CHAPTER TWO

DESIGN PROCESS AND COST ADVICE

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2.1 INTRODUCTION

This chapter reviews design process. Understanding of design process is important since approximate estimating techniques are selected and deployed against the design stages. Practice of approximate estimating in Sri Lanka is explored and its impact is discussed to provide important requirements of approximate estimating techniques.

2.2 DESIGN PROCESS

This is a complex area of study. Douglas and Brandon (1991) state that the building design process is a complex process enveloping interaction of skills, judgement, knowledge and time. Objective of such process is satisfaction of client's demand for shelter within the overall needs of society.

According to the above statement design process is an iterative process. A team with recognition of team approach produces particular design solution. The team approach is recognized in all design practices. Several model procedures are available to streamline the design process to a reasonable extent. R.I.B.A model procedure is such outline procedure. Local model procedure (SLIA) is closely related to R.I.B.A model procedure but has been modified to match local requirements.

Researches have been undertaken to improve different aspects of the building design. Programming of building design is a particular area. Austin et al. (1994) have suggested a research methodology that can help plan the building design process. Design models, based on dataflow diagrams, have been developed to map information flow during the design of a modern building. Matrix analysis technique is used to analyse the models. Analysis of models allows to produce schedules or design plans based solely on information flowing between

design tasks. The aim is to reveal how to order most efficiently independent tasks and use estimates of design information further to improve the scheduling of design tasks. More efficient design information management will no doubt call for more efficient and reliable cost forecasting techniques.

Aygun (2000) has proposed an analytical comparative method for evaluation of relative performance of design alternatives by multiple criteria which are expressed in terms of quantitative design variables. Common models of design process (RIBA based) involve the configuration of a system invariably with many qualitative and quantitative attributes, for each of these attribute a design decision is required. This compels the designer to compare the consequences of many design variables and to achieve healthy balance between design variables with respect to performance criteria. The proposed analytical approach is deemed conducive to selecting the most satisfactory solution. Trial and error approaches for alternative generation and evaluation are inefficient.

Extensive research has been undertaken to develop a design and construction protocol which considers the whole lifecycle of a construction project whilst integrating its participants under common frame work. Generic Design and Construction Process Protocol (GDCPP) is a result of such development which aims to develop an improved design and construction protocol and identify the information technology requirements needed to support the process protocol. The concept of process protocol addresses areas for improvement by examining best practice in manufacturing project processes (Kagioglou et al., 2000).

Berdard and Mokhtar (1994) have introduced a new process to eliminate main errors in construction technical documents. The new process has been developed using product data modeling. The studies undertaken show that 50% of the problems in buildings arise through decisions and actions taken while developing technical documents. The studies have come out with following findings:

1. About two- thirds of the problems are caused by inadequate communications;
2. Over 25% are result of poor allocation of time and resources;
3. Less than 10%, resulted from fairly intractable problems such as new forms of design or new materials.

R.I.B.A model procedure is an outline procedure and should be modified to suit the particular practice and the project being undertaken. Model procedure represents a logical sequence of actions that has to be followed for timely decisions that will not prejudice progress. The adherence to a particular sequence is considered essential since estimating techniques used by the cost adviser should be compatible with the information evolving sequence.

Perera (1989) has revealed that there are three main design stages in local practice as accepted by senior architects, quantity surveyors and structural engineers. These design stages are as follows:

1. Briefing stage
2. Sketch plan stage
3. Working drawing stage

The purpose of work and decisions to be reached, tasks to be done and people involved is shown in the Table 2.1. The proposed cost model in this research, processes cost information in accordance with the main stages shown in the Table 2.1.

2.2.1 Client's brief

The Table 2.2 illustrates briefing process. The research cost model facilitates the cost adviser to manipulate information consistently and continuously from the Briefing stage. In practice drastic changes to client's brief at later stages result in abortive work. Proposed research coat model generate cost information from Briefing stage based on client's brief. Therefore, client's brief should be reasonably comprehensive.

The client's brief, or lack of one, remains as a common problem in construction projects. In this era of high-tech design solutions for buildings, most clients do not have sufficient understanding of design and the construction process to be able to brief building services team. If the client fails to give a clear written brief then the quantity surveyor should confirm his understanding of requirements in terms of quality, time and cost followed by a response from the professional team on how the brief is accomplished (Greenstreet, 1998).

Table 2.1- Design stages and activities (traditional practice)

MAIN STAGE	DESIGN STAGE	SITUATION	DESIGN ASPECTS	COST CONTROL ASPECTS
Briefing	Inception	Client decides he wants a building. His ideas are usually vague at this stage. These ideas must be crystallized.	The client must set up an organization to prepare a brief. Appoint an Architect and Quantity Surveyor.	No estimate should be given. He can quote previous jobs. Example: BCIS, In-house data
	Feasibility	Client requires a recommendation as to the feasibility: 1. Financially 2. Practically 3. User requirements	The architect must ascertain broad requirements (brief) 1. User of the building 2. Size 3. Quality 4. Time 5. Cost Limit The Architect and the Quantity Surveyor must study the factors, propose site and make a recommendation. If the scheme is not feasible the architect should say so at this stage.	Establish a cost limit. Single rate estimating models. Interpolation method. Financial method. Establish realistic first estimate.
Sketch Design	Outline Proposal	The decision to go ahead has been made and the cost limit established.	The architect must develop the brief. Various solutions in sketch form must be considered to establish the type, design and shape. Apply for planning approvals.	Prepare cost studies for alternatives, effect of plan shape, height, span, prepare outline cost plan using a brief cost analysis. Confirm the cost limit.
	Scheme Design	Form of the construction must be established and type of services, e.g. oil or gas and plan of the structure, EG. Position of stairs, key rooms, etc.	Full brief must be ascertained. Preliminary design must be obtained form the specialists. An outline specification should be prepared. Obtain planning permission.	Prepare full cost and further cost studies. Cost plan based on detailed cost analysis.
Working drawing	Detail design	Final decision to be taken on every matter related to design, specification, construction and cost.	Emphasis changes from planning to action. Detail designing for all elements completed. Design could be in sketch form but decisions finalized.	Scope change from planning to control. Extensive cost checking for all elements. Remedial action 1. Review element design. 2. Cost targets adjusted on client's approval. 3. Reduce quantity or quality. 4. Request for essential additional funds.

Table 2.1 continued...

MAIN STAGE	DESIGN STAGE	SITUATION	DESIGN ASPECTS	COST CONTROL ASPECTS
Working drawing	Production information	Design, specification, construction and cost decision to be converted to documentation.	Preparation of working drawings, specification scheduled, etc.	Preparation and pricing of Bill of Quantities and complete final cost check, and confirm cost plan.
	Tender Action	Process of invitation of tenders.	Prepare tender documents. Pre qualify if required. Prepare tender list, approve and invitations to tenders, tender evaluation, recommend and select the best. Prepare cost analysis, reconcile tender. Belated remedial action if required.	Usually the actions mentioned under "Design Aspects" are carried out by the Quantity Surveyor.
Procurement	Project Planning	Enter into a contract. Scope changes from planning to implementation.	Client should enter into a contract with the contractor. The contractor commences detail project planning	Evaluate contractor's programme.
	Site Operations	Works in progress. Site visits by client to ascertain visual progress.	Continuous site supervision. Assessment of progress. Issue additional instructions, detail drawings for work inadequately described. Issue of interim certificates.	Valuing variations and effect on project cost. Monitoring cash flow of the client. Keep records of the site activities. Site visits. Interim valuations.
	Completion	Works satisfactorily completed and handed over to client.	Issues of final certificate. Preparation of schedule of unfinished works. Application for Certificate of Conformity planning authorities.	Preparation of final accounts. Adjusting contract sum for, 1. Provisional work 2. Variations 3. Cost Variations Monitor maintenance activities during defects liability period.
Post Procurement	Feed back	Defects liability period ends. All and full responsibility of the building handed over to the client.	Release of retention, performance bond at the end of satisfactory period. Arrange for maintenance procurement required.	Claims, negotiations, Preparation for arbitration if required. Extract cost data from the project. Update in-house database. Maintenance management.

CLIENT ACTION	MATERIAL FOR BREIF	CONSULTANTS ACTION
RIBA Stage A - Inception		
• Considers need to built • Sets up supporting organization (working party, committee or representative) • Appoints consultants • Commences exchange with consultants • Provide information for outline brief	• History of events leading to decision to build • Details of client and consultants firms, personnel • Time-scale for the project • *Outline brief* • Policy decision • Purpose and function of project • Details of site and services • Basic details of building requirements and cost	• Carry out preliminary consultations and appraisals of buildings or sites • Receive and examine outline brief
RIBA Stage B - Feasibility		
• Conduct user studies • Considers feasibility results and analytical studies and reports • Develop brief	• Additions/amendments to outline brief in as much detail as possible about: site conditions; space requirements; relationships and activities; interior environment; operational factors • More precise information about client's financial arrangements	• Survey and study site and locality • Consult statutory authority • Conduct feasibility exercise and studies of features of the brief • Advise about meetings of cost time limits • Elicit information required and guide and assist with collection of brief
RIBA Stage C – Outline Proposal		
• Receives and appraises designs and reports • Receives and approves outline designs and costs	• Amendments and additions to brief as a result of appraisals • Completed room data sheets	• Produce first sketch designs for analysis • Complete outline design and cost plan • Complete informal negotiations with statutory authorities
RIBA Stage D – Scheme Design		
• Receives and approves full scheme designs and costs (if satisfactory) • Instructs preparation of presentation drawings • Authorises formal submission for required statutory consent	• Amendments and more details • Layouts etc. Of furniture and equipment in special rooms and areas	• Preparation full scheme designs and estimate of costs • If approved, prepare presentation drawings, perspective sketches and/or models • Apply for planning and other consents

Table 1.2 Development of Briefs

Source: Perera (1997:19)

2.3 DESIGN STAGE COST ADVICE

Cost of a building to client means and includes construction cost and costs in use. The scope of the cost advice of this research is limited to design stage cost advice on construction cost.

The Quantity Surveyors committee report on the future role of the Quantity Surveyors (1971)states that Quantity Surveyors must become more sensitive to dictates of design procedures and to the importance of the performance aspects of design (cited by Smith,1982)

Brandon (1984) identifies some requirements for effective cost advice as follows:

1. The cost adviser should have a clear idea of when the major decision having high impact on costs are taken by the design team;

2. The cost adviser should equipped with techniques, knowledge and experience to provide cost solutions to iterative design solutions

Current research suggests that there is a heavy commitment of cost prior to sketch design being formalized. This may amount to over 80% of the final potential building cost, leaving perhaps only 20% to actually control (Brandon and Ferry, 1989)

The main point here is that cost information shall be manipulated at earliest possible time with most appropriate technique. The challenge is to select most appropriate estimating technique.

2.4 DESIGN TECHNIQUES AND COST RELATIONS

According to Brandon and Ferry (1991) some matters of principle affecting the most design approaches are as follows:

1. Matters relating to constraints

   Physical constraints, statutory constraints, client and design team oriented constraints are of relevance. Proposed cost model of this research has design database to provide necessary information in this respect.

2. Matters relating to priorities

   Theoretically, it can be said that client's priorities may be ranked and design effort and allocation of money are aligned in accordance with the priorities. But this view cannot be realized fully. Compromise between client's priorities, design and cost seem to provide the solution. This will appeal to design and cost databases from historical analysis.

3. Space and spatial arrangement based constraints

   There is a good correlation between the area of a building and its cost. Clients are generally aware of the usable floor area requirements. Cost advisor can predict the cost of a building based on the gross area (usable area + circulation) and other design information. Land area, location of the land and statutory requirements of the region generally govern the spatial arrangements. Spatial arrangements and costs are positively correlated.

4. " What form should the building will take?"

   Form of the building is a result of translating the functional spatial arrangement of bubble diagram (also called planer graphs) into a building form that will reflect the relationships determined. Since the decisions on space, circulation, specification and form are formalized before sketch design stage is completed degree of cost control from this point onwards is limited.

5. Level of specification

Level of specification is influenced to a greater extent on experience of the design team. Client's brief may contain indications as to the level of specification to be met. Cost advisor should be capable of producing alternative estimates for different specification levels providing approximately same facility. Design and cost databases created from historically analyzed buildings can meet the requirements.

2.5 CONTEXT FOR COST MODELLING

The cost modeling has no effective purpose unless it interacts with design process. The point of departure in understanding and building cost models is consideration of design. Design is considered to provide drive and context to the cost modeling process. Context of cost modeling has been described in terms of 'informing design'. Informing design has been described as that cost advisor enables the designer to give their own "concrete and self reflective" form to the cost concepts, ideas and data presented to them. It is only by affecting the models in designer's heads that cost will ever be truly an integral part of design (Newton, 1987).

2.6 SUMMARY

1. Understanding of design process, design techniques are essential for reliable cost advice. Design process is iterative in nature. This demands flexible design cost advice techniques sensitive to design decisions. It has been explained that design provides the context for cost modeling.

2. The traditional and new design procedures were discussed in this chapter. New design process models have been proposed by numerous researchers to eliminate the inefficiencies of traditional models. Experience of the manufacturing sector has been consulted in formulating new process models to tackle design process related problems in the construction industry. Improved design processes will demand appropriate estimating systems.

3. Cost advice given before the Sketch Design stage is finalized, is very effective and crucial in design cost control.

4. Development of cost models with greater capacity to process cost and design information at earliest possible stage (say Briefing stage) is desired. In this respect computer based cost models with necessary databases prove proper.