



Pitfalls of Design-Build

The Devil is in the Details

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The Design-Build concept is gaining increased acceptance, and there's no doubt it's a seductive option to a cost-conscious building owner. Who wouldn't want to shave off the direct cost of professional design fees? After all, a building's a building, isn't it, and it'll come with a warranty, won't it? Hey, the contractor promised to deliver a total package and understands my needs.

Not so fast. Is it reasonable to believe that all contractors have the owner's interests at the top of the agenda? Profit is the driving force behind all commercial enterprises, and there's nothing wrong with that. However, it can be a murky line that separates the very different interests of owners and contractors. For sure, some contractors will have in-house professionals capable of designing appropriate spaces, HVAC and structural systems, land use plans and an appealing aesthetic appearance, but there are many who do not. By the same token, some owners will have their own procurement specialists but many will not. It is this disparity in sophistication that's often overlooked. Moreover, it's not until after something nasty happens to a building in service that the insurance underwriter will start to ask searching questions.

Many of us in the consulting field have been happy to provide design assistance to a design-build contractor but our scope is often limited, and the design parameters likewise. Total control of the selection of the building systems is held by the contractor, and multiple design packages are released to both design professionals and vendors alike. Owners will see this as cost-effective, and in many cases it is. However, on the flip-side, has the owner given the contractor a detailed account of anticipated day-to-day operations; and does the contractor have a full grasp? These two components, the contractor and the owner, generally have little in common. Their occupations, and day to day responsibilities, are quite different.

By way of examples, consider the following personal experiences:

A plastics injection molding company decided to expand its operation and, as a result, determined the need for a two story storage warehouse. For its construction, the

manufacturing company solicited the services of a pre-engineered building erector/construction company that promoted itself as a design-build contractor. It appeared a good fit, the price was right and the contract signed. The project certainly appeared to be within the contractor's scope of work and the design work proceeded. The upper floor was designed to withstand a combined dead plus uniform live load of 100 psf., and the resulting construction was a 2½-inch slab on 0.06-inch metal deck resting on bar joists at 24 inches on center which, in turn, were supported by conventional steel framing. Spread footings were installed as the foundation system. Clearly, none of this is untypical of pre-engineered buildings used for commercial purposes. However, this is a manufacturing facility and an important operational component was overlooked.

Upon completion of the warehouse, the second floor storage area was serviced by hard-wheeled fork-lift trucks on a continual basis, and within a couple of years the slab was severely damaged. Potholes were developing everywhere and the slab was fully perforated in several locations. A desperate owner contacted my firm for help. Upon analysis, we determined a 4-inch thick slab was necessary, and that the supporting super-structure would have to be strengthened to support both the increased concrete slab load and the concentrated loads of the forklifts. In all, additional intermediate supports were installed to support the joist and beam framing, including additional columns and foundations, and the design-build contractor returned to undertake the work.

Notwithstanding the owner's increased production costs resulting from disruption to the manufacturing process, the direct cost of the remedial work was in excess of \$250,000. The contractor assumed this expense, but not before the owner leveraged their cooperation with the promise of the award of an additional planned expansion. Ironically, we earned an engineering fee the owner had initially sought to circumnavigate by opting for design-build delivery. After much finger pointing, the question of which party's action led to this situation will remain.

Pre-engineered metal buildings are more suited for light, uniform service loads, and

design-builder contractors favor the ease by which components can be selected from prescribed catalog information. There is an obvious comfort in this, and the repetition of delivering these structures becomes routine. However, we can see here a classic example of a pitfall of the design-build system, since certain projects require more than the selection of a one-size-fits-all pre-manufactured building and an eagerness to continue cookie-cutter delivery. In fact, this is not the only construction failure of this type, and of this type of building format, that require the retention of engineering firms to investigate.

Another situation involved the expansion at an auto-parts plant, with the addition of a 120- x 360-foot manufacturing building. Approximately, the shop layout required two 60-foot spans, spaced at 20-foot intervals for a total of eighteen bays. Each span was to have two overhead, twenty metric ton capacity, bridge cranes. The owner, a German based company, had previous experience with design-build procurement in Europe, and their typical contract was adjusted to accord with U.S. standard forms. One of their specific contractual requirements was the submittal of structural calculations by the design-build contractor for review by an owner-retained structural engineer, and this was to be done before the start of construction. Clearly a prudent step, and any firm would be pleased to be hired by this sophisticated owner to provide this service.

Despite this safeguard, and anxious to minimize 'general conditions' costs, the design-build contractor jumped into the project, ordering steel and installing foundations and anchor bolts. Gotta move fast to maximize that profit, you know. Submittals are just a formality and the calculations can come later. We're the designers and we're the builders, and we know what we're doing. We've built other buildings like this. Nothing to it.

Once challenged to deliver the calculation package, a photocopy of the Portland Cement Association's slab-on-grade design chart, highlighted to justify thickness selection, was submitted. Not an encouraging start to the review process.

There followed a protracted two week period before a further submittal. Meanwhile, construction continued. The second submittal, this time an impressive looking 300 page computer print-out, documenting the frame analysis, appeared to suggest the contractor was getting the message and finally playing by the rules. However, upon review it was clear that restraint of lateral forces and moments at the column bases had not been addressed.

The footings and anchor bolts, as installed, were designed to withstand the calculated vertical loads but were inadequate to resist other reactions. Not surprisingly, there followed much haggling with the contractor's EOR. All the while, construction continued, and on schedule. Resolving the impasse, the owner's structural engineer concurred with the owner-retained structural engineering firm's determination and arrived from Germany in time to stop the imminent installation of the cranes. A lateral bracing system was subsequently designed to restrain the tops of the columns and mitigate reactions at the bases. The cost of this stabilization added a further \$200,000 to the bottom line and can be judged a pitfall, brought on by the ready-fire-aim philosophy often inherent with design-build projects.

As can be seen from the cases described above, the devil is in the details. It is essential that both the contractor and the owner are on the same page. Unfortunately, there is no mandated mechanism to guarantee this empathy. Active participation by insurance underwriters during design development could provide the necessary oversight, but this is not customarily the case.

Design-build delivery is not the same as Contract Manager delivery but, to unsuspecting owners, they can appear to be the same. Both appear to present the owner with a contractor eager and able to demonstrate alternatives that offer savings. Unlike competitive-bid projects, each of these systems is conducive to the development of a close, one-on-one, relationship between the contractor's team and the owner, and this intimacy will give comfort to the owner. However, despite the advantages of flexibilities within the Contract Manager delivery system, the contractor is, nevertheless, bound by documents prepared by an independent, third-party, design team, who duly monitor the project to ensure satisfactory delivery. Nothing is 'left off the table'.

Also of concern is the prevalence of design-build contracts at local authority level. The majority of small municipalities have limited funds with which to build EMT, firehouse facilities and the like, and the design-build option presents a good fiscal option...and, what's more, there's often a brother-in-law with a construction company only too eager to ostensibly 'give back' to the town. The potential problem is, though, will the buildings withstand seismic or hurricane forces when needed, or will the emergency equipment be stuck in the rubble?■

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