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This article presents strategies to engage in life science projects from a schedule, quality, and budget standpoint – all with "speed to market" in mind.

Fast-Track Life Sciences Projects: When to Use Design-Assist and Why It Works

by Raj Vora, P.E.

Introduction

End-user organizations are constantly searching for the "best" ways to engage in life science projects from a quality, schedule, and budget standpoint, while keeping "speed to market" in mind. In this article, the benefits of design-assist project delivery versus design-bid-build delivery will be examined. The article will demonstrate how design-assist project delivery contributed to the success of a fast-track life science project. Examples of project execution tools utilized to overcome specific challenges will be provided and the article will conclude with an itemized list of the "rules of engagement" for successful design-assist life science projects.

The selection of a proper construction delivery method for capital construction projects can ensure successful execution, while simultaneously meeting overall business goals. While choosing the right approach needs to be evaluated on a case-by-case basis, selecting the right delivery method should be based on a number of factors, including budget, schedule, cash flow, project complexity, risk, project goals, and most importantly, project team composition. Due to the weak economic climate, companies that had large in-house engineering and project management staffs have reduced resources and are opting to outsource these critical project roles. This is a key consideration in selecting the right project delivery method.

Project Delivery Methods

The most commonly used project delivery method is Design-Bid-Build (DBB.) In DBB, the owner functions as the overall project manager and hires external engineers, consultants, and contractors to deliver the project. The owner typically starts by retaining an architect to program and develop a scope of work. The architect then hires a consulting engineering firm, who is the engineer of record, to develop the project plans and specifications. Once the detailed design effort has been completed, mechanical and plumbing contractors are invited to submit pricing to meet the owner's competitive bid requirements. Although this seems like the most cost-efficient method for securing a specific scope of work, design-bid-build has several pitfalls as follows:

1. Quality: the goal of the competitive bid process is to get the lowest upfront cost for the owner's scope of work and the general contractor may invite several mechanical contractors to bid on the project. As a result, the quality of the project could suffer if the owner/general contractor selects the mechanical contractor only on the basis of low price.

2. Design Safety Factors: in design-bid-build projects, the design usually includes safety factors, some as high as 20% excess capacity to ensure that the engineering design is adequate for the project scope. In traditional design-bid-build projects, designers don't want the liability of a design that may not work so they often overcompensate by incorporating excess capacity into the scope of the project. These safety factors lead to oversized building systems and equipment and unnecessary cost to the project. In fact, oversized building systems can lead to underperforming buildings through lack of efficiency and high energy consumption. In a design-assist, the approach is collaborative from the start

with all parties working toward the same goals, allowing them to design based on actual project scope, and avoid costly changes down the road.

3. Change Orders: in design-bid-build, the contractor, based on the construction plans and specifications, assumes all construction and performance risks. Any scope variations from the bid documents result in change orders and schedule delays. The mechanical contractor does not influence the project design and opportunities for alternative approaches at bid time are minimal. Design-bid-build procurement by its nature is set up to create an atmosphere of silo entities with little contractual reason to collaborate to solve design gaps or resolve cost issues.

4. Schedule Impacts: in addition to the scope impacts mentioned above, the submittal review process can impact the project schedule. The mechanical contractor is required to submit shop drawings for each component of work per plans and specifications for formal review and approval by the architect, engineer, and owner. This process takes time and has to be repeated should there be scope changes or additions. All of this can negatively impact the owner's project schedule, leading to additional cost throughout the duration of the project.

5. Project Harmony: the nature of design-bid-build projects can lead to adversarial relationships among the owner, architect, designers, and contractors, especially if the owner's intent is not fully captured in the bid documents. Owners run the risk of expending significant project funds and time for detailed design only to find out the final project does not meet the project budget and schedule parameters.

Conversely, a highly successful delivery method is design-assist, which is becoming more commonly used. A design-assist project allows the owner to maintain control over his project, but key contractors are selected early in the project's lifecycle to achieve schedule and budget goals. Design and construction are integrated in the design-assist method, rather than compartmentalized, as is the case in design-bid-build. The owner still procures the general contractor, architect, and engineer of record, but instead of completing the design documents before soliciting pricing and procuring contractors, the mechanical contractor is brought on board early, usually as part of schematic design, to help finish the design process while simultaneously providing real-time pricing feedback.

There are many advantages to utilizing the design-assist project delivery method in lieu of design-bid-build:

1. Reduction of system cost through:
   a. Correct system application
   b. Use of innovation
   c. Right-sizing of systems
   d. Intelligent procurement
   e. Early coordination with other trades
   f. Enhancement of field productivity
   g. Near elimination of change orders
2. Early firm cost with updates at design revisions
3. Single source accountability for mechanical and plumbing system cost and performance
4. Quality installed system and equipment
5. Time/schedule savings through:
   a. Doing things right the first time
   b. Integrated design and coordination
6. Reduced administrative burden through reduced change order processing
7. Improved risk management

The goal of the design-assist method is to totally integrate the design and build processes in order to design, build, and commission high-quality systems within budget and on or ahead of schedule through designing things once. This collaborative approach reduces design costs and time, in addition to encouraging the design of systems that fully meet the owner's requirements. Design-assist also produces constructible documents that allow design errors to be detected and corrected early in the process, maximizing productivity in the field and saving time. Design-assist enables projects to ramp up to a completion date faster than traditional design-bid-build.

Case Study – Private Lab Facility

A national design-build and design-assist mechanical contractor teamed with a general contractor on a private lab facility project located in Maryland. The building is specially designed for breeding rodents for research purposes. The 54,000-square-foot facility is primarily used for animal holding, but it also includes administrative space, mechanical equipment spaces, lab support areas, and future tenant fit-out space. Specialized HVAC, plumbing, and process systems include 100% outside air handling units, lab exhaust, industrial and animal watering systems, compressed air, vacuum discharge, humidification steam, and services to several cage washers and autoclaves.

This project commenced in early 2007 based on a traditional design-bid-build project delivery. However, problems quickly arose. The owner had budget concerns, the facility design was incomplete and tenant leases had already been signed for May 2008. This created the need for an extremely aggressive project schedule of eight months. With critical time constraints facing the project, the mechanical contractor was brought on board in August 2007 in a design-assist contract delivery.

The project team held weekly meetings to complete the design while developing early cost guarantees. Due to the compressed schedule, construction had to begin while the design was still being finalized. The mechanical and plumbing design was completed in phases to best support the fast-track schedule. As the aboveground services were being finalized, design and installation of underground plumbing got underway. The team was able to keep the mechanical and plumbing equipment off of the critical path by procuring the equipment during the detailed design phase. Simultaneously, the entire project team held regular coordination meetings to ensure a smooth installation of services in the field. Frequent meetings

EXAMPLE PROJECT DELIVERY PLAN
"UNDERGROUND PLUMBING"

PROJECT NAME	Project Anywhere
SHORT PLAN SCOPE	Underground plumbing – all systems
PROJECT NUMBER	7118273
LOCATION/ADDRESS	Anywhere, USA
GENERAL CONTRACTOR	General Contractor, Inc.
MAILING ADDRESS	
BILLING ADDRESS	

PROJECT DIRECTORY (MAIN POINTS OF CONTACT FOR SHORT CP)

NAME	COMPANY	ROLE	TELEPHONE	E-MAIL
John Doe	GC, Inc.	Project Manager	703-555-1212	jdoe@gcinc.com
Cara Doe	Mechanical Contractor	Project Manager	703-555-2433	cdoe@southlandind.com

SAFETY/EMERGENCY INFORMATION

CONTACT	COMPANY	ROLE	TELEPHONE
Joe Safety	Mechanical Contractor	Division Safety Manager	703-555-7748

ACTIVITY HAZARD ANALYSIS (AHA)

SI AHA	GC JHA	DESCRIPTION OF ACTIVITIES ASSOCIATED WITH THIS SHORT PLAN
X		Excavation
X		Inhalation

DIRECTIONS TO NEAREST MEDICAL EMERGENCY TREATMENT FACILITY

FACILITY NAME & ADDRESS	
DIRECTIONS FROM PROJECT	1.
LINK TO INTERNET MAP SITE	

LOCATION OF JOB-SPECIFIC SAFETY PLAN

GC, Inc. - Trailer

SOUTHLAND SCOPE OF WORK (SHORT PLAN)

SHEET METAL	None
PIPE FITTING	None
PLUMBING	Underground sanitary, storm, water and industrial waste piping.

OPTIMUM SEQUENCE OF INSTALLATION (SHORT PLAN)

SHEET METAL	1. N/A
PIPE FITTING	1. N/A
PLUMBING	1. Start at mains exit point on building working towards east wall. Complete A side first before moving down to B side.

OPEN ITEMS OR TASKS TO COMPLETE TO MAKE STATED PLAN

WHO?	DESCRIPTION OF ITEM, TASK OR PREDECESSOR ACTIVITY	DATE CHECKED
Detailing	Drawings for Area A to be completed by Friday	09/04/07

CREW SIZE & MANPOWER

TRADE	CREW SIZE	# OF CREWS	START	COMPLETE	WEEKS	FOREMAN
Plumbing	2	2	09/10/07	10/11/07	5	Mike Plumber

SCHEDULE & CPM ACTIVITIES

COMPANY	MAJOR CONTRACTUAL MILESTONES FOR THIS SCOPE	FINISH DATE
SI	Complete UG before concrete pours	10/11/07

PRE-FABRICATION PLAN

SHEET METAL	N/A
PIPE FITTING	N/A
PLUMBING	N/A

PROCUREMENT

EQUIPMENT/MATERIAL TYPE	TAG NO.	QTY.	SUBMITTAL STATUS	REQ'D ON-SITE
Chem Drain Pipe Material	IW	1976	Approved	09/11/07

OUSTANDING DESIGN OR COORDINATION ISSUES

SHEET METAL	N/A
PIPE FITTING	N/A
PLUMBING	Coordination drawing from detailing (SIDE A COMPLETED)

POTENTIAL ROAD BLOCKS (RISKS) THAT SHOULD BE WATCHED

SHEET METAL	N/A
PIPE FITTING	N/A
PLUMBING	1. Power – We may need to rent a generator if no power present. (COMPLETED)

OPPORTUNITIES

VALUE ($)	TRADE	DESCRIPTION

COST CODES REQUIRED FOR THIS SCOPE

TRADE	SCOPE		HOURS	
Plumbing	Detailing		299	
Plumbing	Supervision		239	
Plumbing	Material Handling		131	
Plumbing	Underground – PVC (Including Drains)		373	
	Underground – Chem Drain (Inc Drains)		1054	
Plumbing	Material (UG Portion Only)		N/A	
Subcontracts	Excavation – T&M Subcontractor Only		N/A	

APPLICABLE DRAWINGS & SPECIFICATIONS

TRADE	SPEC SECTIONS	DRAWINGS
Plumbing	Standard Submittals	P-101 and P-102

CONTRACT OR SPECIFICATION ITEMS OF INTEREST

CONTRACT/SPEC CLAUSE	APPROVED INTERPRETATION

Figure 1. Project Delivery Plan: document used to plan and organize execution of projects by compartmentalized specific scopes of work into deliverable portions of work.

and daily communication led up to the bulk of the mechanical and plumbing rough-in occurring in just four months, between February 2008 and May 2008. This equated to 11,000 hours of sheet metal labor, 15,000 hours of piping labor, and 11,000 hours of plumbing labor performed within this time frame.

How did the team achieve their goal of delivering the project within eight months? As outlined below, it was the combination of design-assist, frequent communication, and project execution tools that made it possible:

a. Project Delivery Plan: this is a document developed to detail the "plan-of-attack" for executing specific scopes of work for the project. This document contains all of the relevant project information; key personnel, safety contacts, etc., in addition to the project's milestone schedule dates, prefabrication opportunities, and tasks lists. This document compartmentalizes and plans the execution of the project into deliverable portions of work - *Figure 1*.

b. Equipment Delivery Log: this is a spreadsheet that captures all of the equipment on the job, associated lead-times and delivery dates. By understanding when equipment is needed on site, the project team can drive design decisions to achieve associated construction milestones.

c. Trend Log: in a design-assist delivery, owner generated scope changes will occur as the design progresses. The trend log is a tool used to capture owner design decisions that increase scope or cost in addition to capturing contractor ideas that help maintain a net zero impact of those changes. The project team uses the trend log to make educated decisions with an understanding of project schedule and budget impacts. It is a great communication tool that is used by the owner to realize the value in the design-assist process and to ensure involvement of the project team in maintaining project budgets. The log includes a description and the quantity of an item, its location, critical dates – planned/actual including lead times, plus the vendor name, contact person, and phone.

d. Prefabricated Racking of Services: the project contained an extremely congested service corridor running down the

Figure 2. Prefabricated Racking of Services: prefabricated racks in the service corridor that includes all major utilities and services.

center of the facility. All major utilities and services were located in this corridor and hung from several different locations along the route. The team utilized coordination and modeling capabilities in conjunction with weekly coordination meetings with the project team to design the building to allow prefabricated racks for all the utilities, rather than individual piping distribution for each utility service. The coordinated racks were built off-site and delivered to the site in 20-foot sections for field installation, which helped meet the aggressive schedule - *Figure 2*.

Conclusion

The selection of the right project delivery method and the right configuration of roles, responsibilities, and relationships are more crucial than ever. The ability to define and develop project requirements and scope early, in order to deliver a successful project, is the key challenge that will continue to face project teams today. Choosing a collaborative delivery-method will ensure a good project experience by all.

These "Rules of Engagement" should serve as a guideline for determining when design-assist should be considered.

Design-Assist "Rules of Engagement"

1. Schedule: the project has an accelerated timeline that cannot be achieved by using the traditional design-bid-build method.

2. Budget: the project's budget is in jeopardy or the owner wants cost certainty and needs early cost validation.

3. Risk: minimize owner's and mechanical contractor's risk through early involvement in the design process.

4. Owner's Team: the owner wants to utilize their architect and engineer from past projects.

5. Project Complexity: a more complex greenfield or renovation project requires early mechanical contractor involvement and more team collaboration to meet the overall project goals.

Outcome: the owner's quality requirements are met more efficiently through the design-assist project delivery process because design-assist is more collaborative – the budget is shared up front and either through an open-book or lump sum process, the contractors and project team are working together toward a common budget goal as opposed to the negative competitive aspects of design-bid-build.

About the Author

Raj Vora, P.E. has more than 12 years of industry experience ranging from campus-wide master planning and manufacturing expansions to renovation and retrofits of facilities during operations. His background includes experience in client consultation, collaborative design and construction projects, and start-up for a variety of projects within the biotechnology/pharmaceutical manufacturing sectors and bio-containment and R&D laboratories. Vora currently holds the position of President of the ISPE Chesapeake Bay Area Chapter. In his role, he is responsible for the strategic growth and oversight of the 450-member chapter through educational events, facility tours, charity events, and business functions. Vora earned his Master's of Architectural Engineering from Penn State University and is a licensed Professional Engineer in the State of Maryland. Vora is also an Industry Mentor to a 4th year student in Penn State University's Architectural Engineering program, providing coaching and guidance through personal and professional interaction. At Southland Industries, Vora is responsible for the strategic growth of the enterprise through new project and customer development by guiding the company on the type and size of projects to pursue. His extensive customer base has been developed on the principals of repeat business through the execution of projects at a high rate of client satisfaction. Vora frequently leads project pursuit teams, ranging in size from five to 15 people and is one of Southland's technical experts in the areas of life sciences and healthcare. He can be contacted by telephone: +1-703-834-5570 or email: rvora@southlandind.com.

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