licensing problems, insurance and bonding problems, and conflicts with competitive bidding laws.

### *The Relationship and Loyalties Among Parties*

The design professional is not the owner's consultant but the contractor's teammate. Design professionals have contractual incentives to perform their services so as to further the design-build team's goals, which are not always in line with those of the owner. To counter this, employ a designer-led design-build, in which the engineer or architect is the lead member of the team.

### *The Design Professional's Standard of Care*

Ordinarily, an engineer (or architect) is only held responsible for exercising the degree of skill or care that the average design professional would use, and does not usually warrant or guarantee a successful outcome for his or her services. The rule for a contractor is different, in that contractors do implicitly warrant that the result of services will be successful, provided that the design and other factors over which they may have little to no control is sufficient. The design-build relationship allows a change in the designer's standard of care. In the design-build concept, unless written into the contract, the design engineer is held to the same implied warranty as a design-bid-build contractor.

### *Performance Warranties*

In a traditional construction contract, the contractor is asked to warrant the results of their work, but not the overall success of the project. This is because there are many other factors—primarily design—over which the contractor has no control that may determine the success of the project. In most design-build projects,



the situation is reversed. The design-build contractor is responsible for so much of the project that it becomes feasible to require the contractor to warrant the project's performance. Some of the liability borne by the contractor may be considered professional, and the nature of the professional liability borne by the design professional may not be fully insurable.

### Entitlement to Change Orders

In standard construction contracts, the contractor is usually entitled to a change order if any of these situations occur:

- Impacts caused by the owner (scope changes, disruptions by owner);
- Changed conditions (unknown subsurface obstacles); or
- Design problems (errors, omissions).

In design-build projects, the first two categories may still result in change orders, but the third category does not. Because the design-build professional is responsible for the design plans and sometimes the specifications, his or her incentives are to profit from the construction and are more likely to lean toward how much value they are receiving for the project price. The owner may, therefore, want to maintain some control.

### Licensing Problems

Every state in the U.S. regulates the practice of professional engineering and architecture, and each state's laws are different. Most design-build contractors do not meet all of these requirements and are not themselves licensed as design professionals. Therefore, design-build contractors usually provide engineering and architectural services by joining or subcontracting with a design professional.

### Insurance/Bonding Problems

Issues relating to insurance and bonding affect the relationship between the design-build parties. Design professionals' errors and omissions insurance usually excludes construction services and contractors' general liability policies exclude professional services. Certain states have anti-indemnity laws for construction projects that limit the parties' contractual ability to redress this disparate impact. One solution is appropriate cross-agreements with the design professional and the contractor supported by the design professional's errors and omissions insurance.

### Conflict with Competitive Bidding Laws

Projects funded with public money usually require a competitive process to choose a contractor even in design-build projects. In some

cases, more difficult restrictions exist at the state and local levels. Some statutes and regulations require competitive bidding on the basis of price, which could pose a problem for design-build projects.

### Closing Thoughts

The successful implementation of design-build requires a cultural shift away from design-bid-build. Throughout the entire process, owners, designers, and contractors must work together as a team. If followed correctly, design-build offers a faster, less expensive way for water and wastewater utilities to undertake construction projects.

### For More Information

To learn more about design-build construction, visit the Design-Build Institute of America's Web site at [www.dbia.org](http://www.dbia.org).

### References

- Beck, Peter. 2009. "Why Design Build?" Accessed at [www.beckgroup.com/alt\\_package/article.pdf](http://www.beckgroup.com/alt_package/article.pdf).
- Carter, William C. 2006. "Design-Build: An Innovative Approach to Project Delivery for Rural Communities, The Maize Kansas, Story." *Rural Matters* (Fall). Rural Community Assistance Partnership.
- Friedlander, Mark C. 2002. "Design-Build—Legal Obstacles and Solutions." *Journal of Management and Engineering*. Chicago: Schiff Hardin.
- Loulakis, Michael C. 2002. "Design-Build for the Public Sector." Construction Law Library. Aspen Publishers
- Loulakis, Michael C. and Mark C. Friedlander. 2002. "Design-Build—Legal Obstacles and Solutions." Accessed at [www.schiffhardin.com](http://www.schiffhardin.com).
- Smith, Gray. 2009. "Design-Build Concept Expands." Accessed at [www.gsoexpert.com/designbuild.htm](http://www.gsoexpert.com/designbuild.htm).



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