Delays in the Pre-Construction Phase of State Sector Building Projects

D A R Dolage and P W S D Perera

Abstract: This paper investigates the many causes of delays in the pre-construction phase of State Sector Building Projects. The investigation was done through a questionnaire based survey that involved Clients, Consultants and Contractors to evaluate the causes of delays. The technique of Relative Importance Index was adopted to rank the causes of delays in a descending order. Based on this evaluation the causes of delays were identified and ranked, and two remedial measures were developed. Firstly, a process diagram for the pre-construction phase was designed in order to establish the systematic process and to represent useful inputs and outputs at various stages of the process. Secondly, a checklist was formulated in an effort to ensure that important actions are taken at the correct stages to minimise the opportunity for delays. Also, the study proposes suitable additions/amendments to the 'Form of Agreement', an ICTAD publication, and recommends to make the use of these remedial measures mandatory.

Key words: Pre-Construction Phase, Construction Industry, Causes of Delays

1. Introduction

The problem of delays in the pre-construction phase in the construction industry is a common phenomenon. The pre-construction phase can be further divided into ten sub phases namely, consultancy agreement, preliminary project brief, final project brief, pre-feasibility studies, detailed feasibility studies, schematic designs, architectural designs, structural and service design, tender documents, bidding and negotiation. All these phases are in the critical path of the building procurement process and therefore the delay in each phase has a direct influence on the total project duration.

In State Sector Projects, any one person may not represent the client throughout the project. Most of the time the client may not have the full authority to make decisions. They may have to seek the Departmental and Ministerial level approvals on various issues. As a result, state sector clients are less likely to be accountable for the delays in the pre-construction phase. Instead, they are only mindful about the time allotted for the construction in the contract. In contrast, private sector clients are keen on the entire project duration in order to obtain the maximum return for the investment. Hence, they strictly monitor the pre-construction phase by adopting more flexible procedures, which facilitates quick decisions. It is observed that state sector building projects get delayed unnecessarily due to delays in decisions made by clients. A major reason for this situation is that in state sector

decision making, the participation of several government officials is needed. Therefore, any study conducted to explore the causes of delays in the pre-construction phase, has to be conducted separately for the two sectors. In the current economic downturn, in order to remain competitive, the lead consultants and specialist consultants operate with the minimum permanent staff and by outsourcing some of the important work. As a result of the inevitable poor coordination, the consultants can not perform the expected role. The effects of this are manifested in the construction stage in the form of delays and cost overruns.

In state sector projects, pre-construction delays that contribute to the overall delays in construction projects are often responsible for turning profitable projects into losses. These delays can be avoided or reduced, if the major causes for such delays can be identified and dealt with effectively.

The objectives of this study are;

- (i) to identify major causes of delays at different stages
- (ii) to assess the relative importance of these causes

Eng. D.A.R.Dolage, CEng, FIE(Sri Lanka), BSc Eng. (Moratuwa), MSc (Reading), MA (Colombo), MBA (SJP), Senior Lecturer, Department of Civil Engineering, The Open University of Sri Lanka

Eng. Captain P.W.S.D. Perera, CEng, MIE(Sri Lanka), BSc Eng. (Moratuwa), MTech (OUSL), Director Projects, Daya Constructions (Pvt) Ltd.

- (iii) to develop a process diagram and a mandatory checklist for the pre-construction phase in order to minimise these delays.

This paper is organised as follows: Section 2 deals with the literature review on causes of delays in the pre-construction phase; Section 3 illustrates the methodology of research; Section 4 provides the analysis of the data and results, Section 5 presents the discussion and conclusion and Section 6 deals with recommendations.

2. Literature Review

The primary objective to be accomplished during pre-construction phase is to produce the information needed to complete projects on time, within the budget and to the satisfaction of the client. The pre-construction phase is usually planned for individual projects, with each one being different from the other, although there may be much in common between them, be they buildings, highways, bridges, dams or tunnels. The ICTAD publication on Scope of Consultancy Services categorises various services provided by consultants under three categories namely, the 'Basic services', 'Extra services' and 'Other services' separately, for the six types of consultancy services in order to streamline the process of consultancy services. The 'Basic services' describes the Preliminary and basic services which the consultant will normally provide; the 'Extra services' describes services which could be provided by the consultant to augment the Basic services and the 'Other services' describes services which are not pertaining to the particular profession, but which could be provided on special assignments by involving other relevant consultants. The six types of consultancy services are architectural, engineering consultancy, project management, quantity surveying, structural engineering, town planning and consortium (ICTAD Publication No. ICTAD/CONSULT/04, 2002). The Client Guide, another publication of ICTAD identifies five key areas for which client consideration is of paramount importance (ICTAD Publication No. ICTAD /CONSULT/02, 2002). Moreover, while the Client Guide for the Selection of Consultants enables the selection of the most suitable consultant for the project, the Form of Agreement guides the engagement of the selected consultant (ICTAD Publications No. ICTAD/CONSULT/03 and (ICTAD Publication No. ICTAD/CONSULT/01, 2002). The services

provided by lead consultants vary in scope and nature depending on the project and on the requirements of the client. The lead consultant may work in collaboration with other consultants, specialist consultants, consultants nominated by the client and the client's own personnel.

As shown above, there exist a well established procedure in order to facilitate the appointment of the most suitable consultants and thereby to avert possible undesirable eventualities, which includes possible delays in the pre-construction phase. Further, over the years each consultant will have developed its own preferred practices based on its successes and failures. According to Rutter and Martin (1990), the consultants should draw on experience as well as current standards and codes of practice when evolving designs for new schemes in order to mitigate pre-construction delays. SLS ISO 9001-2000 proposes a procedure consisting of seven steps for the design and development (SLS, 2000). While its first six steps deal with aspects such as planning, inputs, outputs, review, verification, validation of design and development process, the seventh step deals with the control of design and development changes. Although the procedure enumerated here provides a useful guideline to minimise delays in the pre-construction phase, the maximum benefits cannot be derived since it provides only a broad outline for the procedure. The consultants are free to develop their own detailed version based on the broad outline procedure. Further, the ICTAD publications on consultancy services do not make any reference to the requirement of consultants having to obtain ISO certifications such as SLS ISO 9001-2000.

Jayawardane and Pandita (2003) conducted an empirical study on 'Understanding and Mitigating the Factors Affecting Construction Delays' within the Sri Lankan construction industry. This study identified the factors affecting construction delays, quantifies the importance of the identified delay factors, and makes recommendations in order to minimise delays during construction. Numerous authors including Sweis et al. (2008), Sambasivan and Soon (2007), Chan and Kumaraswamy (1997) and Mansfield (1994) have studied Delays in Construction projects in various countries. Evidently, no prior studies have been carried out to investigate the delays in the pre-construction phase of the construction projects in any other country, let alone in Sri Lanka.

3. Methodology

3.1 Data collection

As shown in the literature review, the pre-construction phase can be further sub-divided into the following ten generic phases:

- Consultancy agreement
- Preliminary project brief
- Final Project brief
- Pre-feasibility studies
- Detailed feasibility studies
- Schematic designs
- Architectural designs
- Structural and services designs
- Tender documents
- Bidding and negotiating

Prior to the distribution of the primary questionnaire, ten interviews were conducted with four consultants, three clients and three contractors to identify the factors causing the delays in the pre-construction stage, under the above mentioned eight phases. Based on the results of these interviews, the primary questionnaire was developed to assess the perceptions of consultants, architects, structural engineers and service engineers on the relative importance of causes of delays during the pre-construction phase. The questionnaire was divided into two parts. The first part sought the background information about characteristics of the respondents. The second part of the questionnaire focused on the relative importance of the causes of delays, in the pre-construction phase. A five point Likert scale ranging from 1 (not important) to 5 (extremely important) was adopted to capture the importance of the causes of delays.

The data was obtained from a large spectrum of state sector building projects of which pre-construction phase was managed by either semi government organisations or private sector organisations. A field survey was intended to cover state sector building projects of value over Rs. 10 million. Due to the possible poor response for questionnaires, 50 personally known professionals were engaged in the questionnaire survey. Although forty-two questionnaires were received, only thirty could be used, since 12 were incomplete.

3.2 Calculation of relative importance of Factors

Kometa et. al. (1994) adopted the Relative Importance Index (RII) method to determine

the relative importance of the various causes of the delays. The same method was engaged in this study within various groups. The five-point scale ranged from 1 (not important) to 5 (extremely important) was used to transform into RII for each cause as follows:

$$RII = \frac{\sum W}{A * N}$$

where W is the weighting given to each factor by the respondents (ranging from 1 to 5), A is the highest weight (ie. 5 in this case), and N is the total number of respondents. The RII value had a range from 0 to 1 (0 not inclusive), higher the value of RII, more important was the cause. The RII was used to rank the different causes. These rankings made it possible to cross-compare the relative importance of the factors as perceived by the respondents. The RII for each individual cause was used to assess the general and overall rankings of each cause of delay as well as to give an overall picture of the causes of delays in the pre-tender stage.

Table 1: Characteristic of the Projects and Respondents

Characteristic	Frequency
Number of respondents	42
Number of questionnaires considered for the analysis	30
Project Cost (inclusive of services) in Rs. Million	
10 < and <20	4
20 < and <40	4
40< and < 100	12
100 < and < 200	2
200<	8
Respondent's Profession	
Consultant/Engineer	
Semi Government	22
Private Sector	8
Architect	
Semi Government	20
Private Sector	10
Structural Engineer	
Semi Government	22
Private Sector	8
Service Consultant	
Semi Government	22
Private Sector	8
Contractor	
Semi Government	4
Private Sector	14
Not yet selected	12

4. Analysis of Data and Results

The summaries of the characteristics of the projects based on which the respondents

provided answers to the first part of the questionnaire and the characteristics of the respondents is presented in tabular form in Table 1.

Table 2: Ranking of Causes of Delays

Causes of delays	Percentage of Respondents Scoring					RII	Rank
	1	2	3	4	5		
<i>Consultancy agreement related</i>							
Description of scope of work	2.3	4.7	0.0	27.9	65.1	0.898	6
Stipulation of penalty clauses for delays	2.3	4.7	9.3	16.3	67.4	0.884	24
Inclusion of detailed programme for design process	0.0	4.7	7.0	20.9	67.4	0.902	1
<i>Client's preliminary project brief related</i>							
Indication of target cost	0.0	2.3	9.3	41.9	46.5	0.865	11
Assessment of constraints	0.0	2.3	14.0	25.6	58.1	0.879	4
<i>Consultant's final project brief related</i>							
Indication of estimated cost	2.3	2.3	16.3	30.2	48.9	0.842	7
Client studying the project brief	0.0	7.7	6.9	31.3	54.1	0.864	2
<i>Pre-feasibility studies related</i>							
Preliminary site investigation	2.3	2.3	16.3	37.2	41.9	0.828	17
Assessment of availability of services	0.0	4.7	20.9	34.9	39.5	0.818	9
Preliminary environmental impact assessment	2.3	4.7	20.9	32.6	39.5	0.805	26
Submission of alternative conceptual proposals	4.7	0.0	20.9	39.5	34.9	0.800	5
<i>Detailed feasibility studies related</i>							
Detailed site investigation	0.0	9.3	23.3	32.6	34.8	0.786	28
Identification of major limitation of the site	9.3	11.6	9.3	32.6	37.2	0.754	25
Approvals from statutory and local authority	2.3	7.0	18.6	41.9	30.2	0.781	21
Preparation of cost estimate	11.6	7.0	11.6	34.9	34.9	0.749	16
Final environmental impact assessment	4.7	9.3	20.9	27.9	37.2	0.767	19
Submission of most suitable conceptual proposal	9.3	14.0	20.9	27.9	27.9	0.740	8
<i>Schematic drawings related</i>							
Preparation of schematic drawings design proposal/reports	7.0	11.6	20.9	30.2	30.3	0.730	18
Endorsement of service consultants	11.6	9.3	16.3	30.2	32.6	0.726	14
Endorsement of client	14.0	9.3	23.3	23.3	30.1	0.692	13
Realistic cost estimate	9.3	16.3	18.6	25.6	30.2	0.702	20
<i>Architectural drawings related</i>							
Preparation of scale model	11.6	14.0	16.3	34.9	23.2	0.688	22
Client's endorsement of architectural drawings prior to structural design phase	16.3	14.0	16.3	25.6	27.8	0.669	3
Endorsement of architectural drawings by structural engineer and service consultant	16.3	14.0	14.0	25.6	30.1	0.678	23
<i>Structural and service design related</i>							
Concurrent preparation of structural and service drawings	16.3	16.3	18.6	20.9	27.9	0.656	10
Strength of design staff	14.0	16.3	20.9	23.3	25.5	0.660	15
<i>Bill of quantities(BOQ) related</i>							
Obtain Architectural, structural & services drawings, prior to preparation of BOQs.	16.3	16.3	23.3	18.6	25.5	0.641	27
<i>Tender documents related</i>							
Scrutinise the consistency of architectural, structural and services drawings and BOQs	18.6	18.6	16.3	25.6	20.9	0.623	12

The primary data collected from the second part of the questionnaire, in relation to causes of delays, was analysed. Table 2 depicts the RII which was computed for each cause in an effort to identify the most significant causes. The causes were ranked based on RII values. From this, it was possible to identify the most important factors or causes of delays. Table 2 also presents the ranking of causes of delays; while Rank 1 is the most important; Rank 28 is the least important.

5. Discussion and Conclusion

This section discusses the results obtained in the earlier section and proposes remedial measures by way of a process diagram and a checklist, in an effort to minimise delays. The ten most important causes of delays as shown in Table 2, in the descending order are:

- (1) Inclusion of detailed programme for design process,
- (2) Client studying the project brief,
- (3) Client's endorsement of architectural drawings prior to structural design phase,
- (4) Assessment of constraints in the client's brief,
- (5) Submission of alternative conceptual proposals,
- (6) Description of scope of work of consultants,
- (7) Indication of estimated cost in the final brief,
- (8) Submission of most suitable conceptual proposal,
- (9) Assessment of availability of services,
- (10) Concurrent preparation of structural and service drawings.

It can be said that these causes when not addressed and affecting the design process leads to significant delays in the design process. However, the other causes of delays, though not as significant as the former, can have effects on the expediency of the design process.

The preparation of a preliminary project brief by the client and a project brief by the consultant, can provide clear direction to subsequent activities in the project. It is also felt that the consultant should take the views of the end users at the stage of preparing the project brief. On receiving the endorsement of the client for the project brief, the consultant should submit alternate proposals through a prefeasibility study. This

will minimise any possibility of the Client having to require alternate designs at a later stage. The detailed feasibility study provides better insights to the alternative proposals. This enables the ranking of alternative proposals. Detailed feasibility studies should consider site investigation, statutory requirements and views of the other specialist consultants and entails submission of a report containing the evaluation of alternative proposals and recommendation of the most suitable proposal. The schematic drawing can commence after the client's approval is sought for this report. The endorsement of the client, service consultants and the owners of adjoining properties for the project proposal prior to the commencement of the detailed architectural drawings is important to alleviate pre-construction delays.

The structural and service drawings need to commence after receiving the endorsement of the client on the architectural drawing. As the next step, it is important to obtain the approval of the Local Authority before the preparation of BOQ, specifications, draft tender documents, works programme and Engineers Estimate. Hence, in the light of these requirements, to avert pre-construction delays, the remedial proposals should be developed.

The two remedial measures proposed in the study are not only based on the first ten causes of delays but also on the other causes of delays.

The first measure accomplished in this study was to develop a process diagram to implement the systematic design process at pre-construction phase for state sector building projects. Figure 1 depicts the process diagram developed in this regard. However, in addition, a checklist can be formulated in order to make sure that important activities of the design process are not omitted. Table 3 depicts the proposed checklist that the consultants and clients should adopt during the design process to minimise delays. The process diagram was formulated in the light of causes of delays identified and their respective ranking.

Figure 1: Process Diagram for Pre-Construction Phase of State Sector Building projects

Table 3: Proposed checklist for the design process to be used by consultant/client

	DESCRIPTION OF ITEM		
01	Requirements of the end users were considered in assessing the need for the project.		b. reported the limitations of the proposal.
02	Client's staff organisation required for the project was established		c. presented a report assessing the feasibility of the proposal.
03	Client's preliminary Project Brief included following: <ul style="list-style-type: none"> a. A statement of objectives b. A list of priorities and constraints c. A programme and details of phased completion, if required d. A description of user requirements e. The project history, if applicable. f. Target Cost 		d. inform the owners of adjoining premises
04	The consultant and other specialised consultants were appointed and their scope of work included: <ul style="list-style-type: none"> a. Architectural designs b. Civil and structural engineering c. Electrical and mechanical engineering d. Building services <ul style="list-style-type: none"> - Water Supply, drainage and sewerage - Ventilation and air conditioning - Lift e. Quantity surveying f. Interior decorations g. Landscaping 	12	After studying the consultant's report on detailed feasibility studies, with regard to the proposal the client decided to: <ul style="list-style-type: none"> a. abandon b. revise c. proceed
05	Examined client's preliminary Project Brief with respect to: <ul style="list-style-type: none"> a. evaluation of constraints b. economic feasibility c. preparation of preliminary estimate 	13	After completing schematic drawings, the consultant submitted a report which included following: <ul style="list-style-type: none"> a. three dimensional schematic drawings for at least three alternative proposals b. design proposals c. models d. cost estimates
06	The advice of the consultant was obtained to select and acquire a suitable site	14	The service consultant's endorsement of the schematic drawings was obtained prior to commencement of architectural drawing
07	Prior to compile the final Project Brief the site was inspected, preliminary surveys were carried out and enquiries were made with Local Authority	15	The client's endorsement of schematic drawings was obtained prior to commencement of architectural drawings
08	Final Project Brief included following: <ul style="list-style-type: none"> a. Description of the Client b. General Statement of project c. Activities of project d. Schedule of spaces e. Flexibility / Expansion f. Services g. Quality h. Aesthetic factors i. Time limits j. Priorities k. Estimated cost 	16	Obtained endorsement for schematic drawings from adjoining owners, prior to the preparation architectural drawings
09	Client's endorsement for the Project Brief was obtained	17	Advice of the structural engineer and the service consultant were sought prior to the preparation of architectural drawing
10	On completion of Pre-feasibility studies, the consultant proposed alternative proposals recommending the most suitable proposal	18	All architectural drawings were endorsed by client, prior to commence structural designs
11	On completion of detailed feasibility studies, the consultant: <ul style="list-style-type: none"> a. recommended the most suitable conceptual proposal 	19	On finalising architectural drawings by client, full set of same submitted to the structural engineer and service consultant
		20	On completion of structural drawings and service drawing, the Local Authority approval was obtained.
		21	Draft tender documents prepared by consultant included the following: <ul style="list-style-type: none"> a. BOQs b. Drawings; <ul style="list-style-type: none"> i. Architectural ii. Structural iii. Electrical wiring & installations c. Building services <ul style="list-style-type: none"> -Water Supply, drainage and sewerage - Ventilation and air conditioning - Lift d. Interior decorations e. Landscaping f. Specifications g. Programme of work h. Engineer's Estimate
		22	After the preparation of Draft tender documents, client's endorsement was obtained prior to issue of Tender Documents

6 Recommendations

The responsibility of fixing a realistic time period for the pre-construction phase, rests on the consultant with the concurrence of the client. The consultant should take the proposed process diagram and the checklist into consideration in fixing the said realistic time period. Both the process diagram and the checklist has been meticulously formulated in order for any layman to comprehend easily. The insights that it gives can be used in drafting the contract between him and the consultant. Once the realistic time period for the pre-construction phase is agreed upon, the consultant should consistently follow the proposed process diagram and the checklist to make sure that the pre-construction phase can be concluded within the stipulated time period. The client too can adopt the proposed process diagram and the checklist to ensure that the consultant is adhering to the recommended procedure and thereby avoid potential delays that carries financial and other implications. The construction industry professionals consistently point out that the delays in the construction phase can be ascribed to the omission of important tasks during the design phase. Hence, it is stressed that proper adherence to the proposed measures in this study will not only pave the way to avoid delays in pre-construction phase but also helps to avert delays in the construction phase.

This study, as a further contribution, recommends the following amendments to the Consultancy Agreement of the ICTAD.

1. Provide a more detailed Scope of Services under the different phases of a project.
2. Provide a more detailed programme for consultancy services
3. Include a flow chart similar to the one developed in this study
4. Include a checklist to be adopted by the client/consultant
5. Include a more detailed schedule of interim payments with respect to the important milestones.

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