

# Methodology for Selecting the Appropriate Method of Project Management and Delivery

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The purpose of this study is to examine current industry project delivery practices. Ten industry professionals from the varying perspectives of owner, designer and constructor were interviewed and twenty projects were discussed, two from multiple perspectives. The risks, approach and overall success of each project were examined along with interviewee opinions on different delivery methods and considerations when beginning a new project. This examination will serve as a source document for faculty for future research and curriculum discussion.

**Keywords:** Project Delivery Methods; Design-Build (DB); Design-Bid-Build (DBB); Construction Management at Risk; Guaranteed Maximum Price (GMP); Agency Construction Management; Front End Engineering and Design (FEED); Engineering, Procurement and Construction (EPC)

## Introduction

As owners look towards the design and construction of new projects one of the early, important decisions that must be made is how they should assemble the owner – designer – constructor team. Traditionally, owners would first hire a designer who would work with the client and client user groups to develop the owner project requirements and then translate that into a design and a full set of drawings and specifications. The owner would take this completed design and then solicit proposals (bid out) the project and select a builder. The selection was based primarily on price. This process was slow, but with a completed set of documents considered less risky and was understood by most members of the design and construction communities.

Due to increased project complexity, technological advances in information and design technology such as the Web, CAD & Building Information Modeling (BIM), the growth of a more sophisticated Construction Management profession, and more complex owner schedule and programmatic demands the design-bid-build approach outlined above has evolved to include other alternate methods. Faster more integrated and collaborative approaches have been created to move the project through the design-construction process faster and to share information between the many different project participants. Done correctly, the traditional walls between disciplines come down and all members of the project team collaborate throughout the project, everyone working in the client's best interest. Design-Build and various Construction Management approaches are examples of arrangements that have been created to better serve the owner.

This paper will examine the many challenges (risks) that owners face along with the options (management and delivery methods) available to respond to these risks. This paper assumes a more expanded interpretation of the term delivery/management method to include the overall structure of the owner – designer – constructor team, the basis of contractor selection, the scope of designer and constructor services, and the method of compensation for work completed under the contract (Ohrn & Rogers, 2008). This paper will also begin to suggest a preliminary methodology that owners can use to best match the appropriate management approach with their project. In addition to a review of published material interviews were conducted with owners, designers and builders with respect to specific projects.

## Research Methodology

In addition to a review of published literature on the subject of project delivery interviews were conducted with 4 owner (2 being owner representatives), 2 architects, and 4 constructors. Interviews, a qualitative research approach, were used to attain a complete and current understanding of the risks owners face today on their projects as well as the strategies utilized to manage these risks. Interviews were conducted to gain new perspectives on known project delivery issues that would be difficult to quantitatively measure as well as to identify some issues (variables) that may be later investigated quantitatively. Interviews were conducted utilizing open-ended questions first reviewing in detail two past or current projects. The interviewee was then asked to review their own experience with different delivery methods and finally to discuss the best practices in terms of selecting delivery methods with future projects. Below are a summary of questions asked. (Table 1) Marie Hoepfl, in her paper *Choosing Qualitative Research: A Primer for Technology Education Researchers* writes about the importance of qualitative research to open doors to new research topics and to attain information on topics not suited for quantitative methods (Hoepfl, 1997).

**Table 1**

Interview Questions	Choices or examples used
What were major elements of project risk?	Money, technical complexity, schedule work environment, other
Was the project fast-tracked?	
Overview the time-line as to when primary participants became involved?	
Which method of project delivery was used?	Design-Bid-Build, Design-Build, Construction Management, other
Explain how the choice was made?	
On a scale of one to ten rate the best delivery method choice with respect to:	Cost, schedule control, design, changes, quality control, value engineering opportunities, other
If you had the project to do again, would you choose a different delivery method?	

### Why is the choice of project delivery important?

It was found during the interview process that depending on the person's project responsibility the attitude towards project delivery changes. Owners found this research necessary as they struggle to balance the conflicting interests of time, money and quality. Designers felt that owners rush unnecessarily into a fast-track approach and should if at all possible approach the project traditionally. The designers felt that they could help the clients to "vision" the project and develop the program if given adequate time and that budget, schedule and constructability analysis could be done with outside consultants. Producing a 100% design and getting a hard competitive bid is in the client's best interest. Some designers see the providing of a GMP as no guarantee at all since an early GMP changes as the program and design becomes further defined. A GMP provided late (80% design) is not really that risky to the builder and at this point in the project the owner is already committed. See table 2 below for a summary of interviews conducted.

The builders interviewed see value with early involvement. For one they can provide early design input ensuring a constructible design within the client's budget. They can work with the designer to "package" the work and build a subcontractor team. Identifying key subcontractors early can be useful to the design team bringing into play new product ideas and technologies. This early involvement establishes fast-tracking opportunities if the owner desires this. Several builders see "CM at Risk" as the default position for project delivery as they are regularly brought in to provide pre-construction services, most for a fixed fee which later transitions into a GMP once the project design moves towards 75-85% completion with many of the major packages under contract.

The conflict in perspective addressed above really speaks to the issue of control and ultimately risk which needs to be sorted out to provide the client with the best project approach. To head the project in the right direction requires an understanding of the total project risk environment: technical complexity, work environment, client capabilities,

budget and schedule. The above was the focus of the Harvard Business Review, Master of the House: Why a company should take control of its Building Projects (Thurm 2005). Thurm outlines the reasons why he feels that the construction of the NY Times Headquarters Building was a success to include: Insist on Great Design, Demand Meaningful Innovation, Don't be afraid to think big, Dare to challenge the experts, Don't pay a fear premium, Get Involved in the Details and the Art of Value Engineering. Additionally, if an integrated team approach is utilized, a dedicated and experienced project leader is necessary to ensure timely decision making amongst the parties and to manage and maintain a collaborative work environment.

### **What are the risks that owner's face?**

The project delivery process is continually evolving: new government rules and regulations are created, new technologies are launched improving communication and information transfer, and the projects themselves keep expanding in size, complexity and impact on the environment and public. One element, however, does not change: every owner wants the project completed, better, faster and for less cost!

The process is a continual matter of balance between time, cost and quality symbolized by the often repeated "3 legged stool" analogy. Most owners understand this balance, but are challenged to manage it. My interviews, particularly with those who represented clients, revealed a continual pressure to deliver projects faster, but with reduced dedicated professional staff. The staff reductions lead to involving design and/or construction professionals in the "pre-construction" stage of the project. This is a potential boom market for qualified PM and CM firms (ENR, 2008). Design and/or construction professionals are certainly willing to provide this service, but they are not as well versed with the client organization as is the client. Therefore, "downsized" owner staffing should be identified as one element of owner risk.

Also identified through interviews is the challenge to develop a single "vision" for the project with the owner. This risk element is related to the above since with reduced professional staff the owner may not be able to dedicate an experienced owner manager for the project. Without strong owner leadership the program development may wander ultimately letting programmatic questions go un-answered or be answered by the wrong people. Late programmatic decisions may lead to "scope creep," and ultimately rework, increased costs and delays in completion.

The need for early completion which requires an accelerated design-build time frame also adds risk. This may necessitate beginning design with an incomplete program or it may force the early release of construction packages like structural steel or foundation while still in preliminary design. (Fast-tracking) Beginning design without adequate program definition also leads to "scope creep" as necessary programming arrives late. In the second instance fast-tracking commits construction dollars while still in design. Successful fast-tracking requires strong designer – builder coordination to ensure thorough constructability review and an uncompromised design.

Another owner risk is the control of costs from conceptual design through construction completion. To accomplish this owners need a thorough understanding of the owner project requirements and the physical and market conditions under which the project will be constructed. The program must be vetted with all in house constituencies and internal planners and city/town officials must be on board. The physical conditions under which the project will be constructed must be understood to include sub-surface conditions, site accessibility and other on-going owner operations. Lastly, market conditions at the future time of construction must be correctly predicted.

The environment in which a project is constructed both macro and micro can add considerable risk. Projects on a macro scale are impacted by city/town zoning and permitting regulations, competing projects in the region that may be drawing down skilled labor and materials, and abutting neighbors that must be mitigated. On a micro level, sub surface site conditions, site access and egress and scheduling and logistical procedures that must be made to minimally impact owner operations all add risk. By their very nature renovation projects and projects taken on in remote locations can be very risky.

The design and technical complexity of a project needs to also be gauged. Unique, "One-off" projects like the Beijing Olympic Stadium Complex is going to be more risky than a repeated "cookie-cutter" project like a fast food restaurant. Unique projects come with little precedent and require a high level of R&D. Design, Cost and Schedule

models rarely exist and must be developed from scratch. Success requires bringing a more experienced and varied team earlier in the project life.

**Table 2**

<b>Summary of Projects Reviewed during Interview Process</b>					
<b>Project</b>	<b>Project Type</b>	<b>Budget</b>	<b>Interviewee</b>	<b>Delivery Method</b>	<b>Comments</b>
1. Lake Road Addition	Power Plant	400M	Owner	DB	Utilized FEED
2. Lake Road Noise Mitigation	Power Plant	.2M	Owner	DBB	Worked T&M Active Owner
3. Tufts University Granoff Center	Institutional Recital Hall	27M	Architect	CM @ Risk	Limited Owner Staffing
4. MA College of Pharmacy	Institutional Mixed Use	20M	Architect	CM @ Risk	Min Risk late GMP
5. MIT Brain & Cognitive Center	Institutional Laboratory	175M	Architect	CM @ Risk	High level of Technical Complexity
6. RWU Dining Commons	Institutional Dining and Student Union	12M	Architect	DBB	
7. URI Life Sciences	Institutional Research	50M	Constructor	CM @ Risk	Builder at risk for warranties
8. Fidelity	Office Building Complex	N/A	Constructor	CM @ Risk	Extreme Fast-Track
9. MA College of Pharmacy	Institutional Mixed Use	20M	Constructor	CM @ Risk	Very Engaged Owner
10. RWU Residence Hall	Institutional Dormitory	36.5M	Constructor	CM @ Risk	Aggressive Schedule; Tight Budget
11. RWU Global Heritage Hall	Intuitiional Classroom Building	22M	Constructor	CM @ Risk	Signature Building
12. University of Hartford ISET Center	Institutional "GUT" Renovation	23M	Constructor	Pure CM to CM @ Risk	More pure CM than at risk
13. RWU Global Heritage Hall	Intuitiional Classroom Building	22M	Owner	CM @ Risk	High facility staff workload - needed a partner
14. RWU Residence Hall	Institutional Dormitory	36.5M	Owner	CM @ Risk	GMP set at 95% design
15. Barnard College Nexus Project	Intuitiional Theater Arts Building	70M	Owner Consultant	CM @ Risk	Owner struggled with timely decisions
16. NY Times Headquarters	Commercial Building	320M	Owner Consultant	CM @ Risk	Sophisticated Owner – well programmed
17. Art Gallery of Ontario	Renovation and New Construction	250M	Owner Consultant	CM @ Risk	Heavy Donor Involvement Superstar Architect
18. MIT Stata Center	Institutional Computer Science	300M	Owner	CM @ Risk	Signature Building with complex geometry
19. Pentagon Renovation	Institutional Office	1.5B	Constructor	DB	Massive Scale Aggressive Schedule
20. Baltimore Hilton Convention Center Hotel	Institution/Commercial	236M	Constructor	DB-Bridge	Aggressive Schedule Requirement to minimize owner financial risk

## **What Delivery Method options does the Owner have?**

### ***Design-Bid-Build***

In the traditional design-bid-build (DBB) approach the owner would hire a designer to produce complete (100%) bid documents and then go out to bid, and hire a constructor to build the project. Both architects interviewed felt strongly that if it all possible the owner should pursue this approach. The DBB approach provides adequate time to complete project programming, something the architects were willing to help support. A complete and thorough

design could then be completed followed by advertisement and competitive bidding. The owner receives the benefit of a competitive bidder market getting the project for a good price and the architect is able to “fine tune” the design and deliver a less compromised design. A challenge design firms face is the talent to produce complete 100% design bid documents. As projects continue to increase in sophistication much of the “design talent” rests with the subcontract and vendor community. Designers see the advantage of hiring this subcontractor/vendor talent as consultants but continuing with the DBB delivery method.

Owners interviewed saw the DBB approach differently. One owner stated that the DBB approach “took forever and that he rarely ever saw good 100% documents.” Some felt that a DBB approach could work on a “straight forward” project, but on a complex project this approach puts the client at significant risk for delays and claims. Several of the institutions’ whose projects were discussed had “downsized” to the point that only one senior person was left on staff. This “senior” person was left to manage both traditional O&M work in addition to overseeing multiple capital projects. This left little time to fully develop a complete program for each capital project. Owners recognize that without a complete program, the risk of delays and claims increase as the project scope is finalized late. In almost every instance, the owners were not willing to take the time to follow the traditional DBB methodology – time could be saved by “fast-tracking” and the owners were willing to take the risk.

Constructors interviewed saw a decline in the number of projects run with a DBB approach. One stated that less than 10% of their projects were run this way. The reasons cited include the time required, and the increased project complexity combined with a decline in designer skill set. Another stated that one client he worked with did not want to be saddled with the responsibility of arbitrating between designer and builder over changes and claims. Another constructor put it this way; an owner owns the risk on cost and schedule impacts due to unforeseen conditions, design errors and changes. Overall, the constructors saw value in being involved earlier and in working alongside the designer and owner during the preconstruction stage. One builder stated that DBB is suited for long term procurements where the owner has the funds to secure the design, the design is repetitious, and the owner has the time to secure the funding through fiscal budgeting.

### ***Design Build***

In a design build (DB) delivery method a single firm, or joint venture, is hired to complete the design and construction for a project. The builder can be hired under either a fixed price or an open GMP contract. Two interviewees had direct experience with this approach though many had opinions. Several saw this approach as appropriate for complex projects. Another felt that the success of this approach relied on a well staffed and sophisticated client group. All felt that the success of this approach was subject to well defined owner performance standards and a trustful contractor – owner relationship. One DB success story was the construction of the \$611M Washington Nationals Baseball Park which was completed in 23 months. One innovation was the utilization of design-assist where key subcontractors and vendors were heavily involved in the pre-construction stage of the project, streamlining design, procurement and constructability analyses (ENR, 2007).

One interviewee described the process of DB with a “bridge” where a client hires an architect to program a building layout and complete a design through approximately 30% design development. At this point the owner procures a DB firm to complete the remaining design and construct the facility. This approach offers some level of control while shedding some financial and constructability risk. The interviewee added that owners would be advised to develop solid performance criteria for the facility to guide the DB process. This “bridging” approach enables the architect’s vision to occur while enabling fast-tracking and the shedding of some owner risk to the DB firm.

Another interviewee from the power generation field described a similar approach. They typically apply the DB process by first engaging an engineering firm to take the project up to 10-15% design which is termed a fee based study. The owner then negotiates a guaranteed maximum price (GMP) with a DB firm based on this front end design work. This variation of Design-Build was termed a Front End Engineering and Design (FEED) process very similar to the “bridging” approach described above. Another variation this Power Industry owner uses is termed an Engineering, Procurement and Construction (EPC) Full Wrap (Fixed Price) approach. Put simply the owner establishes performance standards and the builder agrees to deliver the completed power plant for a fixed price - all project risk is passed on to the DB contractor. Liquidated Damages are imposed for missing the schedule, or emissions, performance or noise standards. [bonus for completing ahead of schedule]

## ***Construction Management (Agency and at Risk)***

In a Construction Management (CM) delivery method the constructor is engaged by the owner during the preconstruction stage of a project. Owner, designer and constructor are all positioned to collaborate through all project stages. In an Agency approach subcontractors and vendors contract directly with the owner and the CM is hired on fee basis, not at risk. In a CM at risk approach the CM through a GMP “guarantees” the ultimate project cost to the owner and the subcontractors and vendors are under contract to the CM.

### ***Agency CM***

One of the owner’s interviewed felt that the CM could be a valuable supplement to a “downsized” owner, adding expertise and supporting owner decision-making. One of the owner consultant’s recognizes the value in early constructor involvement but often struggles with constructor’s who call themselves CM’s, but still operate as GC’s – not every builder is organized and trained to operate in a Agency CM manner. One architect commented that his firm automatically adds 3% when a job is approached under a CM delivery method. One builder sees an Agency approach as ideal for large scale, complex, fast track projects such as found in the pharmaceutical industry while another builder saw an agency CM as a waste of money since the CM has “no skin in the game.” Most everyone sees the value in early CM involvement, but the owner needs to be positioned and organized enough to work with the CM. The CM and designer must also be able and willing to truly collaborate in the owner’s best interest.

### ***CM at Risk***

This approach was found to be the most popular on the projects that were considered. Owners chose this approach primarily because of the need to compress the design-build process while still attaining a GMP. Several owners also utilized the constructor to supplement depleted in-house facility departments. Most common, was for the owner to engage the constructor in two steps: first under a fixed pre-construction fee followed by a later negotiated GMP once several of the major bid packages had been awarded. The prime advantage to this approach is the ability to fast-track, attain subcontractor/vendor input, and provide the director or board, in the case of institutions, an upset project cost limit.

The question that the architects raised was what is the true value of the GMP? GMP’s provided without complete programs only serve to limit the quality of the final project hence one architect’s comment that a GMP = Guaranteed Minimum Performance. On the other hand, what value does a GMP provide if delivered late after the majority of the design is complete and most of the bid packages are under contract? In this case, the owner would be better served to wait a little longer and attain competitive bids on 100% documents.

The builders and owners agreed with the GMP issue raised above, but felt that the need to fast-track and provide a budget to a board or director outweighed the GMP controversy. One constructor and one owner representative commented that the main reason they favor the Agency approach is this false message a GMP may provide to the public or owner. Most owners, however, want this upset limit and to accommodate and get the work, the constructors agree to work at risk.

## **Conclusion**

The structure of the owner – designer – constructor team is first and foremost an owner decision. The challenge, unfortunately, is that not every owner is positioned or sophisticated enough to select the best management approach for their project. As has been discussed earlier in this paper, owner organizations are understaffed or lack the organizational leadership to make an informed decision on the best approach to take. These owners need to be educated as to their delivery options and to the market pool of designers and contractors available to them. Owners that have adequate in-house talent are well positioned, but those that don’t often turn to management consultants, designers or constructors for guidance. When called, these advisors need to “think like an owner.”

Truly acting in the owner's best interest can be a stretch for the design and construction consultants that are bought in at early stages of a project since the proper advice requires working outside one's field of expertise. Advising also requires the ability to immerse oneself within the organization – this takes time, experience, and strong leadership skills. Owner consultants must also empathize and respect the work of their professional colleagues – just as designers must respect the pressures of time and money to a constructor, constructors must respect and support the design process. Owners need and appreciate true designer – constructor collaboration and designer and constructors need the trust of the owner.

Collaboration is the “buzzword” of the industry today as design build professionals discuss ways to integrate processes and generate consensus. A number of professional organizations have developed contractual documents, consensus docs for short, to define each party's role. Technology solutions like BIM and visioning charrettes (Elvin, 2007) are both management tools that support information transfer and goal definition. What is clear from the interview process is that today's projects require cross disciplinary technical expertise and leadership at all stages of the design-build process, but particularly early when the most influential decisions are made. What is also clear is that each of our AEC professions does not alone have all of the expertise needed to make the upfront decisions that the owner needs - each needs the support of the other. The AEC team should also extend their “collaboration reach” to the subcontractor/vendor community as this is often where significant technical knowledge resides (Tommeliën & Ballard, 1997).

### **Interviewees**

Projects 1&2 Michael Kirkwood and Michael Jakubowski, BG North America Providence, Rhode Island  
Projects 3&4 Dana Anderson, Perkins and Will, Boston Massachusetts  
Projects 5&6 Roger Goldstein, Boston Massachusetts  
Projects 7&8 Michael Kennedy, Gilbane Building Company, Providence, Rhode Island  
Projects 9&10 Robert Collie, Bond Brothers, Everett, Massachusetts  
Projects 11&12 Michael Kearns, Shawmut Design and Construction, Boston, Massachusetts  
Projects 12&14 Joe Pangborn, Roger Williams University, Bristol, Rhode Island  
Projects 15&16 Roland Ferrera, The Ferrera Construction Group, Madison, Connecticut  
Projects 17&18 Nancy Joyce, Owner Consultant, Bristol, Rhode Island  
Projects 19&20 William Thumm, Hensel Phelps Construction Company, Chantilly, Virginia

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