

The Role of Engineers in Design-Build World

Where's the Engineer in Your Design-Build Delivery?

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Unless you're working in the remotest parts of the world, you've likely seen or been part of a design-build project. The design-build delivery methodology has been around for thousands of years... think of the ancient master builders who conceived and constructed the Egyptian pyramids.

Today's design-build teams, although different from the master builders of centuries ago, draw from the master builder model. In the case of building systems, a team of engineers and contractors partner to design and install comprehensive--often complex--solutions for structures of all scopes and scales.

The design-build approach has evolved considerably in recent years. Owners anticipate a greater application of technology, improved collaboration and the delivery of more dynamic, engaging and sustainable solutions. These business drivers, along with more familiar schedule and budget concerns, can blur the roles of the engineer and the contractor and create some barriers to a successful design-build approach.

Technology's Influence

In this current era of design, there has been an explosion of available technologies to help an engineer define his work, analyze systems and create project documents. These technologies can then blend with the contractor's scope in the following manner: 3D-BIM (visual story of the project), 4D-Scheduling (major deliverables and manpower), 5D-Estimating (continuous check), 6D-Sustainability (energy and water) and, finally the latest, 7D-Facility Management Applications (preventative and ongoing maintenance).

An owner should look to the design-build team to help determine how much technology should be part

of their specific project. As a minimum, the design-build team should consider incorporating BIM and 3D. While the use of BIM as the primary design tool certainly increases opportunities for coordination and communication amongst project team members, it can also create confusion.

For owners, it can be difficult to know who is taking the lead—is it the contractor or the engineer? The answer depends on the owner.

Who's in Charge?

In the optimal design-build scenario, the engineer is tasked with the selection, scheduling and equipment definition, effectively the design intent (e.g., planning, flow diagrams and main routings). In that same scenario, the contractor is responsible for means and methods such as securing the equipment and buyout. In other cases, the engineers do the programming work (e.g., bridging documents) then turn the whole design over to the contractor team.

Every project is different, but in every case, a successful project requires that the entire team buys in to the selected hand-off approach. Here are some points to consider when determining the roles of the engineer and contractor.

If schedule is the primary driver, an engineering team has the best shot at meeting a defined timeline because these teams contain a larger bench of knowledge than most contractors, particularly if it's a complicated project. If a problem occurs, an experienced engineering team will have a better chance of making a course correction without delay. If budget is the primary driver, a good contractor with built-in engineering expertise can be the best choice if the design is straight forward with minimal conflicts and clear connections.

Top 5 Points to Consider on Your Next Design-Build Project

- 1. Regional Variances:** Design-build concepts vary based on geographic traditions and state and local processes. Legal contracts will vary as will working relationship between the prime and the sub-contractors. The financial expectations of the team will often be different based on location.
- 2. Safety:** Safety is of course paramount on any project, but especially on a design-build project where a lot of activities are happening at the same time. A compressed schedule can create less time to plan the construction sequence, potentially leading to safety concerns.
- 3. Integrated Teams:** The most collaborative design-build teaming approach occurs when the owner, engineers and contractors all have skin in the game.
- 4. Continuous Quality Control:** Quality control is important on any project regardless of delivery mechanism; however, it's imperative to the fast-pace of design-build approach if the owner wants to stay on schedule and budget.
- 5. Schedule Compression:** A tight schedule is the number one reason an owner goes with design-build over traditional design-bid-build. We've seen projects completed as much as 40% faster by instituting a well-orchestrated Critical Path Method Schedule (CPM), allowing the owner a series of options that would not be possible using other approaches.

Another point to consider, engineering teams, such as NV5, spend considerable effort evaluating and mitigating risk. A risk mitigation approach evaluates the primary project factors (e.g., complexity factor, schedule and budget), and then works with the design-build team to determine the best point within the project process to hand over the project control to the contractor(s). If a project is very complex (e.g., many components and complex programming, analysis and systems definition), the engineer will stay in the position of authority throughout the design phase. However, if the project is driven by a tight budget and schedule, the contractor may take ownership of the project much earlier.

Manage the Scope Creeps

Cost overruns are the greatest risk in the design-build approach to building systems. Surprisingly, these overruns usually occur because of a lack of communication between the team members—a scenario that the design-build approach is supposed to eliminate. Here is the problem. Typically, contractors only price the work that is shown on the drawings at the early stages. I have seen plenty of examples where the cost of a project dramatically increases, because the folks doing the estimates are not engaged in the overall project generation. Simply put, they don't know what they don't know. If they are given a set of documents at the programming or schematic phase of a project, and they only estimate (strip off) what is on the drawings, the project cost could be off by as much as 300%. That's why it is critical that the entire project team has a clear understanding of the predicted project cost—a challenging number to define. But, remember, that the complexity of determining cost is why certain engineers and contractors excel in design-build, and others fail miserably. It takes a strong benchmark of pricing experience to commit to a construction price when the unknowns far outweigh what's known.

It is impossible to get all of the information on the drawings early in the design phase of any project. That's why it's imperative that experienced cost estimators,

working with engineering teams, have the opportunity to use their knowledge of similar projects to estimate system costs that cannot yet be fully determined.

At the very beginning of every project, the cost estimate should be locked into the scope. Cost must be defined at each stage of the project to mitigate project risk. It becomes very easy for scope creep to sneak its way into a project. Scope creep occurs in many ways, including the addition of square footage to meet code compliance, the use of higher grade materials, too conservative of design parameters or the use of more labor intensive components to name a few. All of these scope changes will increase the overall cost of the project if not kept in check. Use your engineering team to better define costs for each phase of a project and for each major discipline. If a cost issue is identified, the project team should recommend a solution.

Emphasize Engagement

Another potential area of cost overrun can occur on projects that have extensive employee and stakeholder engagement during the design process.

These highly collaborative design processes most certainly deliver better end solutions, but they can also play havoc with schedules and budgets. In fact, workforce demographics have become a surprisingly strong driver in the complexity of a project design. A facility manager must understand the needs and requirements of each of the major demographics working within the space, including veteran, baby-boomer, generation X, generation M, and, quickly on the horizon, generation Z. Each group engages in a slightly different way, again putting pressure on the project team to deliver a design that is functional, yet flexible while performing at peak conditions.

Again, your engineering team can help. The NV5 team follows some simple guidelines when dealing with a diverse team of stakeholders. First communication is vital. On every project, we establish and document communication processes for both written and spoken words. Second, knowledge is power. We, as the

project engineers, make sure project information is well collaborated throughout the entire project team. Finally, create a balance between creativity and budgets. We don't want to stifle the enthusiasm and energy of the team, even as we keep the team focused on overall project cost.

Design-build is a tremendous project delivery approach that encourages a can-do teamwork environment, particularly on fast-track projects. However, in the drive to put shovels in the ground, don't forget the role that your engineering team plays in delivering quality solutions.