FACTORS INFLUENCING TIME AND COST OVERRUNS ON CONSTRUCTION PROJECTS IN SOUTHERN PART OF INDIA

S. Binil Sundar*

ABSTRACT

Construction industry is considered as one of the most important and second largest industries in India after agriculture. It is well known that most construction projects in Kerala are exposed to time and cost overrun or both. This phenomenon may affect the progress of construction industry in Kerala as well as may expose many institutions of construction to be destroyed. The study clarified that “labour and equipment factors" was the most critical factor that influence project delay. The survey also indicated that "material- related factors" occupied the second rank in importance. The study illustrated that prices fluctuations of constructions materials, tendering manoeuvres and design changes are some important factors that may lead to cost overrun. Also it clarified that contractor's delay of material delivery and equipment has led to cost overrun. The study also clarified that prices inflation highly contributes to cost overrun. The study recommends owners, contractors, and consultants to hold their responsibilities to avoid any delay or cost overrun which could be achieved by good management of the project, improving worker productivity and for storing the needed materials from the beginning of the project.

* **Asst Professor & HOD – Civil Engineering Department, RVS Padhamavathy College of Engineering and Technology, Chennai, India.**

1.0 INTRODUCTION

1.1 Construction industry background

The construction industry is the one through which physical development is achieved, and that is truly the locomotive of the national economy. The more resources, engineering, labour, materials, equipment, capital, and market exchange are provided from within the national economy, the higher the factor of the extent of self-reliance. The increasing complexity of infrastructure projects and the environment within which they are constructed place greater demand on construction managers to deliver projects on time, within the planned budget and with high quality. Indian Construction Projects, especially those related to engineering construction, do suffer delays or slippage. This is found more relevant in Kerala State especially in central Kerala which includes districts like Calicut, Thrissur, Ernakulam, Malappuram, Palakkad due to its cultural and political environment. The major reasons for the project slippages are physical environment including external interference, negative approach towards construction Industry, lack of advanced technology, Non-availability of trained technical hands, lack of advance planning, comprehensive Engineering, management strategy, inconsistency in monitoring, constant follow up and lack of co-ordination. To the dislike of owners, contractors and consultants, however, many projects experience extensive delays and thereby exceed initial time and cost estimates. This problem is more evident in the traditional or adversarial type of contracts in which the contract is awarded to the lowest bidder- the awarding strategy of the majority of projects in developing places including Kerala. Therefore, improving construction efficiency by means of cost-effectiveness and timeliness would certainly contribute to cost savings for the country as a whole. Efforts directed to cost and time effectiveness were associated with managing time and cost, which in this study were approached via investigating time and cost overruns of construction projects in Kerala.

1.2 Research problem

Project finishing on time and absence of cost overruns are considered the most important factors of successful projects, which help to decrease problems for all parties and give new chances to construct other related projects. It also helps to increase the profits and

development of construction industry in Kerala. Most construction projects in Kerala are exposed to delay to the extent that it may extend to double the period of time specified for that project, causing loss of project's profit, increasing cost and leading to technical and managerial problems among project's parties. Cost overruns are also considered as another big problem, which hinders project's progress, since it decreases the contractor profit leading to huge losses leaving the project in a big trouble

This problem is also due to political situation in Kerala, weak economy, lack of managerial skills, bad labor productivity, bad planning, increasing the prices of materials, environment, type of project and others. For that it is of key importance to exert the utmost effort to accomplish such study, to detect the previously mentioned factors and to treat all the weakness points and from all sides, and so giving specific priorities in order to avoid time and cost overruns at construction projects.

1.3 Research aim

The aim of this research is to assess factors influencing time and cost overruns on construction projects in Kerala.

1.4 Research objectives

1. To identify the variables influencing construction time and cost overruns and to evaluate their relative importance.
2. Investigate the collective group perspectives on the relative significance of these factors from owner, consultant, and contractor point view.
3. To evaluate the magnitudes of the time delay, and cost increases.
4. To conduct specific practical case studies.
5. To formulate recommendations for improving construction performance.

1.5 Limitations and Assumptions

This research included the following limitations:

1. The study included the factors influencing time and cost overruns in Kerala only.
2. Literature on delay and cost overruns for building projects in Kerala are very limited.

2. LITERATURE REVIEW

One of the most important problems in the construction industry is time and cost overruns. Time and cost overruns occur in every construction project and the magnitude of these delays and cost overruns varies considerably from project to project. So it is essential to define the actual causes of time and cost overruns in order to minimize and avoid the delays and increasing cost in any construction project. This chapter reviews literature concerning the major issues of time and cost overruns in order to recognize the related information regard those issues.

2.1 Definition of time and cost overruns

2.1.1 Time overruns

Time overruns is defined as the extension of time beyond planned completion dates traceable to the contractors (Kaming et al 1997). Delays are incidents that impact a project's progress and 2postpone project activities, delay causing incidents may include weather delays, unavailability of resources, design delays, etc. In general, project delays occur as a result of project activities that have both external and internal cause and effect relationship (Vidalis et al 2002).

Choudhry (2004) and Chan (2001), defined the time overruns as the difference between the actual completion time and the estimated completion time. It was measured in number of days. Project delays are those that cause the project completion date to be delayed (Al- Gahtani and Mohan 2007). From above, time overruns is defined as the time increased to complete the project after planed date which caused by internal and external factors surrounded the project.

2.2 Types of delay

The main types of delay have been stated by a number of researchers (Vidalis et al 2002), Ahmed et al (2003), Alaghabri et al (2007) and Al- Gahtani and Mohan (2007). These types are Excusable delay, Concurrent delay, Compensable delay, and Critical delay.

The types of delays above have internal or external impacts on project process. Internal

causes of delay include causes that come from the owner, designers, contractors, and consultants.

2.2.2 Concurrent delays

If only one factor is delaying construction, it is usually fairly easy to calculate both the time and money resulting from that single issue. A more complicated – but also more typical – situation is one in which more than one factor delays the project at the same time or in overlapping periods of time. These are called concurrent delays (Alaghbari et al 2007). Concurrent delays occur when both owner and the contractor are responsible for the delay. Generally, if the delays are inextricably intertwined, neither the contractor can be held responsible for the delay (forced to accelerate, or be liable for liquidated damages) nor can he recover the delay damages from the owner. Until the development of CPM schedule analysis, there was no reliable method to differentiate the impact of contractor caused delays from owner-caused delays. With the sophisticated computerized techniques now available, however, it has become possible to segregate the impacts of apparently concurrent owner and contractor delays (Alwi et al 2002).

In analyzing a delay claim, an analysis based on a comparison of the contractor's approved CPM schedule with the as-built CPM schedule should be performed to apportion proper responsibility for delay. Because the critical path may shift as the job progresses, it is updated based upon contractually required input from the contractor.

3.1 Research Design

"Research design" refers to the plan or organization of scientific investigation, designing of a research study involves the development of a plan or strategy that will guide the collection and analyses of data (Poilt and Hungler, 1985). This research consists of seven phases, the first one is the proposal for identifying and defining the problems and establishment of the objectives of the study and development of research plan. The second phase of the research includes literature review. Literatures of time and cost overruns

were reviewed.

The third phase of the research included a field survey which included the firm of owners, contractors and consultants, also some actual cases were collected during the field survey. The fourth phase of the research includes the questionnaire design, through distributing the questionnaire to a sample of local contractors, consultants and owners' firms. The purpose of the pilot study was to test and prove that the questionnaire questions are clear to be answered in a way that help to achieve the target of the study. The questionnaire was modified based on the results of the pilot study.

The fifth phase of the research was questionnaire distribution. The questionnaire was used to collect the required data in order to achieve the research objective. The sixth phase of the research focused data analysis and discussion. Statistical Package for the Social Sciences, (SPSS) was used to perform the required analysis. The last phase of the research includes the conclusions and recommendations. Figure 3.1 illustrated the methodology flow chart which includes the objectives of the thesis.

3.2 Questionnaire design

Reference to the literature review, it has been assembled around of (136) factors which affect the time and cost overruns in engineering projects in various countries around the world and at intervals of time, but not all of these factors are consistent with the conditions and circumstances with Kerala from economic level, the type of projects, geographical region and occupation factors which experienced. So factors commensurate with the nature of construction projects and problems in Kerala have been suitably selected. Modifications and new questions were then added as a result of interview of experienced construction managers to suit the local construction industry in Kerala.

3.3.1Factors added from the researcher experience

Table 3.1 shows the factors influencing time and cost overruns, which added from the researcher experience.

Table 3.1 : Factors of time and cost overruns added by researcher experience

#	The factor	Groups of factors
1	Inflexibility of donor in giving	Project – related factors
2	Low harmony between technical team of contractor	Contractor's responsibility
3	Unethical behaviors used by contractors to	Contractor's responsibility
4	Contractor uncommitment to consultant Instructions	Contractor's responsibility
5	Dependence on a newly – graduated engineer	Contractor's responsibility
6		Contractor's responsibility
7	Bad past history and reputation of the consultant	Consultant responsibility
8	Lack of job security for the consultancy team	Consultant responsibility
9	Owner delay in freeing the contractor financial	Owner's responsibility
10	Bad Preparation and approval of shop drawings	Professional Management
11	Ageing of site workers	Labor and equipment
12	Different political and factional affiliation	Labor and equipment
13	Absence of managerial programs that help	Cost overruns
14		Cost overruns
15	Long period of the project maintenance period	Cost overruns
16	Increment of material prices due to	Cost overruns

Table 3.1 : Factors of time and cost overruns added by researcher experience (cont.)

#	The factor	Groups of factors
17	Bad allocation of workers inside the site	Cost overruns
18	Over time work hours of supervising Engineer are paid by the contractor	Cost overruns
19	Unsettlement of the local currency in relation to dollar value	Cost overruns
20	Project materials monopoly by some suppliers	Cost overruns
21	Attracting skillful technicians for work	Cost overruns
22	Inability of the contractor to be adopted properly with the projects environmental	Cost overruns

The final questionnaire contains 110 factors influencing time overruns, and 42 factors influencing cost overruns. The respondents were asked to fill the questionnaire and they were assured that the information will be confidential and only for research purpose.

4. RESULTS AND DISCUSSION

4.1 Introduction

This chapter describes the results and discussion of questionnaire survey concerning time and cost overruns from contractors, consultants and owner viewpoints in Kerala. This chapter focuses on describing the respondent's characteristics in addition to the discussion of the factors that influence time and cost overruns.

4.2 Part A: Population characteristics

This part is mainly designed to provide general information about the respondents in terms of the name of organization, major type of work involved, position and experience contact person, location of organization, average of projects executed per year and the number of constant employees at the organization.

4.2.1 Type of organisation

In this study, 52.00 % (26) contractors, 26.00 % (13) owners, 22.00 % (11) consultants participated in the questionnaire as shown at Fig (4.1). The general response rate for contractors, owners and consultants was 82.11% and the total number of respondents for the three parties was 40 out 50 respondents. The response rate of contractors was 81.00% (21 out of 26 respondents), for the owner 77.00 % (10 out of 13 respondents) and 81.00 % (9 out of 11 respondents) for consultants.

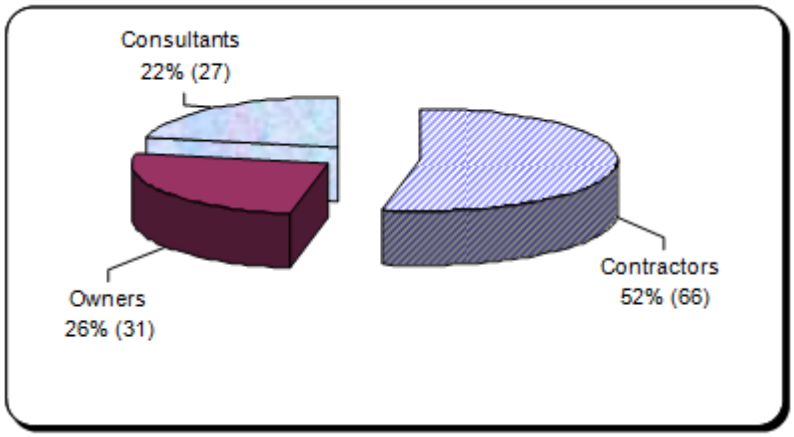

Figure 4.1: Type of respondent's organisation

4.2.3 Respondents designation

Figure 4.2 shows that 51.52 % (34) of contracting companies respondents were site engineers, 31.82 % (21) were projects managers, 9.09 % (6) were the owners of organization and 7.58 % (5) were office engineers. It has been founded that 51.61 % (16) of owners respondents were site engineers, 29.03 % (9) were projects managers, 16.13 % (5) were office engineers and 3.23% (1) was the owner of organization. It has been found that 44.44 % (12) of the consultants companies respondents were projects managers, 37.04 % (10)

were site engineers, 11.11 % (3) were office engineer and 7.41 % (2) of respondents were the owners of organization. Totally out of 124 respondents for the three parties, 48.4 % (60) of the respondents were site engineers, 33.90 % (42) were projects managers, 10.5 % (13) were office engineersand 7.2 % (9) were the owners of organization.

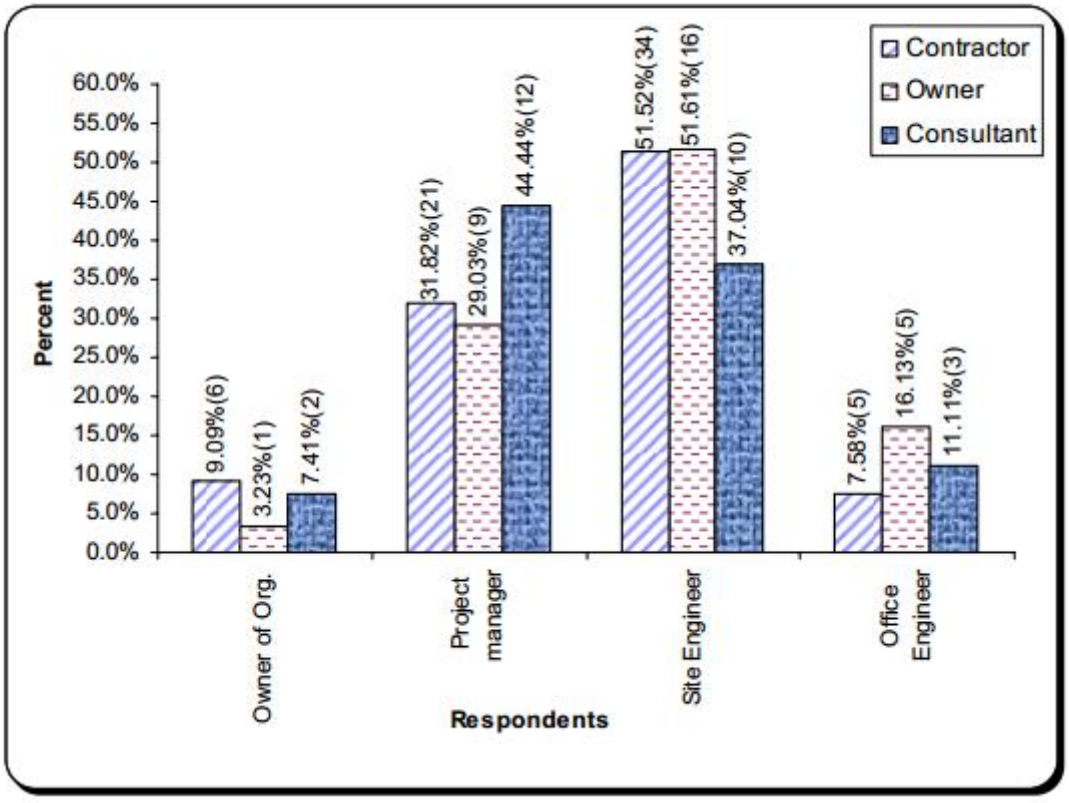

Figure 4.2: Respondents designation

4.2.4 Group 3: Owners responsibilities

Contractor views

Table 4.4 shows that respondents contractors ranked "owner delay in freeing the contractor financial payments" in the first position with importance index (I.I = 76.52%). Payments are considered as the first factor to complete the project on time, as any delay of

freeing contractor payments. It will affect contractor's financial responsibilities, such as wages, the purchase of materials etc.

The second important factor ranked by respondents contractors was "contract modification (replacement and addition of new- work to the project and change in specification)" (I.I = 75.76 %). Contract modification is one of the important reasons that cause delay. As any modification in the technical specification, bill of quantities or replace any work with another one, it would lead to disputes between the contractor's and owner's teams. To solve these disputes and develop new agreements, it takes additional time that affects the project schedule and hence affects the total duration of the project.

Table 4.4 : Owner's responsibilities Factors that influencing time overruns

	contractor		consultant		owner	
Owner's responsibilities	**II**	**Rank**	**II**	**Rank**	**II**	**Rank**
Owner delay in freeing the contractor financial payments	76.52	1	38.89	9		
Contract modifications (replacement and addition of – new work to the	75.76	2	71.3	1	67.74	1
Owner – initiated variation	73.46	3	64.81	2	48.39	2
Unrealistic contract durations imposed by	71.59	4				
Owner interference	70.83	5	52.78	4	29.03	7
Unrealistic owners initial requirements	67.05	6	49.07	6	33.06	5
Lack of unified system for contracts, general	64.77	7	42.59	8	45.83	3
Owner has no priority/ urgency to complete the project	62.12	8	50.00	5	26.61	8
High quality of work	54.55	9	48.15	7	35.48	4

"Owner initiated variation" (I.I = 73.46 %) was ranked as the third factor to cause delay at this group. Variation order is one of obvious reasons to extend the original duration of

project, thus it contributes to delay of the project handing over. Often the required additional duration of variations are specified in the agreement. This result is coincides with the result of Fong et al (2006) and Lo et al (2006). This agreement reflects the importance of this factor. Variation hold the project to additional duration and cost, so in this case the "owner's responsibility" of delay is high.

Table 4.4 shows that respondents contractors ranked "high quality of work" (I.I = 54.55 %) as the least factor that cause delay. The most appropriate interpretation of this rank is that the required quality of work in Kerala is high; also the quality standards are similar in all projects. Through the tendering phase the owner specify the needed quality of work, so the contractor attended to this point from the beginning of the project.

6.0 CONCLUSIONS

6.1 Introduction

This chapter includes the conclusions and recommendations that would help in solving the problem of delay and cost overruns at future construction projects in Kerala. The first objective of this study was to identify variables influencing construction time and cost overruns. The second objective was to evaluate the magnitudes of the time delay, and cost increases. The third objective was to conduct several practical case studies, and the last one was to formulate recommendations to improve construction performance.

6.2 Conclusions

This part of the thesis concludes the main findings as following :

6.2.1 Factors influencing time overruns (delay)

This part of thesis included 12 groups of factors that influencing time overruns. The total number of factors included among the 12 group of time overruns is 110 factors.

6.2.1.1 Project related factors

Results indicated that the factor "suspension of work by owner or by contractor" has been ranked in the first position by contractors, consultants and owners. This result indicates the high importance of work continuity to complete the project on time. The suspension of work creates disputes between the parties of project, and then the sequence of completion will be affected. This agreement of opinions between contractors, consultants and owners proves the importance of these factors in projects delay.

6.2.1.2 Contractor's responsibilities

Results have shown that the factor of "cash problem during construction" has been ranked in the 1st position by the three parties (contractors, consultants and owners). This result indicates the high importance of cash for the progress of project. Any shortage of cash for the contractor will cause many problems such as slow progress and decline in productivity. Also the contractors will not be able to purchase the needed equipment for work. More over the problem due to shortage in cash also extended to traders and suppliers, which in turn leads to slowdown the work, and subsequent project delay.

6.2.1.3 Consultant's responsibilities

Results show that "the delay in materials approval by consultant" factor has been ranked as the major factor by consultant in this group. This result indicates the high importance of each party to perform required work, The delay of materials approval will lead to suspension of the work. If the delay of materials approval was intentional or as a result of staff lacking experience, it will also cause a delay for the project.

Results also have shown that the factor "the centralization of decision making process from consultant party" has been ranked in 1st position by consultant and owner, with (I.I= 66.67%) and (I.I = 70.79%) respectively. It shows the importance of consultant decisions, the speed or slowness of these decisions and the impact of these decisions on progress of the project.

6.2.1.4 Owner's responsibilities

Results have indicated that, "owner delay in freeing the contractor financial payments" has been ranked in 1st position by contractors at this group. Payments is considered as the first priority to complete the project on time, as any delay of freeing contractor payments, it will

affect contractor's financial obligations. Results show that "contract modifications (replacement and addition of –new work to the project and change in specification) " factor has been ranked in the 1st position by consultants and owners, with importance index (I.I = 71.3%) and (I.I = 67.74%) respectively. As any modification in the technical specification, bill of quantities or replacement of any work with another one, it would lead to disputes between the contractor's and owner's teams. To solve these disputes and develop new agreements, it takes additional time that affects the project schedule and hence affect the total duration of the project.

6.2.1.11 Government relationship

Results indicated that the factor "slow permits by government agencies" has been ranked in the 1st position by contractor at this group. Consultant and owner ranked the building regulation as the most important factor at this group.

6.2.4 Factors influencing cost overruns

The top ten factors that cause cost overruns as perceived by contractors are: "increment of materials prices " in the 1st position, "delay in construction, supply of raw materials and equipment by contractors" in the 2nd position, "fluctuations in the cost of building materials" in the 3rd position, "project materials monopoly by some suppliers" in the 4th position, "unsettlement of the local currency in relation to dollar value" in the 5th position, "low commitment of donor to compensate any bad result that may come from the bad economic and political situation" in the 5th position, "design changes" in the 8th position, "additional work at owner's request" in the 9th position and "resources constraint: funds and associated auxiliaries not ready" in the 9th position.

6.2.3 Comparison between the results of questionnaire and the results of case studies

From the results obtained from questionnaire at this thesis, and compare it with the results and analysis of previous cases studies, it's found that there are a real similarity of the important factors that influencing time and cost overruns. Case studies and the respondents of questionnaire concentrate on some factors of time and cost overruns, these factors are:

- Mismanagement of project from the three parties (contractor, consultant and owner) which lead to time and cost overruns of project.

- Poor planning of project and poor documentation at the site.
- Disputes between the parties of project and the absence of trust.
- Delay in revision payments by consultant and delay in freeing it by owner.
- Delay in materials and drawings approval by consultant.
- Unsettlement of the local currency in relation to the dollar value.
- Fluctuation in the cost of construction materials.
- Bad weather condition.

The above agreement between the respondents of questionnaire and the results of cases studies prove the importance of these factors in delay and cost overruns process.

References

1. Iyer, K.C.and Jha, K N (2003) "Analysis of Critical Coordination activities of Indian Construction Projects". In: Greenwood,DJ (Ed.) 19th Annual ARCOM Conference, Association of Researchers in Construction Management, Vol. 2, 563-72.
2. Williams Ibbs (2007) part of the Journal Construction Engineering and Management Vol.133, No. 10, October 1, 2007, @ASCE ISSN 0733-9364/2007/10-736-742.
3. Ren, Z, Atout,M and Jones, J (2008) Root causes of construction project delays in Dubai, In; Dainty, A (Ed) Procs 24th AnnualARCOM Conference, Association of Researchers in Construction Management, 749-757.
4. Faniran, O O, and Caban, G (1998) "Interactions between construction planning and influence factors." Journal of Construction Engineering and Management,124(4),245-256.
5. Assaf S. and AL-Hejji S., 2006, Causes ofdelay in large construction projects, International Journal of Project Management, Vol. 24, No. 4, pp. 349-357.
6. Chan Albert P.C., 2001, Time cost relationship of public sector projects in Malaysia.
7. International Journal of project Management, Vol. 19, No.4, pp. 223-229.

8. Chan Daniel and Kumaraswamy Mohan M., 1996, An evaluation of construction time performance in the building industry. Journal of Building and Environmental, Vol.31, No. 6, pp. 569-578.

9. Chan D. and Kumarswamy M., 2002, Compressing construction duration: lessons Learned from Hong Kong Building Projects.International Journal of Project Management, Vol.20, No. 1, pp. 23-35.

10. Chimwaso, K.D., 2001, An Evaluation of costperformance of public projects; case of Botswana. Department of Architecture and Building Services, Private Bag 0025, Gaborone, Botswana.

11. Choudhury I., and Phatak O., 2004, Correlates of time overrun in commercial construction, ASC proceeding of 4th Annual Conference, Brigham Young University-provo-Utah, April 8-10.

12. Fellows, R., Liu, A.,1997, Research methodsfor construction. Blackwell Science Ltd.

13. Etchegaray, J.M. and Fisher, W., 2006, Survey research: be careful where you step, Reliability and validity of measures, BMJ Journals, Vol. 15, No. 3, pp. 154.

14. Enshassi A., Lisk R., Sawalhi I. and Radwan I., 2003, Contributors to construction delays in Palestine, The Journal of American institute of constructors, Vol. 27, No. 2, pp. 45-53.

15. Fellows, R., Liu, A.,1997, Research methodsfor construction. Blackwell Science Ltd. Flyrbjerg, Bent., 2005, Policy and planning of large infrastructure project problems, causes, cures. World Bank policy research working paper 3781, December 2005.

16. Fong N., Wong L.Y., and Wong LT., 2006, Fire services installation related contributors of construction delay. Journal of Building and Environment, Vol. 41, pp. 211-222.

17. Morris S., 1990, Cost and time overruns inpublic sector projects. Economic and Political weekly, Nov.24,1990, Vol. xxv, No.47, PP. M 154 to M 168.

18. Poilt, D., and Hungler, B., 1985. Essentials of nursing research; Methods and applications, J. B. Lippincott company,