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CAUSES OF DELAY AND ITS EFFECT IN ROAD CONSTRUCTION PROJECT

N.H. Pawar[1], M.C. Aher[2]

[1]PG Student, [2]Assistant Professor, Department of Civil Engineering, NDMVP'S KBTCOE, Nashik, Maharashtra (India)

ABSTRACT

It has been a general observation that the infrastructure projects get delayed and thus have substantial time over-runs. A 2009 study by global consulting firm McKinsey suggests that the infrastructure projects in India get delayed by such an extent, that going by the current trend, over the next nine years, India would end up losing 13 lack crore from its GDP. Such is the gravity of the problem that delays alone cause shelving of major projects even before they are actually executed. Hence this study would study all the causes of delays faced in Infrastructure projects and analyze them in detail.

The methodology for present study contains two phases. The first phase included a literature review and interview. The second phase includes preparation of questionnaire based on different approach used for giving ranking to causes of delay of road construction projects. This study covers the various causes of delays in detail, as well as delays which are caused atvarious stages of the project.The various issues plaguing these projects are studied. The study also includes an in depth literature review of the subject and the various works carried out on the subject.

The delays which are responsible for the time and cost overruns they have been studied. Also the locations of the projects need to be considered for drawing certain conclusions. The study basically carries a qualitative and quantitative assessment of the causes of the delays. It establishes a link to the analysis of the delays in order to quantify the severity of each type of delay with respect to the time overruns.The priority to the ranking of the projects would help the project management to concentrate more on how to avoid the most salient causes of delays. Study the differences in perceptions of the three major parties in any constructions namely owners, contractors and consultant.

Keywords: Construction management, Construction delays, Relative importance index, Spearman's rank correlation coefficient.

I. INTRODUCTION

Delays are an integral part of any construction project; they may be insignificant or otherwise. However considering the Indian scenario, the later i.e. the significant delays are almost universally associated with the word 'delay'.

India being a rapidly developing country needs an equally rapidly developing infrastructure. The infrastructural development is indeed the backbone of the country's economic progress and constitutes a great extent of

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thefiscal spending. India is no different to this exception and the government has duly increased spending on the infrastructure projects. It has been a general observation that the infrastructure projects get delayed and thus have substantial time over-runs. A 2009 study by global consulting firm McKinsey suggests that the infrastructure projects in India get delayed by such an extent, that going by the current trend, over the next nine years, India would end up losing upto 13 lack crore from its GDP. Such is the gravity of the problem that delays alone cause shelving of major projects even before they are actually executed.

Many small and large size contractors in recent years have voiced their concerns over the difficulty to overcome delay problems. The main reason is because the contractors have no ability to identify the important causes of delay occurring during the construction process. Ranking the importance of delay variables by Project Managers enables identification of the most important variables and assists them to seek best alternative solutions.

Hence there is a need of concentrating on the causes of the delays. The various types of delays, caused in the various stages of work need to be studied. There has been a great deal of study in this respect. However, an in depth study about the various causes of delays occurring at the different stages of the project life cycle has seldom been carried out. The aim at carrying out a quantitative study of the various causes of delays and trying to rank them in general based on some identified parameters. Also a brief sector wise study highlighting the most prevalent causes of delays in that particular sector would also be carried out.

1.1 Types of Delay

There are four basic ways to categorize type of delays:

A. Critical or noncritical
B. Excusable or non-excusable
C. Compensable or non-compensable
D. Concurrent or non-concurrent

A. Critical Versus Non-Critical Delays:

Delays that affect the project completion or in some cases a milestone date are considered as critical delays and delays that do not affect the project completion, or a milestone date, are noncritical delays. If these activities are delayed, the project completion date or a milestone date will be delayed. The determining which activities truly control the project completion date depends on the following:

- The project itself
- The contractor's plan and schedule (particularly the critical path)
- The requirement of the contract for sequence and phasing
- The physical constraint of the project, i.e. how to build the job from a practical perspective

B. Excusable versus Non-Excusable Delays:

All delays are either excusable or non-excusable. An excusable delay is a delay that is due to an unforeseeable event beyond the contractor's or the subcontractor's control. Normally, based on common general provisions in public agency specifications, delays resulting from the following events would be considered excusable:

- General labor strikes
- Fires
- Floods
- Acts of God
- Owner-directed changes

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- Errors and omissions in the plans and specifications
- Differing site conditions or concealed conditions
- Unusually severe weather Intervention by outside agencies
- Lack of action by government bodies, such as building inspection

C. Compensable Delays versus Non-Compensable Delays:

A compensable delay is a delay where the contractor is entitled to a time extension and to additional compensation. Relating back to the excusable and non-excusable delays only excusable delays can be compensable. Non- compensable delays mean that although an excusable delay may have occurred, the contractor is not entitled to any added compensation resulting from the excusable delay. Thus, the question of whether a delay is compensable must be answered. Whether or not a delay is compensable depends primarily on the terms of the contract. In the most cases, a contract specifically notes the kinds of delays that are non-compensable, for which the contractor does not receive any additional money but may be allowed a time extension.

D. Concurrent Delays:

The concept of concurrent delay has become a very common presentation as part of some analysis of construction delays. The concurrency argument is not just from the standpoint of determining the project's critical delays but from the standpoint of assigning responsibility for damages associated with delays to the critical path. Owners will often cite concurrent delays by the contractor as a reason for issuing a time extension without additional compensation. Contractors will often cite concurrent delays by the owner as a reason why liquidated damages should not be assessed for its delays. Unfortunately, few contract specifications include a definition of concurrent delay and how concurrent delays affect a contractor's entitlement to additional compensation for time extension or responsibility for liquidated damages. In analysed concurrent delays, each delay is assessed separately and its impact on other activities and the project duration is calculated. There are some guidelines for concurrent delays classification. Firstly, if excusable and non-excusable delays occur concurrently, only a time extension is granted to the contractor. Next, if excusable with compensation and excusable without compensation delays occur concurrently, the contractor is entitled to time extension, but not to damages.

1.2 OBJECTIVES

The main objectives of this study basically as follows:

1. The different stages in the project life cycle and the salient causes of delays in each of the different stages.
2. To study the differences in perceptions of the three major parties in any constructions namely owners, contractors and consultants.
3. Find out the importance index of each causes.
4. Give the rating to the causes of delay.
5. Find out the critical causes
6. Observe the effects of critical causes on road project.

1.3 SCOPE

The scope of the study is as follows:

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1. To study available literature.
2. To identify the various causes of the delays of Infra projects.
3. To carry out a questionnaire survey and rank the causes of delays in infrastructure projects.
4. To carry out a survey of Infrastructure Projects pertaining to the transport sector.
5. It is helpful to project manager to identify effects of critical causes of delays on project.

II. METHODOLOGY

The research methodology for present study contains two phases. The first phase included a literature search and interviews. The literature review was conducted through books, conference proceedings, internet and international project management journals. As the outcome of this phase the causes were categorise in nine main groups as: Project related, Owner related, Contractor related, Consultant related, Design-related, Material related, Equipment related, Labour related and External factors depending on their nature and mode of occurrence.

The second phase includes preparation of questionnaire based on different approach used for giving ranking to causes of delay of road construction projects. Present study suggests technique for ranking of causes of delay is Relative Importance Index (RII) of each cause of delay can be calculated. The study area of this project is delay management. Based on the knowledge gained on literatures, the project was carried out.

Table 1: CLASSIFICATION OF CAUSES OF DELAY

Sr.No.	Causes of delay
1	Original contract duration is too short
2	Legal disputes between various parties
3	Ineffective delay penalties
4	Delay in progress payments by owner
5	Delay to furnish and deliver the site to the contractor by the owner
6	Change orders by owner during construction
7	Late in revising and approving design documents by owner
8	Delay in approving shop drawings and sample materials
9	Poor communication and coordination by owner and other parties
10	Slowness in decision making process by owner
11	Unavailability of incentives for contractor for finishing ahead of schedule
12	Suspension of work by owner
13	Difficulties in financing project by contractor
14	Rework due to errors during construction
15	Conflicts b/w contractor and other parties (consultant and owner)
16	Poor site management and supervision by contractor

ISSN (O) 2454-9665
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17	Poor communication and coordination by contractor with other parties
18	Ineffective planning and scheduling of project by contractor
19	Improper construction methods implemented by contractor
20	Inadequate contractor's work
21	Delay in site mobilization
22	Delay in performing inspection and testing by consultant
23	Delay in approving major changes in the scope of work by consultant
24	Inflexibility (rigidity) of consultant
25	Poor communication/coordination between consultant and other parties consultant
26	Late in reviewing and approving design documents by consultant
27	Conflicts between consultant and design engineer
28	Inadequate experience of consultant
29	Mistakes and discrepancies in design documents
30	Delays in producing design documents
31	Unclear and inadequate details in drawings
32	Complexity of project design
33	Insufficient data collection and survey before design
34	Misunderstanding of owner's requirements by design engineer
35	Changes in material types and specifications during construction
36	Delay in material delivery
37	Damage of sorted material while they are needed urgently
38	Delay in manufacturing special building materials
39	Late procurement of materials
40	Late in selection of finishing materials due to availability of many types in market
41	Equipment breakdowns
42	Shortage of equipment
43	Low level of equipment-operator's skill
44	Low productivity and efficiency of equipment
45	Shortage of labours
46	Unqualified workforce
47	Low productivity level of labours
48	Personal conflicts among labours
49	Effects of subsurface conditions (e.g., soil, high water table, etc.)
50	Delay in obtaining permits from municipality
51	Rain effect on construction activities
52	Unavailability of utilities in site (such as, water, electricity, telephone, etc.)
53	Effect of social and cultural factors
54	Traffic control and restriction at job site
55	Accident during construction
56	Differing site (ground) conditions
57	Changes in government regulations and laws
58	Delay in providing services from utilities (such as water, electricity)
59	Delay in performing final inspection and certification by a third party

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III. METHODOLOGY

3.1 DATA ANALYSIS: Relative Importance Index method to determine the relative importance of the various causes and effects of delays. The same method is going to adopted in this study within various groups (i.e. clients, consultants or contractors). The four-point scale ranged from 1 (not important) to 4 (extremely important) will be adopted and will be transformed to relative importance indices (RII) for each factor as follows:

RII = Sum of weights (W1+W2+W3+.....+Wn) / A*N

Where, W is the weighting given to each factor by the respondents (ranging from 1 to 4) A is the highest weight (i.e. 4 in this case), and N is the total number of respondents.

The RII value had a range from 0 to 4 (0 not inclusive), higher the value of RII, more important was the cause of delays.The RII was used to rank (R) the different causes. These rankings made it possible to cross-compare the relative importance of the factors as perceived by the three groups of respondents (i.e. clients, consultants and contractors). Each individual cause's RII perceived by all respondents should be used to assess the general and overall rankings in order to give an overall picture of the causes of construction delays in Indian construction industry.

3.2 Problem Statement

Many construction projects have faced various problems and delay of time is one of the major problems. The delay in dispute settlement has manifold effects such as it will give detrimental to the relationship between owner and contractor. Moreover, it will also contribute to the cost and time overruns. The most serious problem is it sends bad signals to foreign investors thereby slowing down the national progress.It is generally said that the contract language is considered difficult to comprehend and they are therefore a major source of disputes.

3.3 Limitations

Then study has been carried out for the completion of Post Graduation in Construction Management from Pune University and as such has some limitations. These are mentioned as follows:

a. The study is primarily based on questionnaire analysis and hence the feedback from respondents. However the views of the respondents can be inaccurate.
b. The case study was conducted from information available from various sources such media reports, journals, and internet sources. No information could be gathered from personnel working on actual project.

Table Ii Summary of Relative Importance Index And Rank for The Various Causes of Delay in Road Construction Project

Sr. No.	Causes of Delay in Road Construction Projects	Relative Importance Index
1	Original contract duration is too short	0.541
2	Legal disputes between various parties	0.875
3	Ineffective delay penalties	0.541
4	Delay in progress payments by owner	0.729
5	Delay to furnish and deliver the site to the contractor by the owner	0.792
6	Change orders by owner during construction	0.458

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7	Late in revising and approving design documents by owner	0.917
8	Delay in approving shop drawings and sample materials	0.833
9	Poor communication and coordination by owner and other parties	0.750
10	Slowness in decision making process by owner	0.772
11	Unavailability of incentives for contractor for finishing ahead of schedule	0.833
12	Suspension of work by owner	0.500
13	Difficulties in financing project by contractor	0.841
14	Rework due to errors during construction	0.417
15	Conflicts b/w contractor and other parties (consultant and owner)	0.750
16	Poor site management and supervision by contractor	0.500
17	Poor communication and coordination by contractor with other parties	0.417
18	Ineffective planning and scheduling of project by contractor	0.583
19	Improper construction methods implemented by contractor	0.833
20	Inadequate contractor's work	0.375
21	Delay in site mobilization	0.875
22	Delay in performing inspection and testing by consultant	0.828
23	Delay in approving major changes in the scope of work by consultant	0.875
24	Inflexibility (rigidity) of consultant	0.917
25	Poor communication/coordination between consultant and other parties	0.833
26	Late in reviewing and approving design documents by consultant	0.500
27	Conflicts between consultant and design engineer	0.875
28	Inadequate experience of consultant	0.708
29	Mistakes and discrepancies in design documents	0.498
30	Delays in producing design documents	0.750
31	Unclear and inadequate details in drawings	0.625
32	Complexity of project design	0.500
33	Insufficient data collection and survey before design	0.458
34	Misunderstanding of owner's requirements by design engineer	0.375
35	Changes in material types and specifications during construction	0.291
36	Delay in material delivery	0.458
37	Damage of sorted material while they are needed urgently	0.417
38	Delay in manufacturing special building materials	0.478
39	Late procurement of materials	0.792
40	Late in selection of finishing materials due to availability of many types in market	0.375
41	Equipment breakdowns	0.292
42	Shortage of equipment	0.417
43	Low level of equipment-operator's skill	0.250
44	Low productivity and efficiency of equipment	0.625
45	Shortage of labours	0.375
46	Unqualified workforce	0.542
47	Low productivity level of labours	0.709
48	Personal conflicts among labours	0.584

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ISSN (P) 2454-0663

49	Effects of subsurface conditions (e.g., soil, high water table, etc.)	0.333
50	Delay in obtaining permits from municipality	0.500
51	Rain effect on construction activities	0.417
52	Unavailability of utilities in site (such as, water, electricity, telephone, etc.)	0.792
53	Effect of social and cultural factors	0.958
54	Traffic control and restriction at job site	0.910
55	Accident during construction	0.708
56	Differing site (ground) conditions	0.458
57	Changes in government regulations and laws	0.458
58	Delay in providing services from utilities (such as water, electricity)	0.667
59	Delay in performing final inspection and certification by a third party	0.756

Table III Ten Most Important Causes of Delay in Road Construction Projects from Owner Point of View

Sr. No.	Causes of delay in Road construction projects	Relative Importance Index	Rank
1	Impacts on environmental condition	0.965	1
2	Late in revising and approving design documents	0.82	2
3	Delay in progress payments	0.79	3
4	Slowness in decision making process	0.785	4
5	Delay in approving drawings and sample materials	0.74	5
6	Changes in material types and specifications during construction	0.71	6
7	Delay to furnish and deliver the site to the contractor	0.695	7
8	Poor communication and coordination with other parties	0.68	8
9	Unavailability of incentives for contractor for finishing ahead of schedule	0.64	9
10	Low productivity and efficiency of Equipment/labour	0.615	10

Table Iv Ten Most Important Causes of Delay In Road Construction Projects from Contractor Point of View

Sr. No.	Causes of delay in Road construction projects	Relative Importance Index	Rank
1	Conflicts with other parties (consultant & owner)	0.915	1
2	Effect of social and cultural factors	0.9	2
3	Low productivity level of labours	0.755	3
4	Low productivity and efficiency of Equipment	0.73	4
5	Difficulties in financing project	0.725	5
6	Shortage of labours	0.71	6
7	Poor communication and coordination with other parties	0.695	7
8	Poor site management and supervision	0.67	8

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9	Rework due to errors during construction	0.625	9
10	Unavailability of utilities in site (such as, water, electricity, telephone, etc.)	0.615	10

Table V Ten Most Important Causes of Delay in Road Construction Projects from Consultant Point of View

Sr. No.	Causes of delay in Road construction projects	Relative Importance Index	Rank
1	Inflexibility (rigidity) of consultant	0.917	1
2	Conflicts between consultant and design engineer	0.875	2
3	Poor communication/coordination between consultant and other parties	0.833	3
4	Delay in performing inspection and testing by consultant	0.828	4
5	Delays in producing design documents	0.750	5
6	Inadequate experience of consultant	0.708	6
7	Unclear and inadequate details in drawings	0.625	7
8	Late in reviewing and approving design documents by consultant	0.500	8
9	Mistakes and discrepancies in design documents	0.498	9
10	Insufficient data collection and survey before design	0.458	10

Table Vi Ten Most Important Causes of Delay in Road Construction Projects from Materials & Equipments Point of View

Sr. No.	Causes of delay in Road construction projects	Relative Importance Index	Rank
1	Late procurement of materials	0.792	1
2	Low productivity and efficiency of equipment	0.625	2
3	Delay in manufacturing special building materials	0.478	3
4	Damage of sorted material while they are needed urgently	0.417	4
5	Delay in material delivery	0.458	5
6	Shortage of equipment	0.417	6
7	Late in selection of finishing materials due to availability of many types in market	0.375	7
8	Equipment breakdowns	0.292	8
9	Changes in material types and specifications during construction	0.291	9

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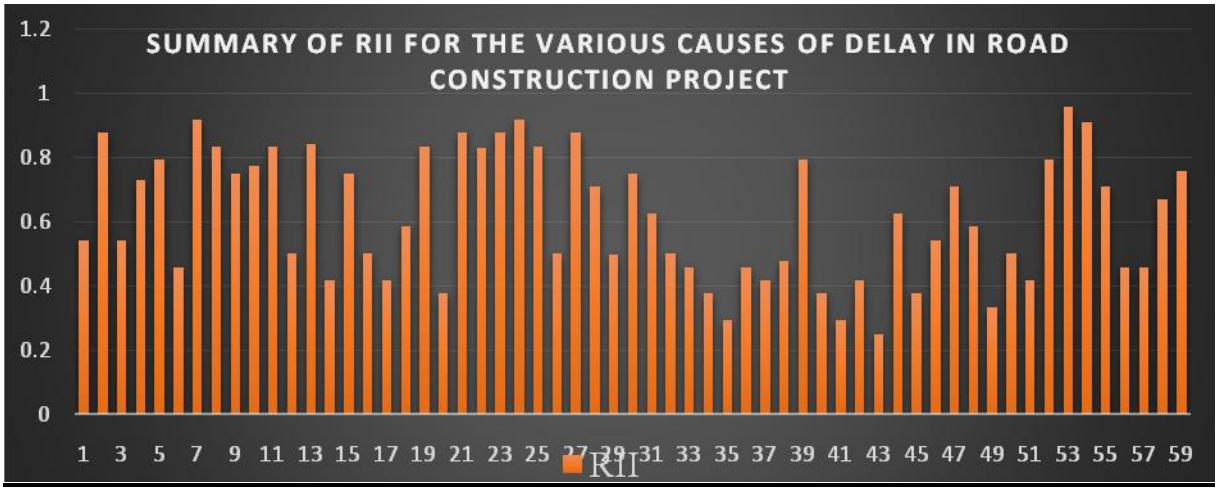
10	Low level of equipment-operator's skill	0.250	10



IV. RESULTS AND DISCUSSIONS

A questionnaire survey was conducted to solicit the causes and effect of delay from contractors' viewpoint. Nine most causes of delay were: (1) Legal disputes between various parties, (2) Late in revising and approving design documents by owner, (3) Delay in site mobilization, (4) Inflexibility (rigidity) of consultant, (5) Delays in producing design documents, (6) Late procurement of materials, (7) Low productivity and efficiency of equipment, (8) Low productivity level of labours, (9) Effect of social and cultural factor

V. CONCLUSIONS

The all ranking indices explained earlier were used to rank delay causes from viewpoints of the contractors.The relative importance index, RII, was computed for each cause to identify the most significant causes. The causes were ranked based on RII values. From the ranking assigned to each cause of delays, It was possible to identify the most important factors or causes of delays in road construction industry

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