

Progressive Contracting for Transportation Infrastructure ... a White Paper

Introduction

In recent years, there have been several discussions and papers written about things like Progressive Design Build as an alternative project delivery approach. As those in the industry know, there have been significant advances in project delivery using all types of integrated delivery during the past 2 decades, including Public Private Partnerships (PPP) and various forms of Design Build Operate and Maintain concepts with and without finance overlays.

None of these ideas are new. Early transportation systems in this country were developed and operated by private enterprise for the public benefit ... they were just not called PPP's. Design Build concepts have been around since medieval times, during the period when many of the most magnificent cathedrals were built in Europe. Progressive design build has been used in the utility industry for decades, and to some degree were memorialized in AGC and AIA contracting forms during the Eighties. More recently, the Water Design-Build Council has been developing guides for procurement documents and contract forms, including Progressive Design Build.

Simply put, a PPP is nothing more than a cooperative agreement between a public entity and one or more private concerns. Similarly, a design build approach is nothing more than the integration of engineering and construction activities under a single point of responsibility and most recently extended to incorporate the operation of the resulting system into a design, build, operate and maintain approach (DBOM) which adds the benefit of a "whole life" cost approach. The idea of a "progressive" design build simply places most, if not all the activities under a single responsibility and executes the activities in a sequential and fully integrated approach. A Progressive PPP then combines the best of a PPP with that of progressive design build (or preferably DBOM) while also integrating those funding activities necessary to pay for the endeavor at each stage of development, execution, and operation.

Consolidating responsibility and risk under a single entity not only delivers a system in the shortest time possible and at the lowest cost, but also results in a higher level of system quality as well as at the lowest total life cycle cost. In addition, if correctly done most of the unwanted changes, disputes and claims can be completely avoided. In the case of a Progressive PPP, the assets and resources of both the public and private sectors are shared under a balanced risk and reward allocation over the complete spectrum of early program development through project delivery and extending into system operation and eventually hand-back.

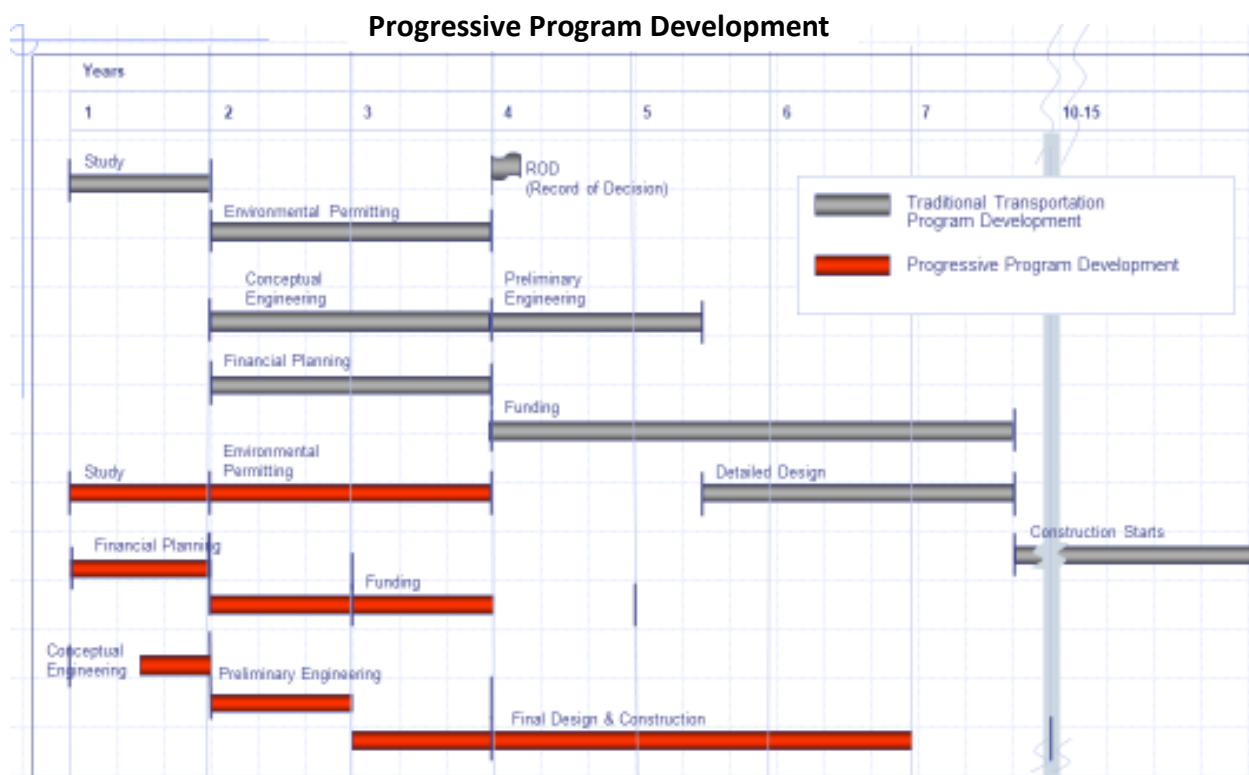
The purpose of this paper is to discuss the fundamental delivery concepts which are applicable to most infrastructure projects. Nuances of project and program financing are highly dependent on the type and use of the project and vary significantly depending on the project's ability to pay for itself [or not].

Discussion

Depending on the project procurement process utilized, there can be dramatic differences in the resultant cost and the time required to implement each phase. The success of any program revolves around several key elements including whether there is a clearly defined need for the project, having a sponsoring “champion”, local grass roots support, and ultimately a financing underpinning.

Similarly, the success of any related project includes operations planning to focus engineering, not just on design, but performance & operating objectives: early construction work planning & constructability reviews; cost and schedule integration of environmental planning, engineering, design and construction; financial advisory services to assist in developing & implementing a financial plan; and hopefully a single source of responsibility for engineering, design, construction management and related services.

Progressive Program Development allows many activities to proceed concurrently rather than sequentially and therefore reduce the overall time to place a large transportation project into operation from the traditional duration of 10 to 15 years down to 6 years; if federal funding can be avoided, a project can be implemented even faster. Remarkably, the overall cost of the entire program can also be reduced by as much as 40%.



Regardless of delivery approach, every project is broken down into at least three phases, development, engineering and construction, and finally operation. Development includes project definition, technology selection and performance planning followed by conceptual engineering, environmental permitting, cost estimating and plans of finance. Execution consists of preliminary engineering and procurement followed by final design and construction. Operation includes startup and compliance testing and ultimately operations and maintenance under a defined agreement.

The project delivery approach selected is enormously important and accounts for both cost and schedule impacts. Today, the most prevalent delivery approaches include:

- Traditional Design-Bid-Build (DBB)
- Bid-Design-Build (BDB)
- DBOM - Design-Build-Operate-Maintain
- Public Private Partnerships (PPP)
- Progressive Design-Build (PDB)

Design-Bid-Build (DBB) is the traditional method of project procurement, sequentially conducting engineering and financial studies, environmental compliance programs, and project design and construction, using a myriad of consultants, designers, and contractors, all under the management of a public agency. This process puts environmental, engineering, design, construction, and construction management under different entities without a master plan, or integrated schedule and cost estimate. Multiple construction contracts are awarded after final design is complete, and the public agency must manage interfaces among multiple suppliers, engineers, and other consultants.

DBB is a disjointed, inefficient, costly, and time-consuming process providing few if any discernible benefits to the public ... all driven by the procurement process

Bid-Design-Build (BDB) Method of project procurement, sequentially conducting engineering and financial studies and environmental compliance programs but bidding out design and construction under a lump-sum, guaranteed schedule approach. Design-Build-Operate-Maintain (DBOM) is a variant of BDB when operations and maintenance is included in the bid program. It still puts environmental and preliminary engineering under different consultants with little or no integration, but at least bids out final design and construction to a single entity (hopefully also including O&M). The public agency must still manage the interfaces between the design-builder, the environmental consultant, owner's engineer, and the financial institutions.

BDB (and DBOM) removes procurement from the critical path ... resulting in a higher quality project with less chance of large claims and multiple change orders

A Public Private Partnership (PPP) is a contractual relationship between a public agency and a private provider, to supply an essential public service through sharing of assets & resources coupled with balanced allocation of risk & reward over the complete spectrum of early program development all the way through project delivery. It puts all engineering, final design, and construction under a single entity, working to an integrated schedule and [ultimately] a guaranteed cost. The private partner assists in the development of funding sources and may arrange financing. Activities are conducted concurrently, not sequentially and eliminates at least three consultants (program manager, preliminary engineering, and final design). As in BDB, O&M may be added to the scope of the private partner.

PPPs are ideally suited to projects whose elements have the financial capacity to fund all or part of the program / project cost elements, significantly reducing the time to develop a project ...

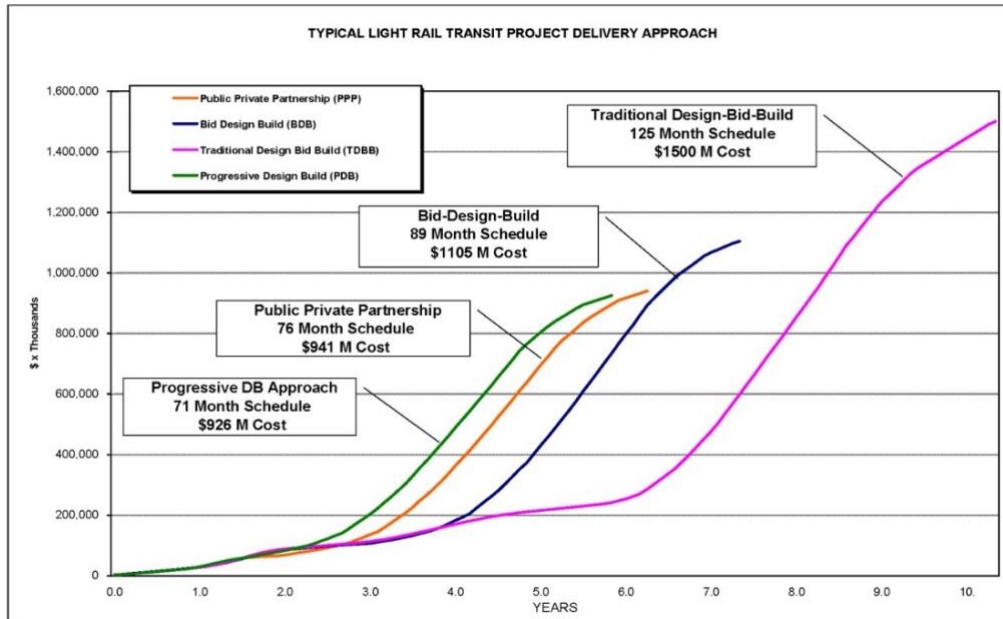
Progressive Design-Build (PDB) is a Method of project procurement, combining program development, project financing, environmental compliance and project delivery under a single program manager, sometime acting as an extension to the Public Entity.

- Puts all engineering, design, environmental compliance & construction management under a single entity working to an integrated schedule & detailed cost estimate.
- The Program Manager plays a key role in development funding.
- Program Activities are conducted concurrently, not sequentially.
- Packages design & construction into logical [lump-sum bid] segments.
- Acting as “Agents For” procurement of contracts and materials.
- Manages all interfaces under a single PM/CM

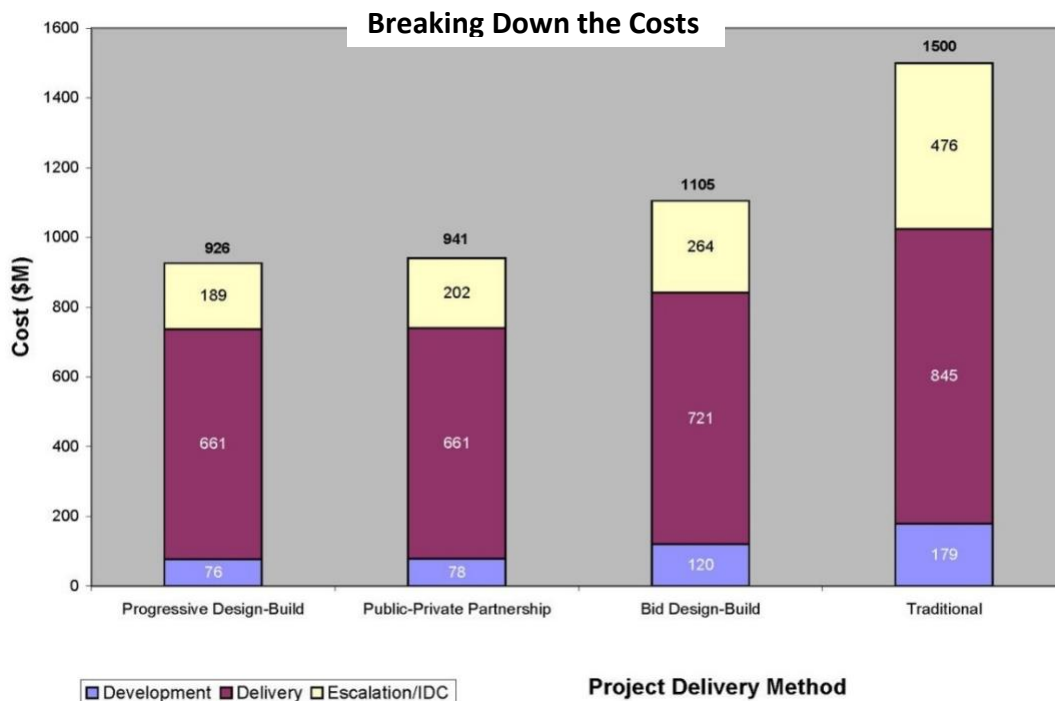
PDB allows an immediate start while shortening the time to develop as well as build the project ... if Federal funding can be avoided, the schedule is shortened even further

Using actual experience obtained through execution of actual projects such as the Hudson Bergen Light Rail Project, the South Jersey Light Rail, and the Dulles Rapid Transit expansion of the Washington Metro to Dulles International Airport, a detailed model (using the example of a typical light rail project) was created comparing not only differences in implementation schedules, but detailed breakdowns of the cost of development, construction, and short-term financing. The benefits of reduced cost and shortened implementation schedules can be summed up in a single slide clearly showing the benefits of Progressive DB delivery and the dangers inherent in traditional approaches. The results are eye opening.

Importance of Project Delivery



In addition to schedule comparisons, the model breaks down the costs into development, delivery, and the short-term cost of money, each of which plays a significant part in the total cost of a project depending on the delivery approach. If an alternate approach can reduce the cost of any one of these categories, a dramatic reduction in total cost can be achieved.



For example, in a traditional approach to delivery, only about one half of the total cost of a project is represented by design and construction: the other half entails development and the cost of money. In the case of development, engineering costs are increased by over 50% when comparing Progressive DB to Traditional Bid-Design-Build; and what should be very important to a public agency, agency costs (which include staff as well as a separate program management consultant) are over tripled!

During construction, the basic costs of material do not change much, but because of the increased time of implementation, indirect costs of site facilities and construction management also increase by over 50%. In addition, traditional methods of delivery usually result in large contractor claims due to the lack of interface coordination and integration of contracts; in the model, the costs of claims and contractor change orders increase by an astonishing 800%.

Perhaps one of the most insidious costs are those of escalation and interest during construction (short-term cost of money); both are time related and are driven by the implementation schedules. For example, in a traditional approach, over 30% of the total cost of the project is the cost of money. The disjointed activities of traditional contracting and multiple procurements result in almost a doubling of the time it takes to move a project from authorization to operation, and during this time the agency must bear the increased costs of money. These costs are not so visible to the public, but nonetheless are born by the local taxpayers, and can increase by as much as 250%! In many cases, the local tax rates may be able to support the resulting increase in the payoff period from perhaps 13 to 30 years but think of all of the additional projects that could have been funded during this time frame from the savings in project delivery; we are not talking about inconsequential numbers, but savings in millions and millions of dollars.

In some parts of North America, notably in Canada and in some financial circles in the United States, there exists a body of thought that believes if you put the risk of financing (short or long term) on the private sector, this risk allocation results in most of the reduction in cost and time of implementation. Nothing could be further from the truth. The sheer mechanics of design-build procurement are the primary reasons for these reductions.

Private sector financing does have some merit in the grand scheme of risk allocation but is largely dependent on the type of project. For example, it makes absolutely no sense to finance a typical highway project by the private sector since the combination of credit rating and tax-free bond financing clearly favor the public sector; on the other hand, a toll road project (where payments are underwritten by user fees) might very well benefit from private financing.

The mechanics of project financing get very complicated very quickly and that is not to say that some combination of private vs public financing cannot benefit a project. Placing the short-term financing risk on the private sector during the final design and construction period creates an impetus on the part of the contractor to minimize schedule impacts and complete the

project on time. Although private financing during construction may result in a small increase in the overall cost of design-build, there may be a significant benefit to the private sector in ensuring contractor performance.

Setting aside traditional Design-Bid-Build for the moment, the other methods of project delivery all embody some form of risk sharing between the public and private sectors. We learned early on in projects such as the Hudson Bergen Light Rail, that direct costs (and indirectly the cost of financing by reducing the time of performance) were significantly reduced by allowing the party best suited to manage those risks. This is especially true when measured over the complete spectrum from early development through operations, maintenance, and asset replacement. Balancing this risk allocation results in the lowest cost achievable in every instance.

Combining the balancing of risk along with the form of project delivery then results in both cost and schedule improvement, can be evaluated using probabilistic decision making. Traditional Bid-Design-Build results in both the highest risk of performance to the Public Sector as well as the highest cost exposure. Design-Build has a much lower risk factor but a moderate cost exposure. A Public Private Partnership reduces the risk somewhat but has a better cost exposure. A Progressive Design-Build improves both the risk and the cost exposure over that of a PPP and thankfully does not require any special legislation.

Balancing the Risk Lowers Cost



Looking at this combined probability, an Attractiveness Ratio can be determined that clearly demonstrates the benefits of each delivery approach, pointing out the efficacy of both Public Private Partnerships and Progressive Design-Build [or Progressive P3] approaches. Adding Operations and Maintenance to the delivery method (that is: creating a DBOM) enhances the

process even further by adding in the life cycle cost benefits of combining O&M with DB, as well as significantly reducing the risk of contractual squabbles between the builder and operator.

Risk and Cost Assessment

<u>Delivery Method</u>	<u>Risk Factor</u>	<u>Cost Exposure</u>	<u>Attractiveness Ratio</u>	<u>Ranking</u>
Progressive DB	7	3	0.43	1
Public- Private	8	4	0.50	2
Design-Build DB	7	6	0.86	3
Traditional BDB	2	9	4.5	4
Scaling Factors				
Highest	1	10		
Lowest	10	1		

Conclusions

Just to recap, Traditional Design-Bid-Build (DBB) project delivery is an inefficient, time consuming and costly practice that unfortunately is common in the industry.

DBB disadvantages include:

- Maximizes agency control but tends to result in over-designed systems.
- Maximizes agency exposure to risk issues.
- Increases the total cost and extends the time of system implementation.
- Encourages multiple contractor claims.
- Does not consider total life cycle cost considerations.
- Traditionally involves the hiring of a program management consultant in addition to one or more design engineers and environmental consultants.
- Places an extraordinary burden on the public agency.

Employing any contract form of Design-Build (BDB):

- Creates fewer points of responsibility and accountability, still providing an acceptable level of control over design.
- Reduces agency staff needs as well as risk exposure to increased cost of construction claims and change orders.
- Significantly reduces the time required for project delivery, including design, construction, and commissioning.
- Reduces the capital cost of a project (and in the case of DBOM, the overall life cycle cost of a program, while actually increasing the level of quality)
- Reduces program management, oversight and other agency administrative costs.

Taking it a step further employing a Progressive Design-Build (PDB) approach with Public-Private principles, advantages include:

- A Single Point of Accountability.
- Allows early project mobilization while minimizing agency staff needs.
- Increases agency flexibility to shape the project.
- Maximizes Value Engineering while encouraging early operations planning.
- Shortest Program Schedule and lowest project cost.
- Facilitates environmental compliance.
- Same High-Quality Result.
- Eliminates Multiple Markups and minimizes claims and change orders.
- Reduces each party's financial risk at project start, ultimately matching project and program progress to funding available.

Just as data for the cost and schedule evaluation model was developed from actual experience during execution of the Hudson Bergen Light rail Project (over \$1.8 Billion in scope), the idea for Progressive Design-Build/DBOM came from actual design and construction experience going back over 50 years in the utility/power plant industry. Performance goals and conceptual engineering were developed into a design and operating basis document after which design and construction was performed on a discipline basis (site preparation/concrete/steel/etc.) using a limited number of contracts ... all to a fully integrated schedule.

Over many years of hands-on experience, standards were developed for the successful execution of projects including organizational structures in both the office and field, definitive project scope and design/construction criteria, integration of cost estimates and schedules, strong commercial language for administration of purchase orders and contracts, and meaningful status and performance monitoring.

In the case of transportation infrastructure, projects should not be built by "segment" but by type of work [subsurface/paving/guideway/rail/systems/etc.] This process results in the shortest delivery time frame while at the same time eliminating those [unnecessary] construction interfaces that traditionally result in claims and changes. In the case of more complicated rail systems, DBOM works best to achieve the same goals.

Public Private Partnerships allow combinations of the best of each approach; however, Progressive Design-build provides all the process and financial benefits of a PPP without employing the need for special legislation ...

Recommendation

Procure the work under a Progressive Design-Build approach including requirements for Operations & Maintenance.

- Select the PDBOM team base upon qualifications using “Best Value”.
- Extend the team scope to include that of Owner’s Engineer and Environmental Consultant.
- Be mindful of and control inter-agency processes.
- Avoid Federal Funding if possible.

About the Author



Ben Redd has made a career out of the engineering and construction business for over 40 years. Following graduation from the U. S. Naval Academy and service in the Nuclear Power Submarine Program, Ben joined United Engineers & Constructors Inc. (a subsidiary of the Raytheon Company) where he obtained a professional engineering license working in the design and construction of commercial nuclear power plants. Over the years, he held many other project and executive level positions including President and CEO of Raytheon Infrastructure where he was responsible for the award and execution of the

Hudson Bergen Light Rail Project, the first Design-Build-Finance-Operate-Maintain project in North America.

Following retirement, he formed the organization, Integrated Program management Services, the purpose of which was to offer innovative solutions to structure, develop and execute large scale infrastructure projects. Currently acting as a Senior Advisor to P3 Collaborative, Ben lives in Warrington, Pennsylvania with his wife Joanne.