
Analysis of Time Slippage for Construction Projects in Public Sector: Owner's Perspective

MISBAH JAMIL*, NADEEM A. MUFTI**, AND WASEEM SAIF DAR***

RECEIVED ON 21.12.2009 ACCEPTED ON 08.06.2010

ABSTRACT

Time slippage frequently occurs in construction projects throughout the world and Pakistan is no exception. This phenomenon is especially significant in public sector where most of the projects complete beyond their target dates. Though there are numerous factors that cause time slippage, the emphasis of this study is to identify those for which the owners are responsible. Lack of knowledge and poor appreciation of proper planning for different phases of construction projects and its impact on cost and time is a dilemma for owners. This research is based upon three case studies of public sector projects and aims to identify different factors that cause delays in public sector construction projects in order to help different stakeholders find the causes of delays due to the owners' action or inaction.

This research also looks into cost overruns resulting from delays, with the aim at educate the owners about their responsibilities towards different phases of construction projects and devise measures to mitigate different types of claims, which may arise because of these delays. The most common delay factors, such as, inadequate design details at the start of the project; major changes in design; late issuance of construction drawings; inadequate funding and delay in issuance of NOC's/approvals associated with government agencies, have been identified to help owners in planning the projects in an efficient and effective manner. The results of this study are expected to improve the contribution of owners in overall project management. Results will also be helpful for consultants, designers and contractors in anticipating the problems during execution of the projects.

Key Words: Time Slippage, Construction Projects, Delays, Public Sector, Pakistan.

1. INTRODUCTION

Delays in construction industry are most common problems encountered on construction projects. This exceeds initial time and cost estimates agreed by all the stakeholders involved [1]. During execution of construction projects frequent changes result in escalation of costs, time delays and poor quality of output [2]. Inspite of the advanced technologies

and construction management tools and techniques available, construction projects suffer delays [3]. Delays are broadly classified into two categories (1) excusable delays and (2) non-excusable delays. Excusable delays are further divided into (i) excusable delays with compensation and (ii) excusable delays without compensation. Excusable delays are those for which client

* Lecturer, Department of Architectural Engineering and Design, University of Engineering & Technology, Lahore.
** Professor, Department of Industrial and Manufacturing Engineering, University of Engineering & Technology, Lahore.
*** Engineer, Construction Management Division, NESPAK (National Engineering Services Pakistan Limited).

is responsible e.g; inadequate funding, design changes, approvals from authorities etc. For non-excusable delays contractor is responsible e.g; material and equipment related delays, labour related delays, etc. Compensable excusable delays are generally responsibility of client and contractor may be entitled for extension of time and extra costs related to these delays e.g. design changes, failure to provide payments on time, approvals for authorities, etc. Excusable delays without compensation are neither under control of client nor the contractor e.g; war, acts of God, etc. [4-5].

Construction projects in Pakistan, especially government funded projects, often experience delays that exceed their completion time by up to 100% in addition to exceeding the budget. There are many possibilities; a construction project can be delayed. Since there are many parties associated with the design and construction process that may be responsible for delays. The scope of this study is limited to the evaluation and identification of delays caused by owners. Major owners in Pakistan's public sectors are WAPDA, NHA (National Highway Authority), C&W, and different building departments etc. For the purpose of this research, small to medium sized projects in government sectors with a completion period of about 1-2 years have been selected. According to Wysocki, et. al. [6] projects categorization can be based on duration. The projects under discussion fall under Type-B, the highest level being Type-A. The Handbook of Planning Commission [7] indicates the categorization on the basis of budget. The projects under discussion also fall in the medium budget range.

Three projects from different owners in the government sector, namely, PHA (Pakistan Housing Authority), CDA (Capital Development Authority), and NHA (National Highway Authority) were selected. These projects were analyzed to evaluate the delaying factors. The focus of the study is to evaluate delays that are caused by owners

of the projects. The most common delaying factors have been identified which may help owners in planning future projects in an efficient manner. Results will also be helpful for consultants, designers and contractors in anticipating the problems during execution of the projects.

2. LITERATURE REVIEW

Some work has already been done for analysis of delays as a contribution to mitigate their adverse effects in future projects. Ali, et. al. [5] selected three public sector construction projects as case studies and analyzed the delays experienced during execution of these projects. After analysis of excusable and non-excusable delays they concluded measures to safeguard the future projects from adverse effects of delays. On the other hand, Memon, et. al. [8] concentrated on analysis of excusable delays and recommends measures to complete construction projects on time and within specified budget. He concluded that significant excusable delays include; changes in design, late approvals of construction drawings and improper planning.

Assaf, et. al. [9] conducted a field survey to identify causes of delay in construction projects in Saudi Arabia. They studied frequency, severity and importance of causes of delay. The study identified 73 causes of delay through research and separated the causes into nine groups. They presented the perceptions of consultants, contractors, owners, and other parties involved in construction projects and agreed that one cause of delay is common, which is "change orders by owner during construction". Study indicated that consultants and owners realize that award of work to the lowest bidder, is the highest frequent factor of delay, while contractors considered causes of delay related to owners as severe.

Alkass, et. al. [10] identified that analysis of delays is usually complex and computerized approach can be used. They discussed different techniques for analysis of delays

currently used in construction industry by professionals and proposed a new analysis technique called IDT (Isolated Delay Type). Sweis, et. al. [3] conducted a survey and interviews of stakeholders involved in construction projects to evaluate most common causes of delay. They conclude that financial problems faced by the contractor and "change orders" from client side are the most common causes of delay in construction projects. On the other hand least important causes indicated are severe weather conditions and changes in government laws and regulations.

Odeh, et. al. [11] presented the findings of survey conducted to identify the most important causes of delay in construction projects with traditional type contracts. This study concluded that contractors and consultants viewpoints, owner interference, inadequate contractor experience, financing and payments, labor productivity, slow decision-making, improper planning and subcontractors are among ten most important factors for delay in construction projects. Sambasivan, et. al. [12] identified delay factors and their effect on project completion in the Malaysian construction industry. The ten most important factors for delay were: (1) contractor's improper planning, (2) contractor's poor site management, (3) inadequate contractor experience, (4) inadequate client's finance and payments for completed work, (5) problems with subcontractors, (6) shortage of materials, (7) labor supply, (8) equipment availability and failure, (9) lack of communication between parties and (10) mistakes during the construction stage.

Ogunlana, et. al. [13] conducted a survey of the delays experienced in high-rise construction projects in Bangkok, Thailand and compared the results with other studies carried out around the world to investigate whether there are special problems that generate delays for construction in developing economies. Majid, et. al. [4] classify the main causes of non-excusable delays first according to

the source of occurrence and then factors identified contributing towards those causes. Lo., et. al. [14] aimed to gather the perceptions of civil construction practitioners in Hong Kong on the significance of the causes of delays and then ranked these causes of delay by using mean score method. The results of this study showed that consultant and contractor groups have extremely different perceptions regarding the importance of various causes of delay. Assaf, et. al. [15] presented the main delay causes in large construction projects in Saudi Arabia and relative importance of these causes. This study included 56 delay causes grouped into nine major categories and it was shown that the financing group of delaying factors was ranked the highest by all parties and the environmental group of delay factors was ranked the lowest.

The study by Aibinu, et. al. [16] assessed the causes contributing towards delays by looking at actions and inactions of project participants and external factors. In addition, it revealed areas in the practice that requires improvement. Borddi, et. al. [17] reviewed existing methods for assessing the effects of delaying factors and a new method of delay analysis was presented. A questionnaire survey was conducted by Kumaraswami, et. al. [18] having 83 factors identified for delay. Analysis of responses revealed a difference in perceptions of clients, contractors and consultants about relative importance of these causes for delay. All parties involved agreed about the relative importance of delay factors, such as unforeseen ground conditions. Al-Momani, [19] investigated causes of delays on 130 public projects in Jordan and provided aid to construction managers for evaluation prior to the contract award using quantitative data. The survey indicated that poor design, negligence of the owner, change orders, weather condition, site condition, late delivery, economic conditions and an increase in quantities are the main causes of delay.

3. OBJECTIVES OF THE RESEARCH

The main objective of the research study presented in this paper is to identify the factors that are responsible for delay in construction projects in Pakistan government sector caused by owners. In addition, to present the financial impact of these delaying factors by calculating percentage increase in costs of the selected construction projects.

4. METHODOLOGY

Three projects from different owners were selected as case studies to evaluate the common delaying factors that caused them to delay. The projects selected were of diverse nature in order to get the common delaying factors encountered in different circumstances. The first project consists construction of bridges, while other two are building projects. Even both building projects are not alike in nature, as one is the construction of a residential building while the other is an office building. Three different owners provided the intrinsic diversity for different organizational behaviours and construction practices in the Pakistan government sector.

Different EoTs (Extension of Times) given during or after the course of projects were analysed to obtain the delaying factors attributable to owners. Many variations were initiated during the execution of these projects due to change in design of these projects. These variations

were also studied and their impacts on the cost of the projects were also taken into account. Major delaying factors of each project were indicated after analysing and discussing the different EoTs and design changes, etc. Their impact on time and cost was also established. Types of delays were also identified in terms of excusable/non-excusable and compensable/non-compensable delays. The results could thus be generalized for other similar types of projects and other owners in the government sector.

5. THE PROJECTS

The projects selected as case studies belong to three different government authorities. Project-A belongs to CDA, an agency normally engaged in the construction of roads and buildings of Islamabad, the Federal capital of Pakistan. Project-B belongs to PHA (Pakistan Housing Authority) that undertook around 20 projects of similar nature in different cities of Pakistan. NHA, responsible for the construction of major highways throughout Pakistan, is the owner of Project-C. The projects selected from three different owners were analyzed for the delaying factors, attributable to the owners only. The salient features of the three projects selected have been outlined in Table 1. The periods of delay in months for each project have also been presented in this table. The results indicate that there is no relation of the delays with the original cost and contract period of the project.

TABLE 1. SALIENT FEATURES AND DELAY PERIOD OF THREE SELECTED PROJECTS

Salient Features	Project-A	Project-B	Project-C
Name of Owner	CDA	PHA	NHA
Type of Project	Construction of Bridges	4 storey flats/apartments	6 storey office building
Approximately Cost of the Project			
(Rs Million)	192	109	92
Date of Commencement	November 01, 1999	August 08, 1999	August 25, 2003
Contract Period			
(Months)	12	12	24
Expected Date of Completion	October 31, 2000	August 07, 2000	August 24, 2005
Actual Date of Completion	November 04, 2004	August 15, 2007	September 30, 2007
Delay in Months	45	84	25

6. EVALUATION OF DELAYING FACTORS FOR SELECTED CONSTRUCTION PROJECTS

6.1 Project-A: Construction of Four Bridges on Islamabad Highway (CDA)

The project was designed and supervised by REC (Republic Engineering Corporation). From the outset, the project got into trouble due to shortcomings and discrepancies in the design. The contractor did not proceed smoothly. The design consultant failed to provide solutions to many design problems and therefore the owner decided to terminate their services. UET (University of Engineering & Technology), Lahore, Pakistan, was appointed as design consultant in October 2000. Due to this change of designer and got suspended for next five months due to design vetting/new design by UET. There were no structural drawings available for construction during this five months period.

The project could not be completed in the stipulated time of 12 months and was delayed enormously. The project got four EoT of eight, nine, sixteen and thirteen months on different occasions. The delaying reasons in the first EoT were design related. The owner did not provide decisions on pile cut off levels and the situation became worse as the construction drawings were also not available. When the UET was engaged as the new designer the project again suffered as the design of bridges was changed considerably. Design changes were quite significant which affected the construction activities. The construction of bridges involved casting of pre-stressed girders. The designer changed the lengths of girders (from 40- 48 meter lengths) in the revised design. These revised designs changed the methodology of contractor's casting, launching and dragging sequence of the girders, which was a sizeable task. Moreover, the situation further worsened by the delayed payments to the contractor.

Another major reason for the delays in the third EoT of the project was the unavailability of the NOC from Pakistan Railways to start construction of Railway Bridge (one of the 4 bridges). Since it is the responsibility of owner to get approvals from different government agencies, therefore, any delay caused on this account is the owner's delay. The NOC was eventually given in May 2003. The problem of delayed payments to the contractor continued even in the fourth EoTs period and about 103 days of delay was caused due to delayed payments. Though some other delay reasons from the contractor's side were also present which shifted the completion date to November 2004 and may be categorized as non-excusable but since this study is limited to the identification of owner' caused delays that's why we didn't go into details of delays. As the causes of delay included late NOC and delayed payments, such delays fall under category of excusable compensable delays however contractor was not compensated.

6.1.1 Major Delaying Factors

The study of the above project reveals that the following were the major factors which were responsible for the delay from the owners' standpoint. These delays were excusable and compensable as discussed in introduction.

- (i) Inadequate funding.
- (ii) Delay in issuance of NOC by the Pakistan Railways.
- (iii) Major changes in the design of the bridges by the original and new design consultants and inadequate design review.
- (iv) Inadequate design details at the start of the project.
- (v) Late issuance of construction drawings

Fig. 1 is a Pareto chart of percentage delays. Dotted line indicates the segmentation of major and minor factors responsible for delays. These delays sum up to 90%, as rest of the factors fall out of the scope of this work hence not accounted for. These ignored factors may possibly be material and equipment related delays, labour delays etc., which are non-excusable delays for which contractor is responsible as discussed.

6.2 Project-B: Construction of "C & D" Type Apartments at Wheatman Road, Lahore (PHA)

This project has suffered an enormous delay as compared to its original duration of 12 months. For analyzing the project for its delaying factors, the whole period of construction was divided in two parts. The first part is from start to July 14, 2005 (about 71 month's). The second part is from July 15, 2005 to its completion of August 15, 2007 (about 25 months).

During the first construction period, the project suffered two suspensions. The first suspension occurred from November 1999 to January 8, 2001 due to sudden change of government. The owner's offices were closed and a

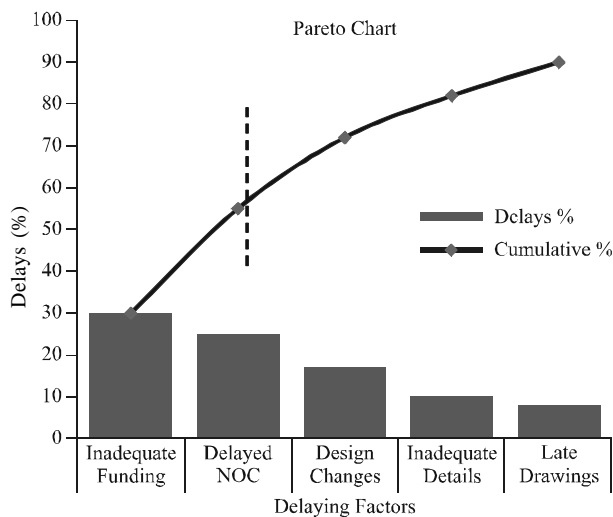


FIG. 1. MAJOR DELAYING FACTORS FOR PROJECT-A

state of confusion about the continuity of project prevailed as owner did not had sufficient funds to continue the project. No notices from contractor were served but the "Engineer" considered it as unwritten/unannounced suspension by the owner as per provisions of the contract. During this period, the contractor also claimed for compensation and therefore the delay in this period was excusable and compensable. The major delaying factors were (i) change of government (ii) unavailability of funds to carryout construction.

EoT was given to the contractor and work resumed. After resumptions, PHA made several changes to the design in order to make the project viable from a market point of view. The contractor was not able to complete the works within the first time extension. There were many factors responsible for the delay which were mainly attributable to the owner such as (i) Late/non-approval of some improved finishes (ii) Cash flow problems due to unpaid claims of first suspension period (iii) Cash flow problems due to deduction of income tax at a rate higher than that stipulated in the contract.

The contractor was given an extension in time due to the above reasons up to May 2002. However, during this period, PHA suspended the project for two months because they had not enough funds to support the project. Although PHA withdrew suspension notice but this suspension shook the confidence of the contractor. The contractor was not getting his payments in time and therefore, he eventually suspended the project up to July 14, 2005. During this period, the contractor also made various claims. PHA negotiated with the contractor to withdraw all claims and instead agreed to pay him watch and ward of the site. The owner accepted the responsibility of this delay and therefore this delayed period was excusable and compensable delay on part of the owner.

The second construction period started after the project resumed by settling all issues with PHA on July 15, 2005. The infrastructure works of the project was given to the contractor as an additional work and extension in time was given to complete the project in another six months. The project again suffered delay, as there were some deficiencies in the design of infrastructure works particularly the sewer systems. Further delay to the project happened as some of the approvals from different government agencies were not obtained on time. Approval from WASA regarding some road cuts in order to lay the sewer line did cause the project to delay for about ten months. There were also some other contractor' caused delays such as material and equipment related which shifted the project completion date to August 15, 2007.

6.2.1 Major Delaying Factors

The study of the above project reveals that five (5) major factors from the owner's standpoint were responsible for the project delays. The types of delays in this project were excusable and compensable as discussed in introduction.

- (i) Inadequate funding to carry out the construction.
- (ii) The instability within owner's (employer) organization due to uncertainty of the government.
- (iii) Late/non approval of finishing items.
- (iv) Poor design/design changes and lack of planning from the outset of the project.
- (v) Late Approvals from the associated government agencies (Poor coordination among different government agencies).

Fig. 2 is a Pareto chart of percentage delays. Dotted line indicates the segmentation of major and minor factors

responsible for delays. These delays sum up to 89%, as rest of the factors fall out of the scope of this work hence not accounted for. These ignored factors may possibly be material and equipment related delays, labour delays etc., which are non-excusable delays for which contractor is responsible as discussed.

6.3 Project-C: New NHA Head Office Building Islamabad

NHA decided to construct its new Head Office Building in a plot adjacent to its existing building to fulfil their increasing needs of office space. The new office building was designed to fuse into the existing building at all floor levels, so that employees can easily circulate and use both buildings. The construction of the works started as per scheduled date of commencement. There were some contractor caused delays during early stage of the project but these were recovered by the contractor and it was anticipated that the works would be completed in the contract period. Later, NHA revised the architectural finishes and interior area planning of the building. Originally designed large halls in the floor areas were changed into small areas/offices. These revisions, when approved by NHA, had a domino effect on all the

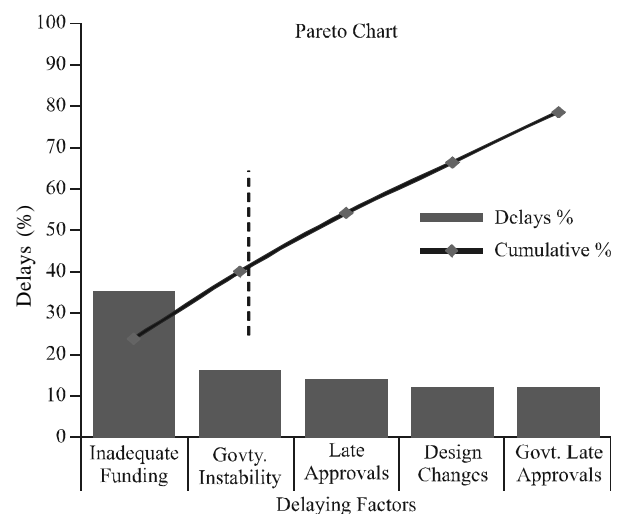


FIG. 2. MAJOR DELAYING FACTORS FOR PROJECT-B

subsequent activities. All the services like Public Health, Electrical works, HVAC works had to be redesigned according to the new interior and exterior planning. It took substantial time to incorporate the changes into design plans and get approval of NHA. The last set of drawings issued by the Architect in this regard was received by the contractor on April 26, 2005. Due to late issuance of these drawings, works were held up and it almost caused a net delay of 240 days.

The HVAC designer had to redesign the HVAC system thrice to induct the revised planning. The initial HVAC design of the new building was completed in April 2004. The re-design of HVAC was done in July 2004 due to inclusion of existing building, on request of NHA. The second re-design was done on revision of architectural finishes and interior floor planning. Revised floor planning besides the structural design implications subsequently altered the already completed design of HVAC, electric and plumbing systems. Therefore, an altogether new HVAC design was to be prepared, and new drawings were inevitable.

Due to late award of HVAC works, redesigning issues, late issuance of construction drawings, and the progress of civil contractor was hampered badly. The civil works could not proceed because of reasons beyond reasonable control of the contractor. The delays in the works were reasons not attributable to the contractor. The delays were purely design related and were attributed to the owner. These delays had enormous time and cost impact on project completion. The civil contractor was given an extension in time for the reasons mentioned above up to February 28, 2007. These owner' caused delays were excusable and compensable type such as design changes/problems. The works were not even completed up to February 28, 2007 due to delays which were attributable to contractor.

6.3.1 Major Delaying Factors

The study of the above project reveals that following major factors from the owner's standpoint were responsible for the delay of the project. The owner' caused delays were excusable compensable type as discussed in introduction.

- (i) Major redesigning of HVAC works and afterthoughts by owner to increase/include loads of the existing building.
- (ii) Major design changes in architecture and respective structural aspects of the project and late issuance of construction drawings.
- (iii) Late approval of already submitted designs during execution of project.

Fig. 3 is a Pareto chart of percentage delays. Dotted line indicates the segmentation of major and minor factors responsible for delays. These delays sum up to 92%, as rest of the factors fall out of the scope of this work hence not accounted for. These ignored factors may possibly be material and equipment related delays, labour delays etc., which are non-excusable delays for which contractor is responsible as discussed.

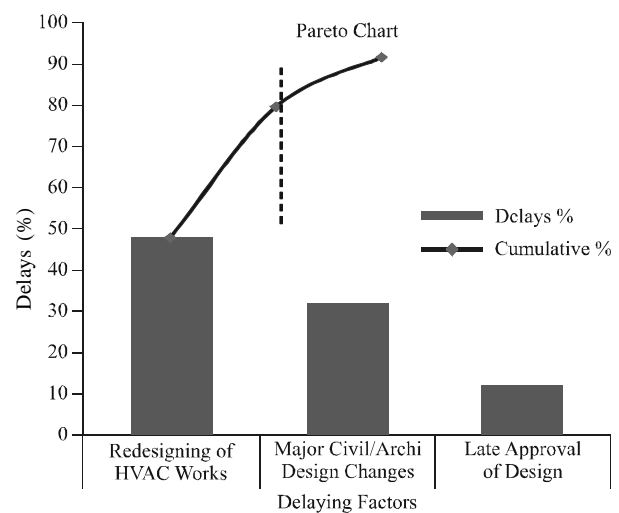


FIG. 3. MAJOR DELAYING FACTORS FOR PROJECT-C

7. FINANCIAL IMPACT

Different design changes made during the execution of the projects caused the project costs to change. Only those additional costs have been taken into the analysis which occurred due to owner's caused delaying factors. The percentage increases in the project costs due to owner's delaying factors have been presented in Table 2. These costs include different variation orders, compensation claims paid to the contractor, changes in quantities, and incorporation of additional items due to design changes etc.

8. DISCUSSION

Case studies reveal that following factors are responsible for delay:

- ◆ Inadequate funding.
- ◆ Delayed approvals from associated government agencies.
- ◆ Design changes/problems.

A financial difficulty faced by the contractor is most frequent cause of delay in construction projects. This

problem relates to poor cash flow management. When funding is not made according to approved financial plans, contractors do not generally keep on investing from their own resources. On client part, delays in payments are quite common because of the lengthy procedures and changing priorities. This problem is very significant in Project-A and B as compared to Project-C, selected as case studies (Table 2). Client of Project-C, NHA, had sufficient availability of funds and relatively less procedural requirements.

Delayed approvals from related government authorities is significant cause of delay faced by construction projects in Pakistan. Two categories of organizations are involved in approvals for any construction project which include (i) owner's organization and (ii) non stakeholder organizations such as government agencies/departments. This problem is very significant in Project-C as compared to Project-A and B (Table 2).

Too many changes in design from client side is among the important cause of delay in construction projects. These problems can be minimized by frequent meetings of stakeholders during design stage. Design changes subsequently responsible for late issuance of

TABLE 2. PERCENTAGE INCREASE IN PROJECT COSTS DUE TO OWNER'S DELAYING FACTORS

Description	Project-A	Project-B	Project-C
Name of Owner	CDA	PHA	NHA
Type of Project	Construction of Bridges	4 storey flats/apartments	6 storey office building
Approximately Cost of the Project			
(Rs Million)	192	82*	92
Delays	% Impact of Delays		
(i) Inadequate Funding	30%	35%	-
(ii) Delayed Approvals	25%	26%	80%
(iii) Design Changes/Problems	35%	12%	12%
Additional Cost due to increase in Quantities & Variation Orders			
(Rs Million)	89.6	13.7	134.5
Total Cost of Project (Rs million)	281.6	95.7	226.5
Increase in Original Cost	46%	17%	146%
* For Project-B (PHA) the revised cost of project i.e. Rs. 82 Million is taken since the scope of work was reduced due to exclusion of 8 blocks as a result of land acquisition problems with Pakistan Railways			

construction drawings. This cause of delay is very significant in Project-A, where design consultant was unable to solve certain problems, as compared to Project-B and C (Table 2).

9. CONCLUSIONS

In most of the cases, it is found that when the owner has the responsibility of delay, it is an excusable compensable delay. The analysis of delaying factors lead to the conclusion that design related delays and funding problems are of prime importance. Designs were inadequate from the outset of the project. The delays were compounded by subsequent major design changes/additions, which invariably lead to cost escalation as well. Other design related causes/factors including inadequate design review, late issuance of construction drawings, late decisions from owners on key design issues share an intermediate position of damaging effect on project completion times and costs.

Poor coordination of the owners with other associated government agencies resulted in the late issuances of necessary NOC's/Approvals. Delaying factors on behalf of owner have significant impact on project completion cost. Increases in costs of the projects studied, due to owners caused delays, range from 17-146%.

Client position in these projects is not very different from what is expected. The procedural requirements are very lengthy and bound by government rules and departmental regulations. Representative of client (government) is a senior government official appointed by designation and not by name. The same individual may not be associated with the project from cradle to grave therefore the limitations of time commitment, responsibility and flexibility become more evident.

10. RECOMMENDATIONS

Based on the findings of this study, the following may be recommended:

- (i) The owner should have an in-house capability to carefully delineate the needs of end users so that the redesign/changes are not required.
- (ii) The owner should make sure its financing, cash flow requirements and project budget before bidding the project. Initial planning and preliminary engineering and design should be given sufficient time in order to avoid subsequent design changes.
- (iii) The owner should carefully select a capable design firm/consultant having relevant experience and provide them sufficient professional hours and fees in order to achieve the necessary level of details. The owner's responsibility for the design may be minimized and coordination of activities may be improved by the use of a design-build contract.
- (iv) The key staff from the owner's side should be retained long enough on the projects in order to have continuity of policy and experience.
- (v) Owners must adopt for quick decision making about important technical issues. Factors for delays in construction projects can be reduced through joint efforts of stakeholders involved. Globally recommended simple approaches like "Joint Project Planning" and "Quality Function Deployment" may therefore prove to be very useful.

- (vi) A future study can be carried out to identify the delaying factors for different types of construction projects such as commercial projects or, highway projects. The study of the difference in points of view of various stakeholders such as owners, consultants and contractors could also be valuable.

ACKNOWLEDGEMENTS

The authors would like to thank Capital Development Authority, National Highway Authority, Pakistan Housing Authority, and National Engineering Services Pakistan Limited, for providing useful data, and University of Engineering & Technology, Lahore, Pakistan, for conducting this research work.

REFERENCES

- [1] Farrow, T., "Developments in the Analysis of Extensions of Time", *Journal of Professional Issues in Engineering Education and Practice*, Volume 133, No. 3, pp. 218-228, USA, 2007.
- [2] Sun, M., and Meng, X., "Taxonomy for Change Causes and Effects in Construction Projects", *International Journal of Project Management*, Volume 27, No. 6, pp. 560-572, USA, 2009.
- [3] Sweis, G., Sweis, R., Hammad, A.A., and Shboul, A., "Delays in Construction Projects: The Case of Jordan", *International Journal of Project Management*, Volume 26, No. 6, pp. 665-674, USA, 2008.
- [4] Majid, M.Z.A., and McCaffer, R., "Factors of Non-Excusable Delays that Influence Contractor's Performance", *Journal of Management in Engineering*, Volume 14, No. 3, pp. 42-49, USA, 1998.
- [5] Ali, T.H., Memon, Z.A., and Memon, N.A., "Causes and Remedial Measures for Construction Delays: A Case Study of Pakistan", *Mehran University Research Journal of Engineering & Technology*, Volume 28, No. 1, pp. 69-80, Jamshoro, Pakistan, 2009.
- [6] Wysocki, R.K., Jr, B.R., and Crane, D.B., "Effective Project Management", Second Edition, John Wiley & Sons, UK, 2000.
- [7] Handbook of Planning Commission, Government of Pakistan, May, 2008.
- [8] Memon, Z.A., "Remedial Measures for Delays at Construction Stage", *Mehran University Research Journal of Engineering & Technology*, Volume 23, No. 1, pp. 9-20, Jamshoro, Pakistan, 2004.
- [9] Assaf, S.A., and Al-Hejji, S., "Causes of Delay in Large Construction Projects", *International Journal of Project Management*, Volume 24, No. 4, pp. 349-357, USA, 2006.
- [10] Alkass, S., Mazerolle, M., and Harris, F., "Construction Delay Analysis Techniques", *Construction Management and Economics*, Volume 14, No. 5, pp. 375-394, UK, 1996.
- [11] Odeh, A.M., and Battaineh, H.T., "Causes of Construction Delay: Traditional Contracts", *International Journal of Project Management*, Volume 20, No. 1, pp. 67-73, USA, 2002.
- [12] Sambasivan, M., and Soon, W.Y., "Causes and Effects of Delays in Malaysian Construction Industry", *International Journal of Project Management*, Volume 25, No. 5, pp. 517-526, USA, 2007.
- [13] Ogunlana, S.O., Promkuntorg, K., and Jearkjirm, V., "Construction Delay in a Fast Growing Economy: Comparing Thailand with Other Economies", *International Journal of Project Management*, Volume 14, No. 1, pp. 37-45, USA, 1996.
- [14] Lo, T.Y., Fung, W.H., and Tung, K.C.F., "Construction Delays in Hong Kong Civil Engineering Projects", *Journal of Construction Engineering and Management*, Volume 132, No. 6, pp. 636-649, USA, 2006.
- [15] Assaf, S.A., Al-Khalil, M., and Al-Hazmi M., "Causes of Delay in Large Building Construction Projects", *Journal of Management in Engineering*, Volume 11, No. 2, pp. 45-50, USA, 1995.

- | | |
|---|--|
| <p>[16] Aibinu, A.A., and Odeyinka, H.A., "Construction Delays and Their Causative Factors in Nigeria", <i>Journal of Construction Engineering and Management</i>, Volume 132, No. 7, pp. 667-677, USA, 2006.</p> <p>[17] Bordoli, D.W., and Baldwin, A.N., "A Methodology for Assessing Construction Project Delays", <i>Construction Management and Economics</i>, Volume 16, No. 3, pp. 327-337, UK, 1998.</p> | <p>[18] Kumaraswamy, M.M., and Chan, D.W.M., "Contributors to Construction Delays", <i>Construction Management and Economics</i>, Volume 16, No. 1, pp. 17-29, UK, 1998.</p> <p>[19] Al-Momani, A.H., "Construction Delay: A Quantitative Analysis", <i>International Journal of Project Management</i>, Volume 18, No. 1, pp. 51-59, USA, 2000.</p> |
|---|--|