

D&B Procedures a Practical Approach for Effective Management of Multiple Projects

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Abstract - Selected infrastructure projects are being implemented by Design and Build procurement system in Sabah (East Malaysia). In these development projects, 45 Bridges in bridge replacement projects are being executed simultaneously by the author's Design and Build firm. The company manages such projects by using established systems for design, contract, contract administration, construction execution and supervision. Engineers from qualified engineering bodies are selected and appointed for In-house design team / supervision team. Team - discussion and inputs in selecting critical bridge components including (i) Methods of pile foundation, (2) Selection of suitable beam technologies, (3) No. of spans, etc are explained. Aspects of specialist works, diversion works, temporary works, construction program, and management, project cost estimation, tendering and final close out are discussed. This paper gives solutions for the complications in the management and procedure to manage multiple Design and Build projects are recommended.

1.0 INTRODUCTION

The Rural development projects are significant for the local community and have to be delivered in time. Any delay in completion of the projects due to failures of improper management and construction systems are often unbearable causing inconvenience to the public. Further the delayed delivery is not going to facilitate the full purpose for which the projects are implemented under development plans. Thus, development projects for rural agencies have been focused with great premium on management of project durations.

Increased usage of calendar day type contracts and the introduction of accelerated construction provisions with high amount of liquidated damages into many construction contracts serve as an evidence of concern for the schedule (O'Connor & Huh 2005). However such effect has limited effect if construction contract estimates too lengthy time. Factors affecting overall construction progress from the experience are weather and seasonal effects, location of the projects, traffic impacts, relocation of construction utilities, type of projects, special items, material delivery time, conflicting construction operation, access to site, logistics, budget, land / property acquisitions, legal aspects. The effective project management system relies on important factors like proper planning analysis, design management, construction control and supervision in order to avoid complications in multiple projects.

Design and Build (D&B) has become significant procurement method for implementing various development projects across the country. The level of its

use varies from country to country. D&B combines the design and construction functions and vests the responsibility of such functions with one entity: the design-builder (Figure 1). The D&B enables owner to employ one contractor that takes sole responsibility for delivering the assigned project with defined requirement standards. Several Public work development projects in Sabah (East Malaysia) are implemented under Design and Build (D&B) procurement methods. The multiple design and build project of Proposed Bridge replacement projects (Project I to V) in various districts of Sabah (Table 1) were managed efficiently and delivered for public usage in stages. The proper management system both in design and construction team has helped to complete in accordance to the master schedule and the construction quality has met the designers' requirements.

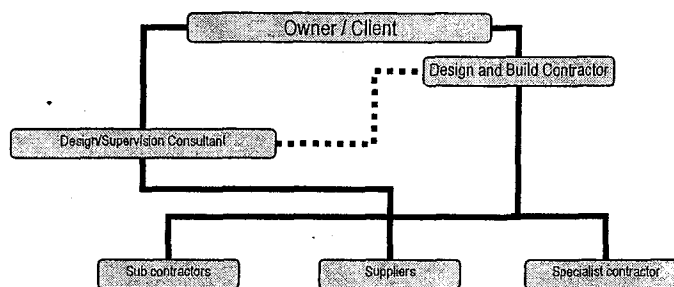


Figure 1: Organizational structure for DB Approach

Table 1: Multiple DB Bridge project in Sabah

Project	No. of Bridge	No. of Districts	Months	Construction Period
1	12	3	18	Jul 03 – Jan 05
2	5	3	18	Jan 05 – Jul 06
3	8	3	18	Jul 05 – Jan 07
4	13	3	20	Oct 05 – Jun 07
5	7	3	20	Oct 05 – Jun 07

For the success of all the projects in multiple environments there are many issues to be carefully considered right from pre design stage till commencement

of construction works and close out. Particularly the projects are spread through out the state at various locations raised many complexities in project commencement, Equipment mobilisation, work coordination, resources transfer, material supply, logistics, etc. Any failure in management system will have heavy cost implications namely over spending and exceeding of estimated budget.

2.0 METHODOLOGY

2.1 D&B Procedures

The procedures adopted for effective management in the D&B project are explained in Figure 2. It covers the activities at various stage of the project and the end output of those stages (at RHS) including the team of personnel involved (to the Left) to progress from one stage to another. The important aspects of the mandatory activities of Pre-design stage, Conceptual design stage, Tender and Contract, Construction stage and Maintenance are given below.

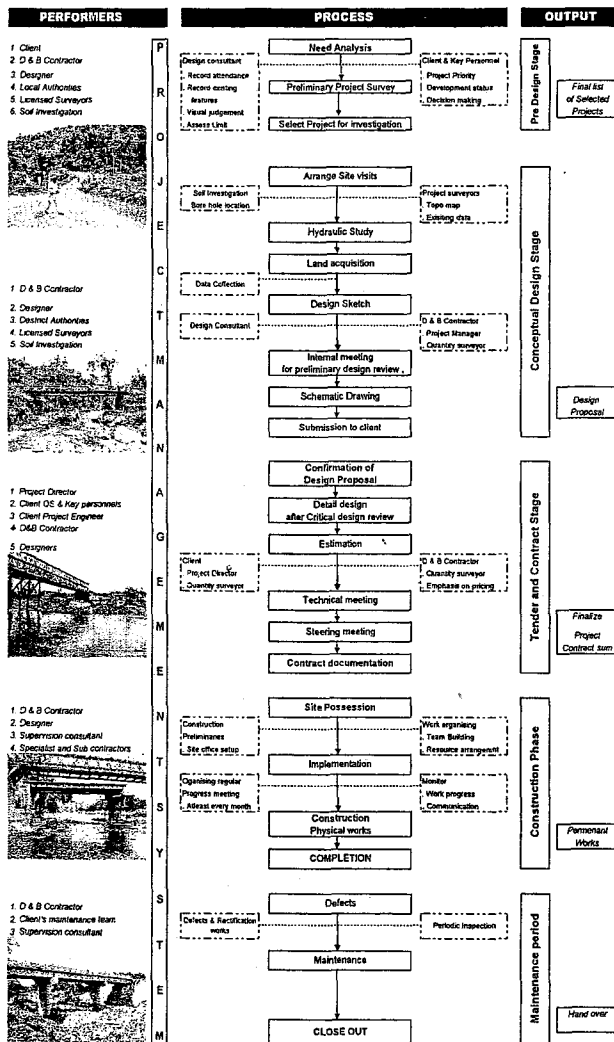


Figure 2: Process Flow Chart of Design and Build Project

2.1.1 Reconnaissance Survey:

- Analysing and understanding the Need statement from the client.

- Arranging Joint site visits with Client, D&B contractor, Designer in the presence of the local key personnel.
- Record the Field data and existing features and draft profile of the site conditions. (Example of the Survey data sheet is shown in Figure 3)
- Visual judgment of the limits of the project.
- Recording the public utility locations.
- Carry out and record interviews with the public staying at the project locations.

2.1.2 Field observation Record:

The parameters and data of the existing features are recorded as shown in the "Survey Record Sheet" (in column 2 and after column 2 respectively of table in Figure 3). This data will guide in all the relevant decisions while designing.

BRIDGE SURVEY RECORD			
Name of Bridge Location: SG, Marabau - Kudat		Date of Survey: 05/09/2002	
Co-Ordinate, X = E 116° 49' 27.4"		Y = N 0° 51' 21.4"	
1 Bridge Type	Span - Structure Sub - Structure Structural Conditions	Existing Covered and gullies	Proposed (Temporary)
2 Approximate Dimensions	Width (m) Length (m) Abutment Deck above Water (m) Water Depth (LCR) (m) Pier/bents (m) Bent	4.5m 8m 3.0m 2.0m	
3 Environmental Parameters			
4 Approach Road			
5 River Training			
6 Type and Condition of River Opening	A. River / Water Stream / Surface water at flood stage = 20 m @ 30 m 1. Fully regular section 2. Irregular Section, with bank, high channel meander? 3. Bank (inner and outer), side or top bank? 4. Dense growth of forest, depth of four + more height 5. Shrubland stream, no vegetation in channel, banks usually steep, trees and brush along banks submerged in high stage 6. Bottom of gravel, cobbles and low boulders 7. Bottom of cobbles with large boulders 8. River channel / channel? Adjacent to natural stream 9. Pasture, no brush (1) Short grass (2) High grass 10. Cultivated area 11. Heavy weed, scattered brush 12. Heavy stand of timber, a few open trees, little undergrowth 13. Chopped land with tree stumps, 100 - 150 per acre 14. Life stream (1) With heavy growth of forest		
7 River Normal Condition	Water Flow: Fast Slow Channel: Flat Shallow Deep No water Subject to Tide Channel Accumulation / Silt? Flood Fast / Slow Flooding Flood plain Submerged Flood over Bridge Deck, marsh?	Stage? Deep	
8 River Flooding Condition			
9 Surface Soil Condition	Assumed Catchment Area (lit / month)	Soil Type?	Source?
10 Existing Ground Features			
11 Services adjacent	Water Pipe		

Figure 3: Field data sheet

2.1.3 Topographic Survey:

- The design consultant will identify and instruct the extent of survey within the project limit.
- Follow and pick up the existing ground levels and existing features as required by the consultant.
- Topographic Survey data to prepare Topo maps of the site.
- Collecting and digitizing the boundaries of the adjoining properties and lands.
- Establish TBM value at vicinity of site.
- Furnish digital & plotted Topographic survey data
- Survey of individual sites.

2.1.4 Soil Investigation:

- Perform Bore Holes at the specified locations given by the consultant.
- Furnish Bore Log report.
- Summary of Soil profile of Bore Holes
- Furnishing Test results and the Soil property report.

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2.1.5 Hydraulic study:

- It is the responsibility of the designer to collect necessary data to perform flood study.
- Survey conducted with the local public about the historic weather conditions.
- Calculating and predicting the flood level for the defined return period mentioned in the need statement provided by the client.

2.1.6 Conceptual Design:

- Schematic drawings prepared for internal discussion with the construction team
- To meet the standard and needs mentioned by the client.
- Design review if required.
- Submitting the Conceptual design to client for approval.
- Briefing the Technical report.

2.1.7 Estimation:

- Preparing financial report on the approved conceptual drawing
- Submitting to the Technical committee for negotiation
- Briefing to the Technical committee.

2.1.8 Contract Documentation:

- Steering committee approves the project based on the recommendation of the Technical committee.
- Compilation of D&B project documents for contract agreement.
- Contract award and site possession to commence physical works.

2.1.9 Execution:

- D&B contractor needs to submit the Project Management Plan (PMP, Safety plan and Environmental Management plan.
- Submit Organisation chart of Supervision team and construction team.
- Works program and Payment schedule
- Executing Construction works in accordance to the PMP.

2.1.10 Practical completion:

- Practical completion of the project complying with approved drawings and need statement of contract agreement.
- Handing over to the client
- Issuance of Certificate of Practical Completion (CPC)

2.1.11 Maintenance and Project Close out:

- Repair of defects and periodic maintenance during the defect liability period as mentioned in the contract.
- Prepare maintenance report periodically and submit to client
- Final inspection and site hand over to client.

2.2 Construction Phase

The above procedures are repeated for every D&B project simultaneously. In multi-project setting every project will be at different level of procedures based on the progress of interdependent activities at pre design stage. Critical activity and aspects of the construction phase are discussed below:

2.2.1 Specialist work

For Bridge works, a major prerequisite is the specialist activities that are of more critical are (1) Sub structure works - Piling works and (2) Super structure – Beams. Table 2 shows classification of beams based on span length.

Table 2: Classification of beams based on span length

Type	Span range (m)
Post tensioned I-16	25 – 28
Post tensioned I-20	>30
Inverted T, M & UM	<23 (pre-cast prestressed in factory)
Steel girders	>40

2.2.2 Temporary works

Temporary works are classified into two sections: (1) Temporary diversion and (2) Temporary works for construction of foundation and substructure. Figure 4 a & b is an example for each type.

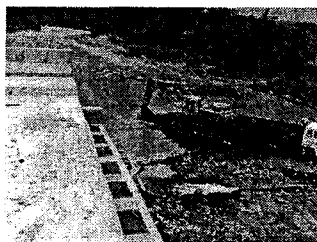


Figure 4a: Temporary works for foundation

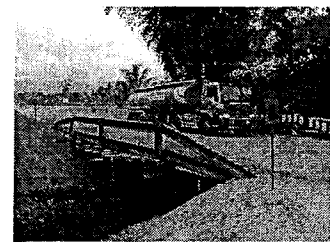


Figure 4b: Temporary bridge diversion

2.2.3 Logistic Plan

Logistic Plan for the projects spread all over the state are linked and derived from the project works program and schedule. Any revision in works program required revision in Logistic plan and the resource management team to be informed. Periodic feed back, monitoring and control meetings are held to improve the logistic strategies and resource management in multi-project sharing settings. The Distance map shown in Figure 5 is to understand the importance of planning in transportation of resources. Herbsman and Ellis (1995) has emphasized that the transportation agencies have great control on construction duration.

3.0 FINDINGS AND LESSONS LEARNED

3.1 Pre Design Stage

Failures of design consultants to consider the builder's problems in implementing the design can result in scheduling problems, delays, and complicated disputes

during the construction process. The D&B contractor needs to pay more attention in selecting design and supervision professionals who have ample experience in working with projects under D&B method.

DISTANCE
Kilometres
(Estimated)

District 1											
District 2	75										
District 3	151	75									
District 4	447	372	296								
District 5	558	483	407	111							
District 6	673	598	522	226	115						
District 7	326	251	175	227	338	453					
District 8	654	579	503	207	96	119	434				
District 9	614	539	463	167	56	79	394	40			
District 10	682	607	531	235	202	317	462	298	258		
District 11	555	480	404	108	75	190	335	171	131	131	
District 12	601	526	450	154	121	236	381	217	177	175	50

Figure 5: Distance Map

3.2 Construction Phase

As many contractors have gained experience in D&B method, the minor negligence in process and output of Pre Design Stage, Conceptual Design stages, Tender contract stages can be rectified and overcome without serious effect on the project completion date. Whereas to achieve the anticipated completion dates Design-builders need to focus early on the solutions and methods to determine the Resource plan and Logistic method when it is multiple projects.

3.3 Benefits of D&B Method to Public sectors

Certain special construction project requires expertise and known specialist contractors experienced in similar kind of projects to undertake the D&B projects. Especially the above studies on the multiple bridge projects undertaken at various parts of the state to benefit the public sectors in rural background are considered unique and special in nature. As these bridges are situated at many locations and crossing rivers having different origins, catchments, profiles, sources, terrains, discharge, upstream, soil conditions, width, purposes, etc. careful study and expertise are required to complete the project successfully. Thus these projects of special characteristics cannot be undertaken by traditional design-bid-build method.

Resulting which special projects in development plans are undertaken by D&B method to ensure the timely completion in order to achieve the anticipated completion date and also fulfilling the commitments to benefit public sectors. D&B methods have shortened the procedures of project implementation time from the date of decision. Meaning which, all the responsibilities are vested with the single Design-Builder, shortening the completion time. Adding to D&B concept PAC chairman Samid, S.A has said "The private initiative was far more efficient and giving the private contractor total control without any government oversight would see the projects completed much faster"(Bernama, 2006).

4.0 CONCLUSIONS

Malaysia is a developing country with plenty of natural resources. A large number of rural sectors are still under semi primitive state. Long term development projects are executed to benefit the public and national economy. Thus the delivery of projects in time with quality is considered important for the nation's growth. These factors are achieved by implementing a significant procurement method with an established Project management system like D&B project.

1. D&B methods are getting popular in development projects benefiting public. It requires constant monitoring and control to achieve the objective.
2. Need to train D&B concepts to the team involved in the project including client representative, consultants and local authorities.
3. General understanding about the industrial practice of project management is to start from the construction phase. This may suit to other procurement methods. Whereas, project management system in D&B method has to be started right from the first day of project implementation (even before pre design stage) to ensure the project success with better results.

The construction of Multiple D&B bridge projects in Sabah were executed smoothly. All the bridges in the five construction packages were handed over to the public works as per schedule and also opened for public usage. Execution of this development projects stands as an example for their unique concept. The benefits from the project are being realized and its objectives gained.

5.0 ACKNOWLEDGEMENTS

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