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ANALYZING CHARACTERISTICS OF DESIGN BUILD DELIVERY SYSTEM IN KOREA

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ABSTRACT

Design build (DB) is a construction project delivery system which has become one of the favored ones and the growth of DB by the public agencies has been steadily increasing. DB can be viewed as an evolutionary project delivery system, since DB project team members collaborate on work with each other, keep seeking cost effective and innovative alternatives that meet the construction needs of the project. Thus DB outperformed others in delivery speed, cost saving, and turnover quality. In Korea, DB projects likewise have steadily increased that it is needed to analyze characteristics of DB delivery system in Korea. For that purpose, this research would offer an analysis of characteristics of DB delivery system in Korea by investigating the public market trend, comparing DB performance to DBB, and analyzing questionnaire survey.

KEYWORDS

Delivery System, Design Build, Design Bid Build, Performance Comparison

1. INTRODUCTION

1.1 Research Background and Objectives

Design build (DB) is a construction project delivery system which has become ones of the favored ones and the growth of DB by the public agencies has been steadily increasing. Numerous studies over the years have been conducted to measure its performance. The results show DB projects to outperform design bid build (DBB) in cost, construction schedule, changes, and rework (Konchar & Sanvido 1998, CII 1998, Ibbs et al 2003). In Korea, DB was introduced in 1975 and the portion of DB project was kept about 10% until 2000 in the public sector. Since then, DB projects have steadily increased, with 26% of public projects being procured by DB in 2005.

Together with quantitative expansion, the Korean government made an effort, such as ‘A Plan for Increasing DB Projects (1996)’, and ‘A Plan for Increasing Efficiency of Public Project (1999)’ for making DB a better system in Korea. Since the plans only consist of descriptions of project scale and a list of project types for choosing the delivery system, they cannot avoid critique (Seo 2003).

The research literature of DB in Korea is drawn on for the suggestions of problems of objectivity of bidding method, confidence in evaluation, high cost for proposal (Kim 2004), high contract price, and exclusive possession of major contractors in market (Lee 2004). However, previous research had been analyzed fragmentarily based on the present state without analysis of empirical data and performance. Consequently, they have limitations of diagnosing present state, tracing the origin, and thus they suggest short term prerequisites for improving.

Therefore, the purpose of this research is to offer a result of analyzing characteristics of DB delivery system in Korea by comparing performance to pervious research and conducting a survey for suggesting prerequisites for improvement. This research would make a contribution to construction industry as a means of being the basis of systematical performance analysis, and developing delivery system in Korea.

1.2. Problem Statement

Despite DB projects in Korea have steadily increased, only a few contractors join the bidding, before prequalification and several big contractors are successful.

1.3. Research Scope and Process

In Korea, DB is generally called Turn Key, but there is a difference. DB means that contractors would be responsible for design and construction, but Turn- Key means that contractors would be responsible not only for design and constructions but also for equipping the facility to be ready to run. So, in this paper, the word 'DB' is used for analyzing characteristics design build delivery system, especially in the public sector, in Korea. Overall process of this research is as below.

(1) Define delivery systems and understand general characteristics of DB from literature review.

(2) Investigate the public market trend, compare performance comparison between DB and DBB and conduct a survey for analyzing the present feature of DB in Korea

(3) Analyze characteristics of DB by comparing between result of above mentioned and previous research.

(4) Provide practical a guide to assist owner and suggest prerequisites for improving DB delivery system

2. BACKGROUND

2.1. Delivery System

There are several definitions of delivery system. In this paper delivery system is a system that regulate the roles and responsibilities of planning, design, construction, operation and maintenance to participants. Thus, three principle delivery systems are used, DBB, DB, and construction management (CM), according to making up the roles and responsibilities of architect, contractor, and construction manager one another.

2.2. Design Build (DB) Delivery System

DB is an outgrowth of a project delivery system steeped in antiquity, dating as far back as the construction of the pyramids in 1596 B.C., and an industry-driven program to find a better project delivery system (Levy 2006).

Recently, the traditional DBB project has become design-bid-redesign-rebid-build project. Budget prepared by the owner often fall short of the actual cost of construction, requiring expensive redesign, making less acceptance of value engineering, and delaying in bringing the project on stream. Because the construction project has become mega-sized, complicated, and the level of client's requests is raised.

Searching for a better project delivery system is a continual process. The construction manager (CM) and design build (DB) concept presents another alternative to the conventional DBB method. Especially, DB can be viewed as an evolutionary project delivery system, since DB project team members collaborate on work with each other, keep seeking cost effective and innovative alternatives that meet the construction needs of the project. Thus DB outperformed others in delivery speed, cost saving, and turnover quality. The report form U.S. Legislative Analyst's Office (LAO) presented in February 2005 compared two primary construction delivery systems-DBB and DB (Table 1).

Table 1 Construction Delivery Processes: Pros and Cons. [Courtesy: Legislative Analyst's Office (LAO), State of California]

Advantages	Disadvantages
DBB	
- Building is fully defined - Competitive bidding results in lowest cost - Relative ease of assuring quality control - Objective contract award - Good access for small contractors	- Agency gets involved in conflicts and disputes - Builder not involved in design process - May be slower - Price uncertain until construction bid is received - Agency may need more technical staff
DB	
- Price certainty - Agency may avoid conflicts and disputes - Builder involved in design process - Faster project delivery - Agency needs less technical staff	- Limited assurance of quality control - Subjective contract award - Limited access for small contractors

In 2002, a report prepared for The National Institute of Science and Technology (NIST) and the Construction Industry Institute (CII), in conjunction with ongoing research by the Building and Fire Research Laboratory (BFRL) can be noted briefly:

- DB projects are four times larger than DBB in terms of project cost
- Public sector projects make less use of DB projects than private sector projects
- Industrial projects made greater user of DB than building projects in the residential or commercial sector
- Overall, owner submitted DB projects outperform DB build projects in cost, construction schedule, change, and rework.

3. INVESTIGATE THE MARKET TREND

3.1. DB Projects are Steadily Increasing

There is a striking change of increasing DB projects in Korea recently, in the public sector. From 1975, the year DB was introduced, to 1994, the average DB projects per year were at most 7 projects. Total DB projects were merely 107 projects during these 17 years. Until the year end of the year 2000 the projects using DB occupied only about 10%, and since then, the growth of DB by the public agencies have been steadily increasing. In 2005, projects worth about $13 billion, 26% of public projects, were delivered using DB. (Figure 1)

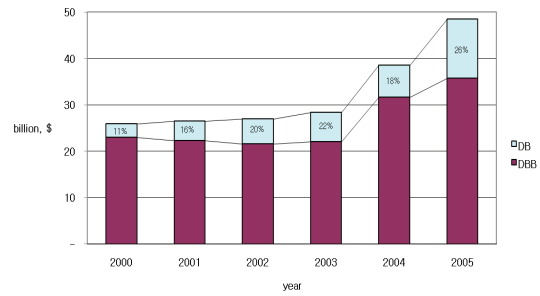

Figure 1 Overview of DB Project Increasing (Public Sector)

3.2 Only a Few Bidders Submit a RFP Responding

Generally, the more DB projects in the market, the more bidders are joined to the tender. However, in Korea, only a few bidders participate in DB bidding. In the early 1990's, only 3 to 5 bidders joined DB projects, and in the late 1990's, this did not exceeding 3 attendants. For the last 3 years, the number of DB bidders, that have submitted a request for proposal (RFP), was below 3. In contrast to DB, the mean bidders of DBB project were 355~536. (Table 2)

Table 2 Overview of Number of Mean DB Bidder

	2004		2005		Oct. 2006	
	DB	DBB	DB	DBB	DB	DBB
Bid attendant	2.5	355	2.5	396	2.5	536

3.3 Only Several Big Contractors are Successful

Although DB projects by the public agencies have been steadily increasing, the diversity of contractors, which were successful in DB bidding, has not altered for the better. During recent years, the top 6 contractors account for ver 67% of public DB projects exclusively. (Table 3)

Table 3 Overview of Award DB Contractors

year	2002	2003	2004	2005
% of the top 6 contractors in successful DB bidding	79.9	81.7	67.3	67.8

4. ANALYZING CHARACTERISTICS OF DB IN KOREA

4.1 Comparison of Delivery System Performance

4.1.1 Factors for comparison

For comparison of delivery system performance, many kinds of factors such as cost change, contract price, cost growth, unit cost, intensity, construction/procurement speed, construction schedule growth, unit construction day, schedule change, productivity, quality, and claims are putted these to good used (Ibbs et al 2003, Konchar & Sanvido 1998, Hyun et al. 2000).

Similarly, this paper sets limits to cost growth, budget growth, construction schedule growth, and owner satisfaction for comparing delivery performance between just DB and DBB projects. There is a cost limit that has been provided to bidders before biding, they have to tender less than this budget, and most of public projects have been completed within the budget, so budget growth carry an important meaning in Korea. Thus, cost, budget, and construction schedule growth could be measured by empirical 19 project data (6 are DB, and 13 are DBB), owner satisfaction could be measured from questionnaire survey.

(1) Cost

Cost growth (%) = [(final cost – contract price) /contract price] *100

Budget growth (%) = (final cost / initial budget)*100

(2) Construction schedule

Construction schedule growth (%) = [(total time used – initial contract time)/ initial contract time]

(3) Quality

Owner satisfaction: taken by owners, was defined as the degree to which the facility met expected facility requirement.

4.1.2 Overview of empirical project data

There are 6 DB, and 13 DBB building and road projects 2000 to 2007 that were chosen for comparing performance, similar to a previous research done by NIST in 2002, In Korea DB projects are at least two times larger than DBB in term of project cost (Table 4).

Table 4 Overview of Empirical Project Data

	project	Initiate date	Scheduled date	Budget($)	contract price($)
DB	A	5-Jan-02	4-May-04	37,726,799	35,795,187
	C	29-Dec-00	28-Dec-02	44,214,870	35,491,276
	D	30-Aug-04	29-Aug-06	46,154,663	40,076,094
	E	16-May-01	15-Mar-03	27,613,721	24,543,075
	F	17-Dec-03	31-Oct-04	13,562,282	11,650,000
	G	24-Oct-05	15-Jun-07	13,000,000	9,295,000
DBB	H	21-Jun-04	1-Sep-05	2,322,320	2,014,845
	I	22-Nov-02	22-Mar-04	3,459,741	3,001,325
	J	22-Jun-04	20-Aug-05	2,328,041	2,019,576
	L	24-Dec-02	31-Dec-03	3,384,210	2,936,141
	M	10-Jun-04	18-Jul-05	1,710,068	1,485,707
	N	30-Dec-04	18-Aug-06	13,611,326	11,708,463
	O	8-Jan-01	19-Jun-02	9,264,345	8,089,626
	P	30-Dec-04	13-Jan-07	20,109,765	16,998,784
	Q	21-Nov-03	31-Dec-04	8,297,900	6,833,321
	R	4-Oct-04	31-Jan-06	5,855,092	5,032,452
	S	19-May-04	10-Jul-05	5,405,525	4,689,293
	T	30-Dec-02	27-Apr-04	6,953,173	5,923,408
	U	20-Jun-01	11-Nov-02	7,313,463	6,278,608

4.1.3 Results of performance comparison

There is not a significant difference in performance between DB and DBB; DB median Cost growth is 4.04%, DBB is 3.73%. DB median budget growth is 88%, DBB is 89.21%. And it was also found that both delivery systems were completed within the initial budget.

However DB was found to have the greatest construction schedule growth at 14.62%, followed by the DBB approach at 8.92%. The reason why

median construction schedule growth of DB project was high was that DB contractors in Korea, government permissions in the construction stage, moreover DB projects were conducted short pre-construction preparing such as site survey, preliminary examination, and etc., compared with DBB projects. It was found that in owner satisfaction in quality between DB and DBB, which was measured by survey similar or DB is slightly better than DBB.

4.1.4 Analyzing

Over the years, many researches, especially in U.S., have been conducted to gauge and compare the performance of DB delivery system. One such previous research by Konchar & Sanvido (1998) looked at U.S. 351 building projects in order to compare DB, DBB, and CM delivery systems. That research showed that generally DB projects outperformed the others in cost, schedule, and quality. CII (1998)'s report had the same result. As well as, Ibbs et al. (2003) which searched effective project delivery systems to maximize project performance by analyzing 67 global construction project from CII database. As a result, DB is most effective for shortening schedule.

Hyun et al. (2000) analyzed and compared delivery performances, particularly DB and DBB, concerning schedule, cost, quality, and claim of 33 projects procured by office of Seoul. In the case of road and building project among this research, DB is outperformed DBB in quality, but in savings of cost and construction schedule, DBB was better than DB. However, result of delivery system performance comparison in this research is not similar to previous. There is no great difference in cost, DBB is great in construction schedule, and DB is similar or slightly great in quality. (Table 5)

Table 5 Comparison with Previous Research

	cost		schedule	quality
	cost growth	budget growth	schedule growth	owner satisfaction
Konchar & Sanvido (1998)	DB<DBB	-	DB<DBB (complex office) DB>DBB (light industrial)	DB>DBB
CII(1998)	DB<DBB 5.2%	-	DB<DBB 11.4%	-
This research	DB>DBB 0.67%	DB<DBB 1.21%	DB>DBB 6.33%	DB≥DBB

4.2 Questionnaire Survey

4.2.1 Questionnaire organization

The questionnaire was composed of three phases, the first phase is about respondent profile, the second phase about respondent's awareness of characteristics of DB in Korea, and the third was about the cause of those kinds of characteristics.

4.2.2 Survey respondents

Over 41 surveys were conducted with 13 public owners and 28 contractors (and architects) to identify underlying causes of the above-mentioned phenomenon in DB. Among survey respondents, 69% out of owners had working experience in less than 3 DB projects, 32% of contractors had less than 3, and 46% out of contractors had experience of more than 9 DB projects.

4.2.3 Result of survey

(1) Respondent profile

41 surveys were conducted from 13 owners, of which 85% of them had a career in construction for over 10 years, and 28 contractors, all of whom had over 15years of experienced as professionals in construction. In particular, respondent's experience of DB project were: 69% of owners had less than 3 DB projects experience, 23% had 3 to 5, 8% had 6 to 8, and none of the owner respondents had over 9; 32% of contractor had less than 3, 14% had 3 to 5, 7% had 6 to 8, and 46% had more than 9 DB project experience. Weighted mean number of DB project experience of survey responding for contractors was 8.25 and for the public owner 3.15 projects. Career length in the construction industry of contractors was over 16years, and the public owner is 13.31 years, on average.

It was found that public owners had not sufficient DB project experience not only for their career but also for contractors had, relatively.

(2) Respondent's awareness of characteristics of DB in Korea

of expecting cost saving; contractor's answer was not different from owner's; 47% of contractor respondents expected high quality, 28% of contractors expected timesaving, and 21% expected cost saving. Consequently, the first.

advantage in DB is high quality, the second is timesaving, and they did not particularly count on cost saving in DB projects

Survey about the basis of that judgment, which could be relied on their own experience, or successful case of other countries, or information from expert, or etc., was conducted: only 46% of owner answered that judgment was the based on their own experience, 23% answered successful case of other countries, and 31% answered information from expert. In other word, it was found that over half of the owners considered that DB delivery system is better than DBB not form owner's experience but from other countries' successful case or expert opinion. On the other hand, 74% of contractor answered that was based on their own experience, merely 7% answered successful case of other countries, and 15% answered information form expert.

(3) The causes of characteristics of DB in Korea

58.8% of the respondents cited the high cost of responding RFP as the limiting factor keeping only a few construction companies that are able to take high risks from bidding in a DB project. In Korea,

a company cannot be responsible for both construction and design. So, the DB team has to be made for attending DB bidding between construction company and design firm, and besides, generally, construction company takes responsible for cost of preparing bid. It was an answer that

54.2% of respondents thought that the influence between the design input/specifications and design innovation was that the more the design input/prescriptive specifications there was, the bigger the innovation in design. And 55% responded that the design input and specifications at this point in time had to be decreased.

4.2.4 Analyzing

It has identified that DB is great in performance in cost saving, timesaving and quality by previous research. Whereas, Significant differences between that of Korea and the others are founded. It is a result of performance comparison that DB project was distinguished for quality; however, there is not enough of a difference for cost saving and timesaving in Korea. Nevertheless, DB projects are steadily increasing since past 5 years ago, because the public owner seemed to look forward to for DB delivery system being exceeding in performance. (Table 6)

Table 6 Answer About Causes of DB Characteristics in Korea

	Owner	Contractor	Total
1. The reason why a few bidders submit a RFP responding to a DB project			
Only big design company can make drawing for winning	53.8%	15.8%	25.5%
High cost of responding RFP limits construction company which can take high risk	30.8%	68.4%	58.8%
All together above mentioned	15.4%	15.8%	15.7%
2. The reason why cost for responding RFP in DB is high			
Because of overburden request for proposal	76.9%	57.6%	63.0%
Because of illegal activity	23.1%	42.4%	37.0%
3. The reason why several big contractors were successful in DB			
Because High cost for responding RFP but not sufficient compensation made a few bidder of RFP responding	53.8%	34.5%	40.5%
Not good diversity of successful DB contractor	15.4%	37.9%	31.0%
Big contractors have excellence in design and construction	30.8%	27.6%	28.6%
4. The influence between the design input/specifications and design innovation			
the more the design input/prescriptive specifications the less design innovation	69.2%	42.9%	51.2%
the more the design input/prescriptive specifications the more design innovation	30.8%	39.3%	36.6%
no influence	0.0%	17.9%	12.2%
5.The design input and specifications at this point in time			
it will be decreased	46.2%	59.3%	55.0%
it will be continued the present level of detail	23.1%	22.2%	22.5%
it will be increased	30.8%	18.5%	22.5%

Table 7 Comprehensive Performance Comparison

		cost saving	timesaving	quality
In Korea	Performance comparison	inappreciable	DB<DBB	DB≥DBB
	Survey result	DB>DBB	DB>DBB	DB≥DBB
	Hyun et al.(2000)	DB<DBB	DB<DBB	DB≥DBB
Previous research about Other countries		DB>DBB	DB>DBB	DB>DBB

5. CONCLUSION

It is a problem that lack of diversity of responding. RFP brings about a lack of diversity of successful DB teams of construction and design companies. For analyzing characteristics of DB, an empirical comparison of delivery system performance 19 projects and a questionnaire survey were used. Based on these results, the characteristics of DB delivery system in Korea were analyzedIt is conformed that DB delivery system in Korea was used for relatively bigger project than DBB like previous research of NIST (2002) et al. Whereas, DB project was distinguished in quality but there is not enough of a difference in cost saving and

timesaving in Korea. However, the public owner had a confidence that DB delivery system would be excellent without enough experience or information which is caused of absence of performance measure or analysis result. Therefore, performance measure system should be set up for analyzing and developing construction delivery system.

The cause of a few bidders submit a RFP responding to a DB project was high cost of responding RFP limits DB companies which can take high risk. The reason why several big contractors were successful in DB bidding is because of not only high cost for responding RFP but not sufficient compensation made a few bidder of RFP responding, but also not good diversity of successful DB contractors. Consequently, prescriptive specifications and overburdened RFP made high cost for responding in DB made only a few bidders submit a RFP responding and several big contractors were successful. High cost for responding DB RFP is general phenomenon in DB delivery system over the countries. Thus, it is demanded that change form overburdened prescriptive specifications of design, which permit fewer options to submitting bid, to performance specification allow a smart firm more freedom in design.

It must be noted, however, that this study was carried out using limited data, and thus there is a need for a continued study that analyzes of a wider range of data whilst taking into perspective the culture of construction

6. ACKNOWLEDGMENTS

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