NAC Executive Insights

The Design Engineer's Role in Alternative Delivery

Key Points

- Design engineers must recognize they have the same professional responsibility under alternative delivery (AD) projects as they do under more traditional delivery methods.
- Selection of partners is critical for successful execution of AD projects.
- Collaboration and transparency are key to successful AD teaming.
- Open communication is a must for successful AD project execution.
- Accountability is most important when evaluating innovations related to design. A lesson learned is it is a mistake to assume the originator of the innovation will be accountable for the outcome.

Background

After the advent of professional engineering licensing in 1907 and the formation of the American Association of State Highway and Transportation Officials (AASHTO) in 1914, project delivery in transportation evolved from semi-private entrepreneurial development to agency-sponsored design-bid-build (DBB) as a baseline. Alternative delivery (AD) is defined as any one of the variations from DBB, including design-build (DB), construction manager/general contractor (CMGC), alliance (a New Zealand framework), design assist (an American Institute of Architects commercial organization), and similar options promoted as more collaborative alternatives to the discrete staging and commercial segregation of DBB.

The statutory obligations of professional design engineers have not changed for alternative delivery. The commercial position of design engineers, however, may change considerably, depending on the project organization for AD methods. This Executive Insight reflects the experience and advice from two design engineers who have delivered a variety of conventional and alternative delivery projects in the U.S. market over the course of four decades.

Introduction

The design and construction of transportation facilities in the United States have been managed by public agencies or toll road authorities for most of the last century. The primary method of project delivery called for a design engineer to represent the interests of the owner during preparation of engineering plans and specifications (either through an in-house design agency or through contracting

with a consulting engineering firm), followed by a public advertisement for competitive bids to construct the facility according to the owner's plans and specifications. This came to be known as the design-bid-build (DBB) method of delivery (see Figure 1).

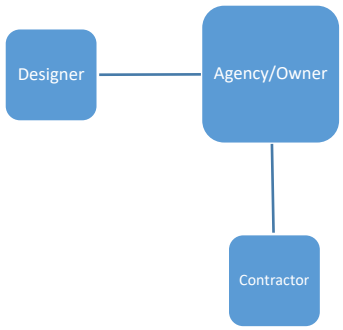

Figure 1. Design-Bid-Build Organization

Alternative delivery methods have become more frequent in the past 20 years. The three major alternative delivery methods currently operating in the U.S. are:

1. **Design-Build (DB)** delivery provides for a single contracting entity for both design and construction with the owner/agency. The typical organization includes a prime contractor who retains a design engineer and other subcontractors for turnkey delivery of a project that has been defined by the agency as a basic configuration for the transportation improvement (see Figure 2). After defining the project, the agency secures financing in advance of contracting with the DB contractor.

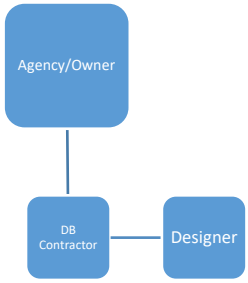

Figure 2. Design-Build Organization

2. **Construction Management/General Contractor (CMGC)** delivery provides for two-party agreements with the agency, where both the designer and the contractor are retained separately by the agency (see Figure 3). The contractor, however, is retained on the basis of commercial and performance qualifications rather than through a bidding process. In this method the engineer develops the agency's definition of the project while considering preferential information for construction from the CMGC. The process is similar in name only to a construction manager (CM) process in the commercial building sector since in the transportation industry the contractor self-performs a similar level of construction as would be done in DBB contracting. As with DB, the agency finances the project.

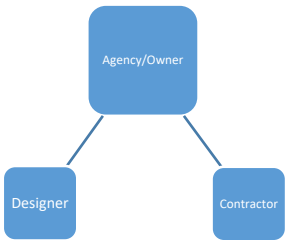

Figure 3. CM/GC Organization

3. **Public-Private Partnership (P3)** delivery combines elements of DB with project development (heretofore an agency function), which often includes financing and operation of the transportation facility. The delivery organization includes a financial management lead (concessionaire), who in turn retains a design-builder who operates in a similar fashion as for the DB method, except the DB now reports to the concessionaire (see Figure 4). The concessionaire also contracts or self-performs the operations and maintenance of the transportation facility for the life of the contract with the owner/agency.

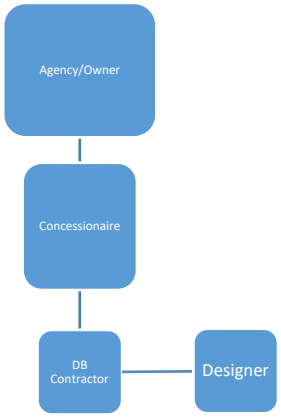

Figure 4. Public-Private Partnership Organization

History

Many of the early infrastructure projects in the industrial revolution were performed as design-build projects, often with the owner, builder, and designer being the same entity. This would include all 19th Century railroad construction. Design-build also was the delivery method for many significant projects early in the 20th Century, including the Brooklyn Bridge and Hoover Dam.

It became apparent that many facilities required oversight for safety and for operations and maintenance. It then fell to government agencies to own much of the public infrastructure and be responsible for safety. Accordingly, the engineering profession became part of a public trust, followed by licensure and a primary role of advocacy for the public. In all engineering codes of ethics and licensing statutes, it is universally acknowledged that the engineer's first responsibility is to public safety.

Standard of Care

Referring to U.S. practice, the engineer's responsibility to design in accordance with the standard of care is the same under alternative delivery as it is under DBB. At this point, a brief digression is in order to address conditions for designers.

The design standard of care is based on convention. That convention is largely developed from years of standard practice and engineering procedures with DBB delivery. In the case of highway and bridge design, standard specifications govern agency construction contracts, which have been developed over decades of design and construction practice. Provisions encompass both methods and performance specifications, but more the former than the latter. In most cases, the methods specifications have been

codified in response to past issues (commercial or technical) that have occurred, but which agencies/owners now seek to avoid. A second basis for methods specifications is that developing a performance standard is often problematic. Past practice, however, has shown that adherence to a method should produce an acceptable result.

The standard of care is independent of economics, schedule, or comity. One of the first discussions that ensues in the collaboration process among parties in an AD project is how the standard specifications can be modified in order to improve value. Because standard specifications across agencies differ, in some cases histories are associated with a particular proposal for a waiver of local practice. Yet in many cases advanced for exception, expectations are based on forecasts rather than history, whether the forecast results from isolating provisions from within an alternative specification reference or from the conviction of the proponent on the results that can be achieved with the waiver.

Designers are advised to respect the basis for standards of practice since it contributes to AD project developments. If a designer is uncertain about the basis for standard specifications or is cautious about the effects of alternatives, then it is advisable to proceed with caution. One should recognize, as the specifier, where adoption of nonconforming construction methods or concepts carries additional obligation. Instead of replacing standards, consider maintaining references to established methods while granting an option.

Collaboration in the Design Phase

There is nothing novel in the expectation that teams can produce more than individuals. Just as in sports, teamwork can improve success in project delivery when all players focus on how their performance can leverage the outcome for all their teammates. Also true in sports, however, team members are most productive in the area of their specialty…few football linemen will excel at quarterback.

The structure of the traditional DBB delivery process calls for each party to “stay in their own lane.” That is, designers design, owner’s program and finance, and contractors build. In this traditional realm, a designer’s focus is on the performance characteristics of the finished product; the contractor’s focus is on the means and methods for how to achieve the finished product. This organizational constraint does not exist with alternative delivery, so licensed engineers need to be deliberate when assessing alternatives and be clear on how options relate to project risk.

Team formation differs for the two more common AD methods, DB and CMGC. In DB, the contractor selects their designer teammate. Presumably the two parties understand each other’s skill sets and project approach. In the case of CMGC, the owner/agency selects the designer and contractor independently. If these two parties do not have prior working experience with each other, less common awareness of the skill sets of each within the other’s project role is likely.

Collaboration as a Process

Transparency is key to successful AD teaming. Four primary principles should be recognized and discussed in order to establish a constructive framework for AD projects:

1. **Objectives** of each party for outcomes from the project
2. **Opportunities** to enhance outcomes for each party
3. **Accountability** of each party for scope, duties, and participation on the project
4. **Definition of risk sharing** through a written, contractually referenced risk register

Each of a project's three principals—agency/owner, contractor, and designer—will have different objectives at a granular level. The discussion needs to go beyond the normal platitudes of "successful project," "fair profit/price," "mutual respect," and so on. In most cases, the three principals represent three business interests with different business needs. In order to form a successful team, potentially conflicting priorities should be discussed and integrated into a game plan that optimizes outcomes for all team members.

In traditional DBB, the contractual framework for performance is fairly static. In contrast, AD projects will be evaluating opportunities to enhance outcomes as an ongoing process in project development. From the standpoint of the designer with AD projects, innovations sought by the team often involve departures from standard design and specifications associated with DBB delivery. Designers that fail to register the risk elements associated with these departures may unwittingly assume an elevated commercial risk on the project.

Accountability is perhaps the most important discussion when evaluating innovations that relate to design and specifications. One of the major lessons learned by the authors is that it can be a mistake to assume that the *originator* of an opportunity will be accountable for the *outcome*, whether the subject is commercial (owner/agency), means and methods (contractor), or design (safety and efficiency of finished project.)

Collaboration in the activities and developments at the design stage may inject recommendations by non-engineers into the engineering discipline. There is a natural enthusiasm and optimism for innovation that adds incentive for a departure from standard specifications applicable to the character of work. This contractor or owner enthusiasm can influence design decisions, and designer input to construction means and methods may also depart from a traditional designer's scope to encourage a departure from methods specifications for construction.

Successful innovation can contribute real value to an AD project. When that innovation improves commercial margins as well as economic value for the agency, everyone smiles. When that value accrues only to one party or when value is lost instead of gained, however, one party or another may be looking for recovery. When this happens, forget about the comity present during the design phase and look to the contract and standard of care for the obligations as the designer.

One point of advice for AD designers is to understand there are commercial risks with innovation where "innovation" is defined as a departure from accepted standards of practice. Acceptance of an alternative

method (*vis a vis* a standard methods specification) during the collaborative design phase that wins acclaim during the pre-bid phase design may be a burden when outcomes are not as expected. This is true whether the disappointment is commercial (a contractor loses money or an agency pays a claim) or technical (performance of the finished product is less than expected). AD designers need to judge innovations and alternatives not as a communal decision process but rather in terms of the probability of failure to achieve design outcomes.

Risk and Responsibility

There are both corporate and personal perspectives on risk for design engineers, often to a greater degree than for other parties. In transportation work, contractor risk for operational reliability is often limited by contract and statute. Construction liability for agencies is limited in a similar way. In most jurisdictions, the EOR (Engineer of Record) is the only party licensed for professional product, thus they are carrying both personal and commercial risk.

Few if any factors in project development are deterministic *a priori*. This is particularly the case for DB projects, where the bidding process is affected by joint probabilities associated with the contractor's forecast of construction cost and the designer's forecast of design outcomes. Reliability is generally recognized in design and standard specifications, but less so when considering commercial and construction process questions. This often comes into play when discussing variances against standard practice or standard specifications, particularly when an advocate offers a singular example in support of an exception (or even less reliably, only a hypothesis for an exception).

While development entails commercial risk, the question for the designer is not only the degree of risk, but who might wish to subrogate their downside risk to the engineer through a legal argument tied to a designer's traditional duty. One of the influences for designers to consider in AD projects is the Spearin Doctrine, a legal precedent associated with a DBB civil construction project in 1918. The court ruled in Spearin that DBB plans and specifications are warranted by the owner to the contractor. What may seem inequitable to designers in AD projects is that unsuccessful proposals promoted by contractors for alternative specifications or even construction sequences that differ from those typically shown on plans may become a liability for the designer due to Spearin because they were "permitted" by the designer. Every design engineer should recognize the implications of Spearin. While a designer might believe Spearin should have little bearing on AD project development, recognize that the legal profession may not appreciate the difference between DBB and AD roles or recognize accountability for decisions that are not otherwise stipulated in the contract terms.

Recommendations

Alternative delivery can lead to either synergism or chaos for project designers. Successful alternative delivery requires a teaming approach to risk sharing by all parties in order to improve on the arms-length relationships in conventional construction contracting. A few recommendations on a path to success for AD projects include the following:

1. Designers should recognize that if an innovation promoted by any team member is represented on the plans or in the specifications, the contractor and/or owner may expect the designer to carry the risk of that innovation to the extent that it departs from established norms. Designers need to assert the right of refusal for content on plans and specifications that are produced over their stamps.

2. Designers should evaluate and communicate the basis for conventions in design and explain the empirical conditions applicable to design and construction before entertaining exceptions.

3. Risks associated with unconventional design and construction methods should be an open topic for discussion, not inferred or assumed to be understood by all parties. To the extent any party expects that unconventional specifications or methods might affect contractual obligations, agreements should be documented in accordance with contract requirements. The discussion process should be documented in a contract risk register.

4. Designers should consider using established designs and specifications and then permit contractor options in cases described in item 3 above, particularly for CM/GC projects. The approach of presenting a "baseline with contractor options" better communicates assignment of risk to third parties and maintains a consistent design basis for certified plans and specifications.

5. Not all designers are comfortable with the diffusion of roles and exceptional risks related to AD. Those that are not should avoid alternative delivery projects in favor of traditional delivery, for while successful AD projects can be the best experience, unsuccessful or contentious AD projects can expose the uninitiated to risks and results that may be among the worst one can encounter.

6. Open communication is imperative with alternative delivery. Parties with differing experience, expertise, and perspectives often do not draw the same conclusions from discussions. Agreements and meeting minutes should be well documented. Changed contract terms should be updated in real time. "Go along to get along" is *not* an option for a design engineer.

7. Selecting teammates is the key to successful execution of AD projects. Discussions on the allocation of risk must be held *during* the teaming process, not *afterward*. It is important that each party understands their role while respecting the roles of others. The commercial parameters, such as scope definition and payment terms, must be fairly and reasonably discussed prior to beginning the project. Wishful thinking is not a good strategy. If reasonable contract terms with insurable liability risk for design cannot be confirmed in writing prior to embarking on a pursuit, the best strategy is to close the book and move on.

About the Authors

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