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Design/Build proponents will argue that their preferred construction method is superior to design-bid-build. What is sometimes lacking in such arguments is hard and fast evidence. Until now.

Choosing the Design/Build delivery method for new construction projects has had a notable positive impact on the bottom line for the clients of the McClure Co., a \$50 million mechanical contracting firm in Harrisburg, PA.

A recent study of 120 projects at the McClure Co. found that Design/Build projects ended up with 90% fewer field-generated change orders than design-bid-build projects. This resulted in projected “cost-growth” savings of 98%, or more than \$1.7 million. This study provides objective evidence that using the Design/Build approach in mechanical construction can decrease both the occurrence and size of change orders. In many cases, it can practically eliminate field-generated change orders.

The study was led by David R. Riley, Ph.D., an associate professor at Pennsylvania State University. In comparing McClure’s Design/Build projects to other delivery methods, it was found that:

- Cost growth due to unforeseen change orders was 98% lower
- The average size of all change orders was 50% lower
- The size of unforeseen change orders averaged 77% smaller
- The number of unforeseen change orders was reduced by 90%
- Cost growth due to change orders was 71% lower.

### **The Effects of Change Orders**

Change orders represent one of the largest sources of cost growth on building construction projects. While owner-generated change orders may be inevitable, field-generated — or “unforeseen” — change orders, which often arise from design errors or lack of coordination in contract documents, are usually avoidable.

Field-generated change orders produce many negative effects on construction projects, including forced changes in the work sequence, declines in productivity, increases in overtime, and the need for costly re-working.

### **How the Study was Conducted**

The researchers in this study confined their scope to mechanical construction. Focusing on a single contractor also allowed the researchers to observe how policies of a company might contribute to its projects’ outcomes.

The researchers selected 120 new mechanical construction projects occurring between 1996 and 2002 with initial budgets of \$50,000 or more.

After selecting the projects for study, the researchers asked each project manager to identify how change orders were generated. An owner-directed change order was defined as any order by a client to modify the original contract. An “unforeseen” change order

was defined as any order resulting from a field conflict between systems and/or a design error or omission.

### **Why it Works for the McClure Company**

The researchers were careful to point out that a company's overall approach to project management may be a critical factor in the degree to which the Design/Build method affects change orders and cost growth. In other words, much like the disclaimers found at the end of infomercials for weight-loss products, "McClure's results may not be typical." McClure's results, however, are undeniable.

Therefore, McClure Company's managers identified five key company attributes vital to the success of their Design/Build offerings.

**1. An approach that capitalizes on the merits of integrated Design/Build.** An integrated Design/Build process takes full advantage of open communication among players traditionally separated by layers of contracts and organizational structure. Because McClure Co. has engineering and other technical abilities in-house, workers in the field communicate directly and immediately with engineers and project managers. Engineers also can order major equipment directly, ensuring compliance with design and performance intent and reducing overall installation cycle time.

**2. Designation of the engineer as team leader.** McClure's president, executive vice president, service manager, and Design/Build director are all registered P.E.s, so the concept of "designer-led Design/Build" is ingrained throughout the organization.

Unlike mechanical contractors whose engineers strictly produce stamped drawings for interpretation in the field, McClure Co. gives its engineers direct authority over field decisions and over the purchase of material and equipment. Engineers also can direct work to subcontractors with particular abilities.

Perhaps most important, engineers are involved from the initial proposal through closeout and commissioning of projects. This continuity of involvement by design professionals increases the likelihood of attaining project performance in accordance with initial expectations.

**3. Acceptance and management of the higher levels of risk and uncertainty in the Design/Build environment.** Because the scope of work in Design/Build frequently evolves during the construction process, there's no distinct separation between pre-construction and construction activities. To avoid cost-creep, the Design/Builder must be willing and able to predict final project outcome prior to completing a final design. McClure Co. employs engineers and estimators who have the strong ability to conceptualize and who are willing to trust their intuitions. The deployment of such abilities allows the company to offer project performance guarantees, which are important factors in distinguishing them from competitors.

**4. A common attitude and approach to projects.** Successful Design/Build requires coordinated pre-construction efforts. Project managers, field foremen, and accountants all need to adhere to a set of rules different from those traditionally found in a plan-and-spec or design-bid-build environment.

At McClure Co., these rules include avoiding change orders unless directed by the client, holding the company's good reputation as a more important goal than net profits, and willingly disclosing project costs and margins when warranted.

**5. Early involvement by construction experts.** Design/Build allows the entire construction team to be involved in the design process, which frequently results in more efficient designs consistent with "constructability." Laborers and project managers can affect a project's design by participating in peer-review design meetings. Advice from project managers and field foremen can optimize materials purchasing and ensure efficient use of labor hours.

McClure Co. also expects its engineers to be receptive to the input of experts in the construction trades. McClure consistently finds that budgets and schedules are met or improved upon when constructability information is included.

### **Will it Work for Others?**

The success of McClure Co.'s Design/Build approach is due in part to the company's culture. Not all contractors offering Design/Build project delivery will necessarily handle circumstances the way McClure does.

For other companies, the convincing results of the McClure Co. study demonstrate the possibilities that exist for well-executed Design/Build. As this study makes clear, the Design/Build project delivery method can potentially decrease the occurrences of field-generated change orders in mechanical construction projects through more fluid adjustment to project design, operational efficiencies, and team-building across construction trades and professions.

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