

# Causes and Effects of Delay in Iranian Construction Projects

Towhid Pourrostan and Amiruddin Ismail

**Abstract**—Delays are one of the biggest problems in construction projects in developing countries, as cause a negative effects on the projects. Delays can be minimized only when their causes are identified. The aim of this paper is to identify the main causes and effects of delay in Iranian construction projects. The literature related the field of causes and effects of delay in construction projects has been reviewed over the last decade. A questionnaire survey was conducted to solicit the causes and effect of delay from consultants and contractors' viewpoint. This study identified 10 most important causes of delay from a list of 28 different causes of delay and 6 different effects of delay. The elements of this list has identified on the basis of literature review over the last decade. The perspective of contractors and consultants has been analysed to rank the causes of delays based on their Relative Importance Index. The 10 most causes of delay were: (1) delay in progress payment by client, (2) change orders by client during construction, (3) poor site management, (4) slowness in decision making process by client, (5) financial difficulties by contractors, (6) late in reviewing and approving design documents by client, (7) problems with subcontractors, (8) ineffective planning and scheduling of project by contractor, (9) mistakes and discrepancies in design documents, and (10) bad weather. Six major effects of delay were: (1) time overrun, (2) cost overrun, (3) disputes, (4) total abandonment (5) arbitration, and (6) litigation. The paper predicts some future trends and suggests certain areas in which future research on construction projects should be focused.

**Index terms**—Causes of delay, effects of delay, Iran, construction project.

## I. INTRODUCTION

Delays are one of the biggest problems which construction firms face [1]. The problem of delay in the construction industry is a global phenomenon [2]. Keeping construction projects within estimated costs and schedules requires sound strategies, good practices, and careful judgment. However, to the dislike of owners, contractors and consultants, many projects experience extensive delays and thereby exceed initial time and cost estimates [3]. Assaf and Al-Hejjei [4], found that 76% of the contractors have indicated that average of time overrun is between 10% and 30% of original duration, while about 56% of the consultants specified the same percentage. Time and cost overruns occur in most construction projects, although, the magnitude of these delays and cost overruns varies considerably from project to project [3]. Cost overruns can be traced back to "root causes" that are often associated with the preliminary phases (project planning or design).

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The authors are with Department of Civil and Structural Engineering, Universiti Kebangsaan Malaysia (The National University of Malaysia), 43600 UKM, Bangi, Malaysia (e-mail: towhid@eng.ukm.my; abim@eng.ukm.my).

Such root causes include poor estimation of quantities, design variations or errors, project schedule changes, scope changes, unexpected site conditions, rising costs of materials and labour (largely due to inflation), and/or unforeseen events [13]. The scope of this study was research to identify causes and effect of delay in Iranian construction project. Projects investigated in this study included residential, office and administration buildings, and roads. The literature related the field of causes and effects of delay in construction projects has been reviewed over the last decade. A questionnaire survey was conducted to solicit the causes and effects of delay from 100 consultants and contractors' viewpoint. Then was discussed the analysis the data using statistical procedures and recommendations for reducing delay in construction projects.

## II. LITERATURE OF REVIEW

Many articles and studies conducted on causes and effects of delay in construction projects. Al-Momani [5] determined the causes, level of time extension needed for public projects and aid requirement by construction managers in establishing adequate evaluation prior to the contract award using quantitative data. He has believed that the arguments and findings presented in this study provide a good guidance for managerial intervention, and provide some guidelines and actionable information that managers can utilize to manage their projects. According to [2, 4, 6, 7, 8] delays can lead to many negative effects such as time overrun, cost overrun. Sambasivan and Soon [2] has noted that identical factors such as disputes, arbitration, litigation and total abandonment. The literature related the field of causes and effects of delay in construction projects has been reviewed over the last decade. Summary of causes of delay from literature review are shown in Table I.

## III. METHODOLOGY

Delays are one of the biggest problems in construction projects in developing countries, as cause a negative effects on the projects. The literature related the field of causes of delay in construction projects has been reviewed over the last decade. Summary of causes of delay from literature review are shown in Table I. A questionnaire survey was conducted to solicit the causes of delay from consultants and contractors' viewpoint. The respondents were asked to identify their response category on 28 construction delay factors from Table I. The second part of questionnaire focused on the effects of construction delay in Iranian construction projects.

TABLE I: SUMMARY OF CAUSES OF DELAY IN CONSTRUCTION PROJECTS FROM LITERATURE REVIEW

S. NO	Causes of delay in construction projects	Authors											
		Al-Momani [5]	Odeh and Battaineh [9]	Faridi and El-Sayegh [10]	Koushk, Rashida and Kartam [6]	Assaf and Al-Hejji [4]	Meeampol and Ogulana [7]	Lo, Fung and Tung [11]	Alaghbari, Kadir, Salim and Ernawati [12]	Sambasivan and Soon [2]	Le-Hoai, Lee and Lee [8]	Gkriza and Labi [13]	El-Razak, Bassioni and Mobarak [14]
1	Poor site management	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓
2	Ineffective planning and scheduling of project by contractor		✓			✓							✓
3	Financial difficulties by contractor	✓			✓		✓			✓	✓	✓	✓
4	Shortage of labours		✓	✓		✓	✓			✓	✓	✓	✓
5	Delay in delivery of materials to site	✓		✓	✓				✓				✓
6	Change orders by client during Construction	✓			✓	✓					✓	✓	✓
7	Lack of materials on market				✓				✓	✓	✓		✓
8	Lack of communication between the parties		✓				✓				✓	✓	✓
9	Lack of consultant's experience	✓							✓				✓
10	Inaccurate estimates	✓									✓		
11	Bad weather	✓	✓			✓			✓		✓	✓	✓
12	Incompetent subcontractor					✓					✓	✓	✓
13	Mistakes during construction	✓	✓						✓	✓	✓	✓	✓
14	Improper construction method by subcontractors		✓			✓					✓	✓	✓
15	Delay in progress payments by client				✓					✓	✓	✓	✓
16	Low productivity level of labours		✓	✓		✓					✓	✓	✓
17	Problems with subcontractors		✓							✓	✓		✓
18	Equipment unavailability		✓							✓			✓
19	Problem with neighbors and site condition	✓	✓										✓
20	Type of project bidding and award					✓		✓			✓		✓
21	Poor contract management by consultant		✓			✓					✓		✓
22	Obstacles from government		✓								✓		✓
23	Slowness in decision making process by client		✓	✓		✓							✓
24	Mistakes and discrepancies in design documents	✓	✓			✓	✓				✓	✓	✓
25	Late in reviewing and approving design documents by consultant	✓	✓	✓		✓			✓		✓		✓
26	Delays in producing design documents	✓	✓	✓		✓			✓	✓	✓		✓
27	Late in reviewing and approving design documents by client	✓	✓	✓		✓	✓				✓		✓
28	Inadequate contractor experience		✓			✓		✓		✓			✓

IV. DATA ANALYSIS AND DISCUSSION OF RESULTS

Odeh and Battaineh [9] determine the ranking of different factors from the view point of contractors and consultants, and compute the Relative Importance Index (I) by using the formulae as shown in Equation (1):

$$RII = \frac{\sum_{i=1}^4 W_i X_i}{\sum_{i=1}^4 X_i} \tag{1}$$

W<sub>i</sub> = the weight assigned to i<sub>th</sub> response = 1, 2, 3, 4, respectively

X<sub>i</sub> = Frequency of the i<sub>th</sub> response;

i = Response category index = 1, 2, 3 and 4 for Very important, Important, Less important, and Not important respectively.

Accordingly, W<sub>1</sub>=3 for Very important, W<sub>2</sub>=2 for Important, W<sub>3</sub>=1 for Less important, and W<sub>4</sub>=0 for Not

important have been used for this analysis. To study the strength of relationship between two sets of ranking, the Spearman rank correlation coefficient was determined. The Spearman rank correlation coefficient is calculated using Equation (2):

$$r_s = 1 - \frac{6 \sum d}{(N^3 - N)} \tag{2}$$

r<sub>s</sub> = Spearman rank correlation coefficient;

d = Difference in ranking between the contractors and the consultants;

N = The number of variables.

A. Causes of Delay

Summary of Relative Importance Index and rank for the causes of delays in Iranian construction projects is shown in Table II.

**TABLE II: SUMMARY OF RELATIVE IMPORTANCE INDEX AND RANK FOR THE CAUSES OF DELAY IN IRANIAN CONSTRUCTION PROJECTS**

S.NO	Causes of Delay in Construction Projects	Consultants		Contractors		Overall	
		Index	Rank	Index	Rank	Index	Rank
1	Poor site management	3,38	1	3,24	4	3,31	3
2	Ineffective planning and scheduling of project by contractor	3,32	3	2,38	19	2,86	8
3	Financial difficulties by contractor	3,34	2	2,76	8	3,04	5
4	Shortage of labours	2,72	11	2,72	10	2,72	12
5	Delay in delivery of materials to site	2,64	14	2,56	14	2,60	19
6	Change orders by client during Construction	3,32	3	3,30	2	3,34	2
7	Lack of materials on market	2,58	15	2,56	14	2,57	21
8	Lack of communication between the parties	2,06	21	2,72	10	2,39	24
9	Lack of consultant's experience	2,22	18	2,54	15	2,38	25
10	Inaccurate estimates	2,12	20	2,44	17	2,28	27
11	Bad weather	2,68	12	2,90	7	2,79	10
12	Incompetent subcontractor	2,82	8	2,32	20	2,57	21
13	Mistakes during construction	2,48	17	2,62	12	2,55	22
14	Improper construction method by subcontractors	2,96	7	2,40	18	2,68	15
15	Delay in progress payments by client	3,24	5	3,50	1	3,37	1
16	Problems with subcontractors	3,06	6	2,72	10	2,89	7
17	Equipment unavailability	2,66	13	2,58	13	2,62	18
18	Problem with neighbors and site condition	2,76	10	2,50	16	2,63	17
19	Type of project bidding and award	1,94	23	2,08	21	2,02	28
20	Low productivity level of labours	2,68	12	2,70	11	2,69	14
21	Poor contract management by consultant	1,74	24	3,12	5	2,43	23
22	Obstacles from government	2,55	16	2,74	9	2,65	16
23	Slowness in decision making process by client	3,30	4	3,26	3	3,28	4
24	Mistakes and discrepancies in design documents	2,63	15	3,04	6	2,84	9
25	Late in reviewing and approving design documents by consultant	2,72	11	2,76	8	2,74	11
26	Delays in producing design documents	2,16	19	3,26	3	2,71	13
27	Late in reviewing and approving design documents by client	2,76	10	3,12	5	2,94	6
28	Inadequate contractor experience	2,78	9	1,86	22	2,32	26

From the analysis of the results, it was found that poor site management, change orders by client during construction, delay in progress payments by client and slowness in decision making process by client are ranked high by both consultants and contractors. Moreover the shortage of labours, low productivity level of labours, lack of materials on market, and delay in delivery of materials to site are same ranking by consultants and contractors.

In addition the consultants and contractors disagreed on some of the factors. Ineffective planning and scheduling project by contractor is ranked much higher (Rank 3) by the consultant whereas this was ranked lower (Rank 20) by the contractors. Moreover late in reviewing and approving design documents by consultant is ranked much higher (Rank 2) by contractors but this was ranked lower (Rank 22) by consultant.

To study the strength of relationship between two sets of ranking, the Spearman rank correlation coefficient was determined. The Spearman rank correlation coefficient is calculated using equation (2). The Spearman rank correlation coefficient is found to be 0.954 for these research data. This higher value of  $r_s$  (approaching 1) shows a strong agreement between contractors and consultants for the ranking of the causes of delays.

The collected data were statistically analysed further to determine the overall Relative Importance Index (RII) of these 28 causes of delays. Table III shows ten most important causes of delay in Iranian construction projects.

**TABLE III: TEN MOST IMPORTANT CAUSES OF DELAY IN IRANIAN CONSTRUCTION PROJECTS**

S.NO	Causes of Delay in Construction Projects	Overall	
		Index	Rank
1	Delay in progress payments by client	3,37	1
2	Change orders by client during Construction	3,34	2
3	Poor site management	3,31	3
4	Slowness in decision making process by client	3,28	4
5	Financial difficulties by contractor	3,04	5
6	Late in reviewing and approving design documents by client	2,94	6
7	Problems with subcontractors	2,89	7
8	Ineffective planning and scheduling of project by contractor	2,86	8
9	Mistakes and discrepancies in design documents	2,84	9
10	Bad weather	2,79	10

From the analysis of the result shown the delay in progress payments by client and change orders by client during construction are high ranking. Moreover the analysis of the data shows that based on consultant and contractor's points of view are eight and seven of the top 10 causes of delays are from the overall top 10 causes of delays.

*B. Effects of Delay*

On the basis of review, according to [2, 3, 4, 6, 7] delays can lead to many negative effects such as time overrun, cost overrun. Sambasivan and Soon [2] has noted that identical factors such as disputes, arbitration, litigation and total

abandonment. The second part of questionnaire focused on the effects of construction delay in Iranian construction projects. Similar to the first part of the questionnaire, the respondents were asked to identify their response category on 6 construction effect factors from Table IV. From the analysis of the results, it is found that time overruns and cost overruns are ranked high by both consultants and contractors. Moreover total abandonment is ranked much lower (Rank 5) by consultant but this was ranked higher (Rank 3) by contractors.

The Spearman rank correlation coefficient is found to be 0.829 for these research data. This higher value of  $r_s$  (approaching 1) shows a agreement between contractors and consultants for the ranking of the effects of delays. Moreover the analysis of the data shows that based on consultant and contractor' points of view are four of the six effects of delays are from the overall six effects of delays.

TABLE IV: RELATIVE IMPORTANCE INDEX AND RANK FOR THE EFFECTS OF DELAY

S. NO	Causes of Delay in Construction Projects	consultants		contractors		overall	
		Index	Rank	Index	Rank	Index	Rank
1	Time overrun	3,34	1	3,12	2	3,27	1
2	Cost overrun	3,20	2	3,30	1	3,25	2
3	Dispute	2,70	3	2,58	4	2,64	3
4	Arbitration	2,52	4	2,46	5	2,49	5
5	Litigation	2,36	6	2,40	6	2,38	6
6	Total Abandonment	2,50	5	2,68	3	2,59	4

### V. CONCLUSION AND RECOMMENDATION

This study identified the causes and effects of delay in Iranian construction projects. Projects investigated in this study included residential, office and administration buildings, and roads. A questionnaire survey was conducted to solicit the causes and effect of delay from consultants and contractors' viewpoint. Ten most causes of delay were: (1) delay in progress payment by client, (2) change orders by client during construction, (3) poor site management, (4) slowness in decision making process by client, (5) financial difficulties by contractors, (6) late in reviewing and approving design documents by client, (7) problems with subcontractors, (8) ineffective planning and scheduling of project by contractor, (9) mistakes and discrepancies in design documents, and (10) bad weather. Six major effects of delay were: (1) time overrun, (2) cost overrun, (3) disputes, (4) total abandonment, (5) arbitration, and (6) litigation.

This paper has highlighted factors and the need to reduce delays by client, consultants and contractors. Clients should make progress in payments to contractors on time, recruit competent project manager, and on time preparation and procurement of needed materials to the contractors. Consultants have to try to manage the project professionally, complete and prepare design on time, using professional specialists and implementation of accurate per-design for minimizing future changes. Contractors need to available source of finance during construction project, proper

materials procurement, and developing human resources.

### REFERENCES

- [1] S. A. H. Tumi. "Causes of delay in construction industry in Libya," in *Proc. The International Conference on Economics and Administration, ICEA – FAA*, Buchares, Romania, 2009, pp. 257-265.
- [2] M. Sambasivan and Y. K. Soon, "Causes and effects of delays in Malaysian construction industry," *International Journal of Project Management*, vol. 25, pp. 517-526, 2007.
- [3] A. Enshassi, J. Al-Najjar, and M. Kumaraswamy, "Delays and cost overruns in the construction projects in the Gaza Strip," *Journal of Financial Management of Property and Construction*, vol. 14, pp. 126-151, 2009.
- [4] S. A. Assaf and S Al-Hejji, "Causes of delay in large construction projects". *International Journal of Project Management*, 24, pp. 349-357, 2006.
- [5] A. H. Al-Momani, "Construction delay: A quantitative analysis," *International Journal of Project Management*, vol. 18, pp. 51-59, 2000.
- [6] P. A. Koushk, K. AL-RashidA, and N. Kartam, "Delays and cost increases in the construction of private residential projects in Kuwait," *Construction Management and Economics*, vol. 23, pp. 285-294, 2005.
- [7] S. Meeampol, and S. O. Ogunlana. "Factors affecting cost and time performance on highway construction projects: evidence from Thailand," *Journal of Financial Management of Property and Construction*, vol. 11, pp. 3 - 20, 2006.
- [8] L. Le-Hoai, Y. D. Lee, and J. Y. Lee, "Delay and cost overruns in Vietnam large construction Projects: A Comparison with Other Selected Countries," *Journal of Civil Engineering*, vol. 12, pp. 367-377, 2008.
- [9] A. M. Odeh, and H. T. Battaineh. "Causes of construction delay: traditional contracts". *International Journal of Project Management*, vol. 20, pp. 67-73, 2002.
- [10] A. S. Faridi and S.M. El-Sayegh, "Significant factors causing delay in the UAE construction industry," *Construction Management and Economics*, vol. 24, 1167-1176, Nov 2006.
- [11] T. Y. Lo, I. W. H. Fung, and K. C. F. Tung, "Construction delays in Hong Kong civil engineering projects," *Journal of construction Engineering and management*, vol. 6, pp. 636-649, Jun 2006.
- [12] W. Alaghbari, M. R. A. Kadir, A. Salim, and Ernawati, "The significant factors causing delay of building construction projects in Malaysia," *Engineering, Construction and Architectural Management*, vol. 14, pp. 192-206, Nov 2007.
- [13] K. Gkritza and S. Labi, "Estimating cost discrepancies in highway contracts: Multistep econometric approach," *Journal of Construction Engineering and Management*, vol. 134, pp. 953-962, 2008.
- [14] M. E.A El-Razek, H. A. Bassioni, and A. M. Mobarak, A. M, "Causes of delay in building construction projects in Egypt," *Journal of Construction Engineering and Management*, vol. 134, pp.831-841, 2008.



**Towhid Pourrostan** was born on September 19, 1972 in Iran. He obtained his B.Sc. and M.Sc. in 1996 and 1999 respectively at the Islamic Azad University in Iran. He is a faculty member of Islamic Azad University, Shoushtar Branch, Iran, since 2000 and membership of the Construction Engineering Organization, Province of Khuzestan, in Iran. He is currently a PhD student at the Department of Civil Engineering and Structural; University Kebangsaan Malaysia (UKM). His research areas are construction management and project management.



**Prof. Engr. Dr. Amiruddin Ismail** obtained his PhD in Civil Engineering from Universiti Kebangsaan Malaysia in 2002, MSCE from University of Pittsburgh, USA in 1984 and BSCE from Point Park College, USA in 1983. Currently, he is the Head of Sustainable Urban Transport Research Centre, Faculty of Engineering and Built Environment, UKM. A corporate member of the UK Chartered Institution of Highways & Transportation, Road Engineering Association of Malaysia, Road Engineering Association of Asia & Australasia and Transportation Science Society of Malaysia. His research areas are transportation engineering and construction management. He has published more than 50 journal articles and 100 conference proceedings.