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Progressive Design-Build: Its Functions as a Contracting Method and the Four Pillars of Project Success

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Abstract: As a project delivery method, Design-Build (DB) has provided owner, architect, and contractor groups with a process of early design and rapid construction for the past three decades. Although there are many benefits to using standard DB, dissatisfaction has arisen due to limitations to innovate, limited owner involvement during design, and often lengthy procurement. Progressive Design-Build (PDB) has become an appealing alternative providing benefits not seen with standard DB. This paper investigates how PDB impacts a project and how it compares against standard DB; it also presents a proposed framework for evaluating the owner's responsibility and assessment of a project, which we named the "Four Pillars of Project Success". The four pillars are defined with respect to an owner's responsibility and assessment of a project, including *project predictability*, *project risk*, *project schedule*, and *project cost*. We conducted a literature review, examined several public project case studies, analyzed PDB project information collected by the Design-Build Institute of America (DBIA), and held stakeholder interviews with owners, contractors, and architects who have used both PDB and standard DB. This paper offers insight into PDB's structure and outcomes so an owner group can make an informed decision when considering PDB as their next construction contracting method.

Key words: Progress Design-Build, Project Delivery, Project Predictability, Public Owner, Design-Build.

1. INTRODUCTION

Design-Build (DB) has been a popular construction project delivery method because of its early integration for efficient project delivery and real-time pricing for design documents [1]. These attributes provide stable costs and schedules for both owners and contractors. DB has seen many iterations of use on construction projects, exposing dissatisfaction for owners. Progressive Design-Build (PDB) is a new construction contracting method primarily in the public sector which aims to accommodate owner needs in unique ways [2]. These unique ways include how PDB divides the builder's contract into two phases, one for design, and one for construction [3]. PDB allows design-builder agencies to submit proposals without drawings to allow for more design options for the owner. Since PDB operates primarily in the public sphere where schedules and budgets are

typically tight for delivery to the general public or agencies [2], PDB uses its unique functions to accommodate these needs and provide owner aimed benefits throughout the project delivery process. In our paper, we used literature review, Design-Build Institute of America (DBIA) archive of statistics data, and stakeholder interviews to create a baseline guide for owner groups looking to use PDB on public projects. Our focus will be on the critical functions of PDB in practical application and a discussion of our "Four Pillars of Project Success": Project Predictability, Risk, Schedule, and Cost. We aim to provide informative breakdowns of PDB's impact on project outcomes for each pillar and conceptualize practical outcomes.

2. METHODOLOGY

2.1. Our Approach to Literature Review and Case Study Analysis

Literature review formed our understanding of DB functions, owner dissatisfaction with DB, the fundamentals of PDB, and how PDB remedies DB dissatisfaction. We created three of our four pillars through literature review, but the basis of project predictability and risk were more difficult to quantify compared to cost and schedule. Through extensive literature review and case study analysis, we were able to collect definable features of success for project predictability and risk for owners, therefore establishing our creation of most of the "Four Pillars of Project Success". Our case study was grounded in our stakeholder interviews, in which we learned about the inner workings of PDB from those who executed the project.

2.2. Data Collection

Through the Design-Build Institute of America (DBIA) archive of statistics on DB and PDB projects in the United States, we were able to collect data on schedule and cost to compare DB and PDB projects. In our data collection, we hedged skewed data points from COVID-19 impacts by solely using projects which started during or after March of 2020. We summarized 50 projects from both DB and PDB projects respectively and found the average cost escalation and schedule overrun between the two delivery methods. The comparison of cost escalation and schedule overrun between PDB, and DB are discussed later in the sections "Pillar 3: Project Schedule" and "Pillar 4: Project Cost". Our methods of calculation are in Equation (1) and Equation (2) below.

$$Cost\ Escalation\ \% = AVG\left(\left(\left(\frac{\Delta\ Actual\ Cost}{\Delta\ Contract\ Cost}\right) - 1\right) x\ 100\right) \quad (1)$$

$$Schedule\ Overrun\ \% = AVG\left(\left(\left(\frac{\Delta\ Duration}{\Delta\ Contract\ Duration}\right) - 1\right) x\ 100\right) \quad (2)$$

2.3. Stakeholder Interviews

The key stakeholders which were interviewed to build upon our findings were from commercial general contractors, owner groups, and design agencies. All interviewee groups have experience executing PDB in Seattle, WA. The purpose of the stakeholder interviews was to form our understanding of the "Four Pillars of Project Success" and understand the practical application of PDB on projects. The interviews illustrated the functions of PDB and how PDB affects project outcomes for owners. We developed one of our four pillars, project predictability, through stakeholder interviews.

3. LITERATURE REVIEW: MECHANISMS OF PROGRESSIVE DESIGN-BUILD

PDB has unique attributes which aim to aid owner groups in providing successful projects. The main functions of PDB differ from other project delivery methods like DB, Integrated Project Delivery (IPD), General Contractor/ Construction Manager (CMGC), and Design-Bid-Build (DBB) in contract structures, risk management, budgeting techniques, and providing for owner needs.

3.1. DB Dissatisfactions and PDB Remedies

Although DB has provided successful outcomes within its project delivery structure, there are three distinct dissatisfactions we recognized for owners using DB. First, limited innovation within the design is a downfall for owner success, which is caused by the architect being hired directly by the general contractor with no input from the owner [4]. Second, frustration over limited owner involvement is due to design progressing 30- 35% on average before the design-builder proposal, leaving the owner behind in design involvement before starting [4][5]. Third, the Request for Proposal (RFP) process to select the design-builder requires extensive time and financial resources from the owner [4].

PDB can help owner groups remedy the above dissatisfactions in the following ways. First, PDB fosters more innovation in design because the design-builder entity is selected based on qualifications without design, so the owner is involved in the design from the beginning [3]. Second, PDB requires the involvement of the designer and builder in the beginning of a project with no design, allowing the owners to save budget and time [3]. Third, PDB divides the design and construction phases into two contracts, so the owner can “off-ramp” a contractor that is not meeting design and construction expectations, or when GMP negotiation cannot be reached [4].

3.2. Master Contract without Design

The contractual relationships of PDB are similar to DB. In DB, the design agency partners with the general contractor, and together as the design-builder, they complete 30- 35% of a design [4][5]. The owner will partner with the design-builder to carry the design to construction. In PDB, the owner will select the design-builder through a Request for Qualifications (RFQ) process with no design developed prior to selection [6]. Once selected, a master contract is signed to partner the owner and the design-builder. Once the design process begins, the owner is an integrated and active participant in the development of design and budgeting [7]. Moreover, the owner can receive a larger number of qualified contractors bidding for the various scopes of work in PDB because the RFQ selection process requires less submission material, like an estimate, to bid [3]. The difference in the participation timeline and structure is outlined in *Figure 1*.

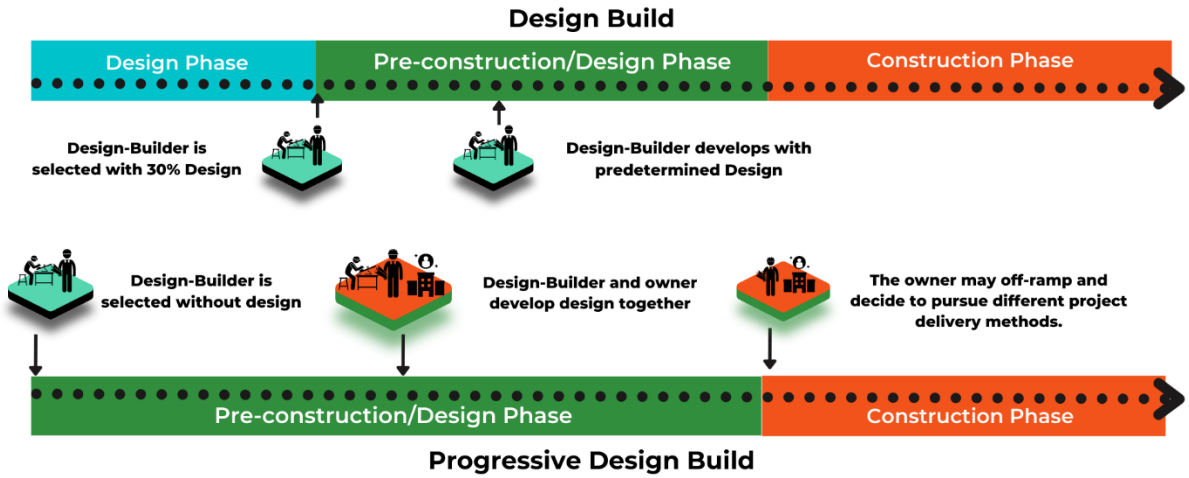

Figure 1: DB vs. PDB Participation Timeline and Structure

3.3. Two-Phase Contract and Off-Ramping

When selecting a team to execute the design-build of a PDB project, the owner has two options. The owner can either select a pre-established design-builder partnership through RFQ then proceed to design, or the owner can select the contractor first through RFQ, then in tandem select the architect through RFQ [6]. This design-builder then moves to design. This process is outlined in *Figure 2*. Once a team is assembled, a two-phase contract structure between the owner and design-builder is established [3]. Unlike a single design-build contract in DB [6][7], PDB splits these actions into two different contracts for the design-builder: design (phase 1) and construction (phase 2) [3]. This initial agreement, as outlined in *Figure 2*, binds the design-builder to design (phase 1), with the option to continue the partnership later into construction (phase 2) at the owner's discretion. The owner can choose to "off-ramp" the design-builder before the phase 2 contract is established, discontinuing their relationship on the project, and leaving the phase 2 contract vacant [4]. If the owner chooses to "off-ramp" the design-builder, the design-builder will complete the construction documents for new contractors to bid the construction services. In PDB, the design-builder owns the documents, so when the owner "off-ramps" the design-builder, the documents transfer ownership to the owner.

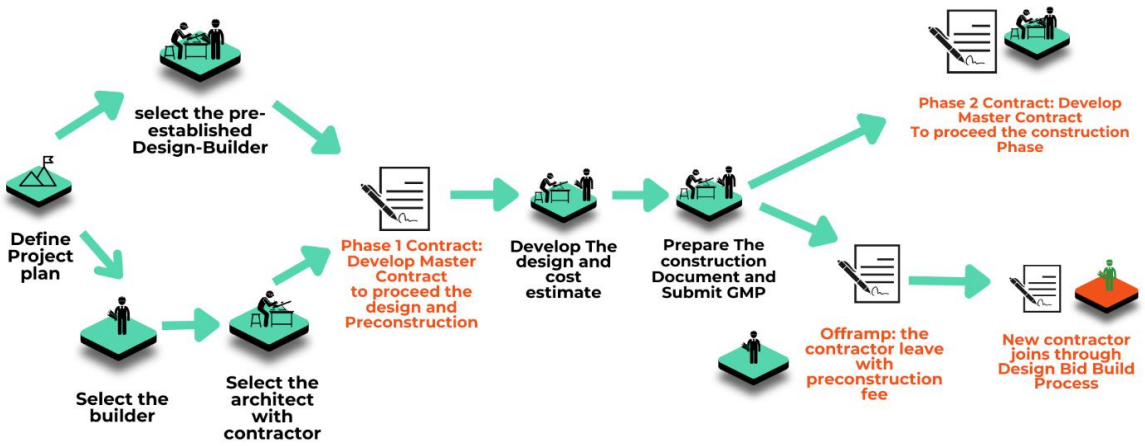

Figure 2: Flow Chart of Two-Phase Contracting

3.4. Risk Allocation in PDB

A popular alternative delivery method, like PDB, is Integrated Project Delivery (IPD) which is known for its division of risk between the owner, architect, and contractor. IPD operates under the premise that each entity shares equal risk on a project. However, PDB uses a method called risk allocation, which adjusts responsibility for managing risks to the party most specialized to mitigate those specific risks [8]. Risk allocation in PDB occurs between phase 1 design and phase 2 construction, where each party discusses who is best suited to manage each risk [8]. Each party is then compensated for its management through higher fees based on the probability and estimated costs of those risks [8]. PDB's risk allocation process is important to the owner group because unlike new ways of sharing risk in IDP, PDB does not put the owner at the mercy of another party for protection against potential damages.

3.5. Budget Reclamation and Target Value Design

PDB utilizes a budgeting technique called Target Value Design (TVD), whereby the owner adjusts its budget for each scope of design, like cutting pieces of a pie [9]. TVD occurs early in phase 1 design, so it is an integrated process between the owner, architect, and contractor. This is an attractive cost reduction method compared to value engineering typically seen in DB because TVD pushes for potential alternatives for best value budgeting [9]. "Budget Reclamation" is a term coined in this paper to represent the allocation of unused budget on one scope of work to cushion the budget for future scopes. TVD allocates budget to specific scopes, and if those scopes are executed with costs less than budgeted, the remaining can be reclaimed by other scopes through "Budget Reclamation".

4. FOUR PILLARS OF PROJECT SUCCESS

4.1. Pillar 1: Project Predictability

The first of four pillars we recognize as important project outcomes for owners using PDB is project predictability. We define project predictability as the ability of an owner to forecast, with reasonable certainty, the outcomes of the project budget, schedule, community impact, safety, and

quality prior to execution. Predictability on a PDB project is influenced by the owner's early involvement in design. For an owner, one of the most important outcomes of a project is the project's community impact. In construction, community impact is the health, safety, and socio-economic impact a project brings to an area. Such an impact is better achieved through PDB because of increased outcome predictability with early team integration, budgeting development, and assessment of operational threats post turnover with a Design-Builder. Outcome predictability is created by the owner's prescriptive role in the development of design and preconstruction services where budgets are developed, and risks are assessed [3]. A budget serves as a major source of predictability for an owner using PDB due to TVD and "Budget Reclamation". TVD allocates budget to the design of different scopes. But when those scopes are executed and the cost control measures are adjusted to reflect actual costs, "Budget Reclamation" is used to reallocate unused budget to further other scopes. The use of TVD and "Budget Reclamation" gives owners control over the ability for a scope to be procured. This control is created by the integration of parties in phase 1 design, which creates transparent expectations and encourages collaboration, providing clearer predictability to owners on future outcomes.

4.2. Pillar 2: Project Risk

The second of four pillars we recognize as important project outcomes for owners using PDB is project risk. We define risk as to the possible negative consequences that can be faced during and after a project. Construction companies are risk-prone, with a start-up company mortality rate of 70% [1]. The act of the owner passing risks to the general contractor in traditional formats of risk dispersion is called Risk-Shredding, and this process increases cost through higher contractor markups as compensation for larger risk responsibility [8]. It is estimated that of all cost increases due to risk shredding on traditional projects, 77% are absorbed by the owner [8]. This is because any unrecognized risk becomes the owner's responsibility. Unlike the traditional idea of risk shredding where parties push risks among themselves to avoid the burden of that risk, PDB uses a tactic called risk allocation, as outlined in the previous section "Risk Allocation in PDB" [8]. There are two main benefits of using risk allocation on PDB projects. The first is the increased foresight an owner gains on potential project risks. Risk allocation opens the conversation early in phase 1 design, helping to preemptively identify foreseeable risks using matrices and comparing risks to their level of importance and probability of occurring [8]. Secondly, allowing the best-fit party to control the risk on a project through risk allocation, owners can transfer risks, like contaminated soils or design faults, that would otherwise burden their responsibilities on a project [7].

4.3. Pillar 3: Project Schedule

The third of four pillars we recognize as important project outcomes for owners using PDB is the project schedule. Schedule overrun is possibly the most important concept for project teams because overrun dictates many financial and contractual downfalls. DB has many advantages in its structure to manage schedules well, like high-level coordination early in the design-build process [5]. DB also faces some negative consequences due to its structure. For example, DB has long RFP periods which last, on average, 638 days, compared to the RFQ period in PDB which, on average, lasts 281 days [4]. When we analyzed the difference in average schedule overrun between the two types of projects using the DBIA data from over 50 PDB and DB projects, we found that projects implementing PDB, on average, finished 1.4% faster than contracted. On the other hand, DB, on average, finished 2.01% slower than contracted. This means PDB projects finish 3.41% faster than DB projects relative to their contracted duration, and we can reasonably

conclude positive schedule impacts with the use of PDB [2]. It is estimated that this positive schedule impact is due to early party integration and collaborative schedule projections. Our process of calculating the difference in schedule impacts between PDB and DB projects is outlined in the previous section “Data Collection”, using formula (2). The sample projects were collected from the DBIA database.

4.4. Pillar 4: Project Cost

The final pillar we recognize as an important project outcome for owners using PDB is project cost. We define project cost as the cost of work performed compared to the contracted cost projections. On public projects, there is a goal to use all available budgets in order to utilize the publicly allocated funds for a project by the city, state, federal government, or local municipality; owners are not looking to leave money on the table. On PDB projects, incentive programs for the general contractor and Value-Added Scope are two techniques utilized by the owner to increase total cost and bring value to the project. Owners can use an incentive program with the contractor where an "incentive" fund for the builder accumulates as they procure more items while staying under budget. Value Added Scope is the process where additional procurement items are proposed and implemented by the design-builder to complete the owner’s wish list of items, and as those items are fulfilled under budget, the owner adds money to the incentive account which is paid to the contractor at the end of the project. Cost-increasing measures are to the total benefit of the project, and the benefit offsets the cost increase. Conversely, a cost-saving advantage of PDB is the using PDB's RFQ selection process. The RFQ selection process creates greater buy-in from contractors and architects in performing phase 1 design [3]. In the same comparison discussed in “Pillar 3: Project Schedule” of 50 PDB and DB projects, respectively, we found that PDB projects had a cost escalation percentage of +3.63% on average, while DB projects had a cost escalation percentage of +3.28%. This cost escalation was calculated from the formula (1) that is described in the Data Collection section. The sample projects were collected from the DBIA database. This similarity in escalation is due to PDB operating primarily in the public sphere [2], which looks to apply budget with cost-increasing tactics like incentive clauses, "Budget Reclamation ", and Value-Added Scope.

6. DISCUSSION AND CONCLUSION

Although PDB provides many unique opportunities for owners, it is not a catch-all solution for projects. The most important aspect of a successful PDB project is a knowledgeable owner group utilizing PDB’s structure to aid in executing the owner-aimed benefits it provides. As seen through the “Four Pillars of Project Success”, PDB has very specific implications for each results: owner’s predictability of outcomes is increased through early involvement of parties, “Budget Reclamation”, and TVD; project risks are mitigated and allocated to the fittest parties if not completely abated; project schedule is expedited through early party integration in design (phase 1); and finally, the project cost is intentionally not lowered, allowing room for further satisfaction of owner goals through “Budget Reclamation”, incentive programs, and Value Added Scope.

Finally, the purpose of our paper is to provide helpful information about PDB for owners, but the knowledge of these topics is only a preliminary step. All stakeholder interviews used in this paper were conducted with highly experienced construction and real estate professionals with well-developed understandings of how to successfully implement PDB. Still, we recognize the limitation that our stakeholder interviews were from local projects exclusively in Seattle, WA. Another limitation is this research used PDB projects exclusively in the public sector and private

sector application will require further research. A final limitation was the DBIA data we use for schedule and cost analysis all came from projects which started during or after March of 2020. Further research is needed on PDB projects and their impacts on the "Four Pillars of Project Success" with our limitations factored.

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