

A Study on Delayed Highway Projects in the UT of Jammu & Kashmir (India)

Peerzada Mohsin Shafi
(Doru Shahabad Anantnag)

Department of Civil Engineering, R.I.M.T Univesity Punjab

Abstract— Construction delay is a common problem and is one of the main reasons for project failure. Our country, India is no exception to it. This study investigated the main causes of delay in highway construction projects in UT of J&K, India. A questionnaire survey was conducted to consider the time performance of construction projects in UT of J&K, India to identify the causes of delay and their important index for delay factors. A total 78 causes of delay were identified during the research. The delay factors were grouped into eight major groups. The top-10 list was dominated by the factors of Limited Construction area, Poor ground Conditions, Late in approving sample materials, Late land handover by the owner, Poor site Management, Improper Construction Methods, Rework due to unaccepted quality, Frequent equipment breakdown, Shortage of Construction material and Incapable Inspectors. The remaining factors on the list were poor qualification of the contractor technical staff and project team, conflict between contractor and consultant, Poor site arrangement, lack of involvement of design team during construction stage, delay in obtaining permits from provincial/municipality, and distribution to public activities. Recommendations to manage the delay factors were presented. Significant relationships, between the delay factors and the project objectives also were observed and discussed.

Keywords:--Construction Delay; Financial Problems; Improper Study

I. INTRODUCTION

Construction delays are very common in most projects everywhere in the world. Delay could be defined as an act or event that extends the time required to performance the tasks under a contract. It usually shows up as additional days of work or as delayed start of an activity (G. Sweis et al 2007). According to Assaf et al (2006) in construction, delay could be

defined as the time overrun either beyond completion date specified in contract, or beyond the date that the parties agreed upon for delivery of a project. It is a project slipping over its planned schedule and is considered as common problem on construction projects. This study is an attempt to fill the gap by carrying out research on the delay analysis of infrastructure projects with a focus on examining the factors that influence

delays and their effects on project time, cost, and quality. The target respondents were engineers from contractor and consultant firms involved in construction projects. Time, cost and quality are the basic of successful construction. Time and cost had parallel relationship with the increasing of the time there will be the increase in the cost. Thus, the control of time is really important for any project. The time that is already discussed is the period which is the schedule for the activities from beginning until finish the process of planning.

Delays in projects have a direct bearing on the overall cost of construction. For example, from 2010 to 2015, the cost of cement (per bag) increased by 74%, steel increased by 34%, bricks increased by 69%, sand increased by 240% and skilled labour (on a per day basis) increased by 96%. It is therefore, understandable, that the cost overrun in delayed projects has resulted in approx. 24.77% increase in the original cost of the projects, amounting to ₹ 1, 09,359 Crores. Delays in a project also increase the likelihood of disputes between the parties and needless to say, these disputes may derail the project. Infrastructure development is one of the core elements in India's growth story and the union government's 'Achhe Din' and 'Sab Ka Saath, Sab Ka Vikaas' vision. In the last two decades, India has pumped billions into mega projects in the country in aviation, industrial development, smart cities, railways, roads and energy. However, the scale of these projects also means that some of that some of them are running behind schedule by years while also seeing massive cost overruns.

The measures were identified that could be implemented at the early stages to avoid project life cycle problems and to speed up implementation of project activities without compromising the quality of work and project. The study of several condition leads to a cause of unsettled disputes, frontrunners to arbitration cases/court cases. The delay in completion of the project, further attribute delayed benefits of the projects to the country, loss of precious time to deals with the disputed issues and heavy over-run of project cost.

By keeping important steps in mind during the preparatory phases of project planning is healthy execution of the contracts. Preparatory phases prior to invitation of tender have a proper concept of the work with accurate planning and proper design for desired outcomes of the project within time frame. Careful planning and giving attention in detailed aspects of contract management and corrective measures adopted within the framework of the contract can save time and money. Consistent review of progress and plans, co-ordinations, close monitoring, adherence to safety plans, tight operational management, good industrial relations, and strict financial control will help in future projects.

II. RESEARCH BACKGROUND

Considering the importance of analyzing delays in construction, many studies have been carried out to identify the factors that contribute to their causes. Some focus on general construction projects (Sweis et al. 2008; El Razeq et al. 2008; Sambavisan and Soon 2007; Lo et al. 2006; Chan and Kumaraswamy 1997), whereas others focus specifically on large projects (Haseeb 2011; Toor and Ogunlana 2008; Assaf and Al-Hejji 2006).

The large number of research papers on the idea of delays does not mean that the topic is saturated. It does, however, indicate the significance of the topic in the construction industry and the individuality of construction projects; therefore, it is a topic worth exploring.

Similar study was carried in the Riyadh province of Saudi Arabia. (Abd el-kharashi and others 2008) and in the Egypt (Ayman H Nassar 2016). They used the questionnaire survey to trace the time performance of the project.

Several studies were done to search out and identify the causes of delay in several countries. Around 35 such research work on delayed construction projects of the various parts of the world has been reviewed. Many researches are done on this issue. However, this study was carried to gather most causes of delay in highway construction projects of UT of J&K in India, its impact factors on the project and to urge some recommendation to reduce these delays and their effects. This study updated the present situation, after the changes everywhere the globe in construction industry especially in India.

III. METHODOLOGY

The various parameters of the project were studied with doctrinal and Empirical approach in phased manner. The research work was carried out in wide variety of data collected through the various concerned offices located in the UT of J&K. The data was collected through the personal visits, email etc. from the concerned.

This research is on the basis of a survey designed to gather all necessary information in an effective way. The survey presents various delay causes generated on the basis of related

research work on construction delay together with input, revision, and modification by some construction parties. A questionnaire was developed to evaluate the importance index of the identified causes.

IV. DATA COLLECTION

In making the questionnaire consultation with the working professionals were held to prepare the set of questions to be asked in the questionnaire

To analyze the data, an approach using the importance index (Assaf and Al-Hejji 2006) was adopted, in which initially it was necessary to calculate the Relative Importance Index using formulas as follows:

$$\text{Relative Important index (RII)} = \Sigma W / (A.N)$$

Where W = weighting given to each factor by the respondents which ranges from 1 to 4

Where '1' is 'not important' and '4' is 'very important',

A = Highest weight (i.e. 4 in this case)

N = Total number of respondents (45)

In this study, the relationship among different parties or factors was measured by Spearman's Rank Correlation coefficient. It offered an advantage of not requiring the normality assumption or homogeneity of variance assumption. The subjected can be compared, as results have one or two outliers, their influence can be negated. In this study, the relationship among different parties or factors was measured. The coefficient can be computed as follows:

$$rs = 1 - 6\Sigma d^2 / N(N^2-1)$$

Where

rs = Spearman's rank correlation coefficient between two parties,

d = The difference in ranking between ranks assigned to variables for each cause (owner and consultants, owner and contractors, consultant and contractors), and

N = The number of pairs of rank for all the delay factor and eight the main categories of delays, respectively.

V. RESULTS

Important Index of Delay Factors

S No.	Category	Effects of Delay Factor on	Relative Importance Index	Over all Rank
1	Project Group	Award the project to the lowest bidder	20	53
2		Disturbance to public activities	70.67	09
3		Limited construction area	56.00	25
4		Inconvenient site access	70.66	10
5		Poor ground condition	70.00	11
6		Poor terrain condition	75.34	04
7		Poor soil condition	63.34	20
8		Impact on people's land along the construction project	57.34	24
9		Accidents during construction	30.00	43
10		Ineffective penalties caused by delay	35.34	37
11		Long distance to borrow pits	34.00	38
12		Quantity increase over contract	42.66	33
13		Unreasonable project time frame	28.66	46
S No.	Category	Effects of Delay Factor on	Relative Importance Index	Over all Rank
14	Owner Group	Late progress payment	78.00	01
15		Late in decision making	67.34	14
16		Poor communication between owner and other parties	66.00	16
17		Financial problems of owner	77.34	02
18		Late in approving sample materials	70.66	10
19		Change orders during construction	40.66	34
20		Late in approving the site to contractor	48.00	31
21		Delay in issuing completion certificate	26.00	51
22		Undefined scope of working	48.66	31
23		Late land handover by owner	38.00	35
24		late issuing of approval documents by owner	32.66	42
25		Difficulties in financing project	60.66	22
26		Unreasonable project time frame	28.66	46
27	Contractor Group	Poor communication between contractor and other parties	69.34	12
28		Conflict between contractor and consultant	74.66	06
29		Poor site arrangement, management, and supervision	75.00	05
30		Inadequate contractor experience	52.66	29
31		Improper construction methods	34.00	38
32		Rework because of unaccepted quality	43.34	32
33		Ineffective construction schedule	27.34	49
34		Poor qualifications of the contractor technical staff and project team	76.00	03
35		Frequent change of subcontractor/supplier	24.30	52
36		Conflict between contractor and other parties	35.34	37
37		Delay in commencement	36.00	36

S No.	Category	Effects of Delay Factor on	Relative Importance Index	Over all Rank
38	Materials and Equipment Group	Frequent equipment breakdowns	62.00	21
39		Shortage of equipment, machinery, and tools	60.66	22
40		Inadequate modern equipment	66.66	15
41		Slow mobilization of equipment	67.34	14
42		Shortage of construction material	60.00	23
43		Change in types and specifications during construction	54.00	27
44		Slow delivery	32.66	41
45		Damage in storage while needed on site	64.00	18
46	Laborers Group	Personal conflict between laborers and management team	34.00	38
47		Personal conflict among laborers	28.00	48
48		Low productivity of laborers	65.34	17
49		Unskillful equipment operator	59.34	23
50		Insufficient laborers	33.34	40
51		Personal conflict between laborers and management team	26.66	50
52		Labor injuries	20.00	53
53		Labor disputes and strikes	29.80	44
54	Consultant Group	Inflexibility of consultant	28.66	46
55		Poor communication between consultant and other parties	34.00	39
56		Delay in performing inspection	32.66	41
57		Incapable inspectors	56.66	25
58		Lack of experience of consultant	70.00	11
59		Delay in approving major changes in the project	30.66	42
60		Incompetent project manager/team leader	66.66	15
61		Late sending progress claims to owner/client	64.66	19
62	Improper study of design affects estimates	77.34	02	
63		Insufficient inspectors	68.00	13

S No.	Category	Effects of Delay Factor on	Relative Importance Index	Over all Rank
64	Design Group	Incomplete design	54.66	26
65		Design changes during construction	69.34	12
66		Unclear and inadequate details in drawings	56.00	25
67		Lacks of involvement of design team during construction stage	73.34	07
68		Delay in approving drawing, specifications, or instructions	54.00	27
69		Mistakes or errors in design	52.66	29
70		Political situation	69.34	12
71		External Factor Group	Fluctuation of exchange rate, material, equipment, machines	30.66
72	Changing of bankers' policy for loans		38.00	35
73	Working during rainy season		48.66	30
74	Natural disaster		25.34	49
75	Changes in government regulations and laws		66.66	15
76	Delay in obtaining permits from provincial/municipality		73.33	08
77	Weather condition		29.33	45
78	Monopoly		53.33	28

The computation of the Relative Importance index presented in Table 1 shows that the project group of late progress payment, which had the highest importance index (78.00), had an outstanding index value compared to other delay factor. This factor had more than a 10-point difference from the second-ranked factor, financial problems of owner (77.34) and improper study of design affects estimated quantity (77.34), which indicated the high significance of the late progress payment in delaying construction work. Other external factors were supposed as low in importance, with an index below 60.0. Further discussion was focused on the top-10 delay factor.

The group importance index was calculated as the average of the Relative Importance index for the delay factors in the group. For example, in the "project group", the group importance index is the average of the importance indices of its constituting causes as follows; Award the project to the lowest bidder(20), Disturbance to public activities(70.67), Limited construction area(56.00), Inconvenient site access, Inconvenient site access(70.66), Poor ground condition(70.00), Poor terrain condition(75.34), Poor soil condition(63.34), Impact on people's land along the construction project(57.34), Accidents during construction(30.00), Ineffective penalties caused by delay(35.34), Long distance to borrow pits(34.00), Quantity increase over contract(42.66), and Unreasonable project time frame(28.66), resulting in an average of 50.31, which is its group importance index.

The ranked groups of delay causes and their corresponding importance index are shown in Table 2.

Table 2
Group Importance Index for Overall Results

Rank	Group of Delay Causes	Group Importance Index
1	Design group	60.00
2	Material and equipment group	58.42
3	Owner group	53.94
4	Consultant group	52.93
5	Project group	50.31
6	Contractor group	49.33
7	External factor group	48.29
8	Laborers group	37.06

EFFECTS OF DELAY FACTORS ON TIME, COST, AND QUALITY

The presentation of a construction project generally can be measured according to the three project objectives of time, cost, and quality. Therefore, the impact of any risks to the project also should be reflected in these three factor From the mean values, it was shown that, in general, the respondents assigned more weight to the effect of time relative to cost and quality. This was reasonable, considering that delays are more related to time than to the other two project objectives. Hence, people in their opinion tended to communicate the effect of delay factors more to time than to cost or quality, which may not always be a true consideration.

The top-10 list for all three objectives in Table 3 is control by delay factors that are in the top-10 list of the importance index. This should make construction engineers aware that

each objective may have assured unique factors that considerably control the purpose. As shown in Table 3, disturbance to public activities again were ranked among the top listed delay factors, especially in affecting quality and time. Because construction projects are outdoor construction projects, disturbance to public activities, which expose construction work to public for a long period, have a substantial impact on quality. Therefore, disturbance to public activities was positioned at the top of the list. These two delay factors were considered to have slightly less effect on cost compared to the other two project objectives.

TABLE 3

Top-10 Delay factor and Their Effect on Time, Cost, and Quality

Rank	Time delay factor	Time mean	Cost delay factor	Cost mean	Quality delay factor	Quality mean
01	Improper construction methods	72.34	Shortage of equipment, machinery, and tools	78.00	Improper construction methods	78.66

Rank	Time delay factor	Time mean	Cost delay factor	Cost mean	Quality delay factor	Quality mean
02	Frequent equipment Breakdown	71.34	Late in approving sample materials	77.34	Late in approving sample materials	76.00
03	Late in approving sample materials	71.34	Delay in performing inspection at construction site	77.34	Rework because of unaccepted quality	75.34
04	Limited construction area	70.00	Limited construction area	76.66	Poor qualification of the contractor technical staff and project team	75.34
05	Delay in performing inspection at construction site	69.34	Improper construction methods	76.66	Frequent equipment breakdown	75.34
06	Low productivity of laborers	69.34	Rework because of unaccepted quality	76.66	Shortage of equipment, machinery, and tools	75.34
07	Slow	68.66	Shortage	76.00	Distribution of equipment	74.66

7	mobilization of equipment	68.00	of construction material	76.00	disturbance to public activities	74.66
08	Shortage of construction Material	68.00	Incapable inspector	76.00	Shortage of construction material	74.66
09	Late land handover by owner	68.00	Late land handover by owner	76.00	Delay in performing inspection at construction site	74.66
10	Poor ground condition	67.34	Frequent equipment breakdown	76.00	Incapable inspector	74.66

Late in approving sample materials was one factor related to the Owner group in the top- 10 list of the importance index. Although Late in approving sample materials was positioned only as second in importance, this delay factor has a high impact on cost, quality and time because it is positioned second in terms of its effect on cost, third for its effect on time, and second for its effect on quality. Delay factor related to the contractors on the top-10 list of the importance index, poor qualifications of the contractor technical staff and project teams, was seen to have a more considerable impact on quality because it was in the sixth rank.

To obtain a more comprehensive understanding of the relationship between the Relative Importance index and the project objectives of cost, time, and quality, the relationships of the top-10 delay factors and their impact on these objectives were analyzed and are presented in Table 4. Overall, there were significant associations between the delay factors on time, cost, and quality. These results indicate that delay problems not only are about time, they also significantly affect the quality and cost of road construction projects.

Relationship between Top-10 Delay Factors and Time, Cost, and Quality

S. No.	Delay Factor	RRI	RRI in Time	RRI in Cost	RRI in Quality
1	Limited construction area	56.00	70.00	76.66	68.66
2	Poor ground condition	70.00	67.34	51.34	49.34
3	Late in approving sample materials	70.66	71.34	77.34	76.00
4	Late land handover by owner	38.00	68.00	76	74.66
5	Poor site arrangement, management, and supervision	75.00	58.66	64	64.00
6	Improper construction methods	34.00	72.66	76.66	78.66
7	Rework because of unaccepted quality	43.34	62.66	76.66	75.34
8	Frequent equipment breakdowns	62.00	71.34	76.00	75.34
9	Shortage of construction material	60.00	68.00	76.00	74.66
10	Incapable inspectors	70.00	52.00	76.00	74.66

VII. CONCLUSION

The key aim of the research was to find out the main reasons of the delay in highway Construction projects in the UT of J&K.. After conducting the research it was found that the top-10 list was dominated by the factors of Limited Construction area, Poor ground Conditions, Late in approving sample materials, Late land handover by the owner, Poor site Management, Improper Construction Methods, Rework due to unaccepted quality, Frequent equipment breakdown, Shortage of Construction material and Incapable Inspectors. The remaining factors on the list were poor qualification of the contractor technical staff and project team, conflict between contractor and consultant, Poor site arrangement, lack of involvement of design team during construction stage, delay in obtaining permits from provincial/municipality, and distribution to public activities.

It was found that Consultants gave more weight to delays caused by contractors than did the contractors themselves, which is reasonable. Frequent equipment breakdown was ranked second by the consultants, but it was ranked fifth rank by contractor. Similarly, poor site arrangement, management, and supervision, which were ranked fourth rank by consultants, were placed seventh by the contractor.

From the consultants' perspective, there were no causes of delays by owners on the top- 10 list, but there were two concerns from the contractors' point of view: late progress payment and financial problems of owner. This finding follows the logical practice in which contractors, in general, have a tendency to blame the owner or consultants for some delays or problems in the project, and vice versa. In this case, the contractors did not consider that the consultants contributed significantly to delays, as no factors from the consultants' side were on the top-10 list of contractor. The blame was allotted more to the owner that did not pay the interim payment on time, possibly because of financial or cash flow problems.

The presentation of the construction project was measured according to the three project objectives of time, cost, and quality. Therefore, the impact of any risks to the project was reflected in these three factors. It was observed that, in general, the respondents assigned more weight to the effect of time relative to cost and quality. This was reasonable, considering that delays are more related to time than to the other two project objectives. Hence, people in their opinion tended to communicate the effect of delay factors more to time than to cost or quality, which may not always be a true consideration.

VIII. RECOMMENDATIONS

Causes of delay and its effect on time, cost, and quality in construction projects are always likely obstacles to project success. The study reported in this paper established that there are a number of causal factors which need to be sufficiently dealt with if time overrun, cost escalation, and quality shortfalls are to be minimized on the construction projects.

A correlation coefficient between contractor and owner; owner and consultant; and contractor and consultant respectively 0.39, 0.89 and 0.74. A correlation of the responses of each party showed the contractor and owner to have non matching opinions concerning the causes of delay,

while the consultant held an intermediate position. The study concluded with the following points in order to avoid delays in the construction projects:

- Project delivery and Client satisfactory enhancement factors needs to be optimized.
- Construction projects must be meticulously planned.
- Construction clients must ensure that adequate funds are available before executing the project.
- Important positions in the construction firms must be filled with the technically competent individuals.

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