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Time Delay Analysis of Rajapeth Cross over Bridge

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Abstract: Time is one of the main reason for which the construction is getting affected. The construction process is subject to many variables and unpredictable factors, which result from many sources such as availability of resources, external factors, etc which lead to loss of productivity.
The aim of this project is to examine the causes and effects of delay on building construction project during construction phase and to provide control measures for time overrun in the project. A study carried out on construction schedule delays and various delay analysis techniques and methods in order to evaluate the causes of delay and their impacts in the construction project. a questionnaire survey is done to find the major causes of delay faced by Client, Contractor, Consultant and Project manager. Population sample of 35 was used in which 30 was deployed. From the survey and study identified 63 causes of delay under 9 major groups such as Project team, Owner, Contractor, Consultant, Architect, material, labour, equipment and external factors. Then a ranking method is done based on relative importance index method to find major cause of delay. It is found that the most common factors of delay which is repeated in most of the project are lack of land acquisition, labour shortage, material shortage, lack of effective communication, lack of supervision. The outcome of the project is to provide recommendation to control delay in the project during construction phase.
Keywords: Time delay, time delay analysis techniques, factors affecting delay, evaluation of delay, delay control.

I. INTRODUCTION

In construction, delay could be defined as the time overrun either beyond completion date specified in a contract or beyond the date that the parties agreed upon for delivery of a project. It is a project slipping over its planned schedule. The delay in the project has an adverse effect on project success in terms of time, cost and quality. The objective of the project is

A. To identify delay factors in construction projects.
B. To rank the delay factors according to the importance level on delays in project.
C. To find the tools to analysis and evaluate the time delay factors in the construction building.
D. Recommendations to control delay during construction phase for construction project.

II. DELAY ANALYSIS TECHNIQUES

Delay analysis is a analytical process that should be employed with project documentation along with collected data from project site. The selection of delay analysis depends on the variety of factors and the available records. There are five commonly used delay techniques.

A. Impacted as-planned method

According to Trauner et al. (2009), in this method the analyst specifies the as planned schedule, and inserts into this schedule the changes which caused project delays. These changes are the only determined delays recorded during construction process which may have affected the project duration. Trauner et al. (2009) point out the major weaknesses of this method as it does not reflect the dynamic nature of construction project and the critical path.

B. Time impact analysis method

The analyst determines the amount of project delay resulted from each of the delaying activity successively by calculating the difference between the project completion date of the schedule after the addition of each delay and that prior to the addition (Ndekugri, Braimah, and Gameson, 2008).

C. Collapsed as-built or _ 'but-for' analysis method

In this method, the analyst studies all contemporaneous project documentation and prepares a detailed as-built schedule instead of an as-planned schedule as mentioned in the what-if method. The analyst subtracts or removes activities which affected the project from the as-built schedule (Trauner et al. 2009).

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D. Windows analysis method

Window analysis method is also called the contemporaneous period analysis and snapshot method. In this method, the basic concept is that the total project duration of CP schedule is divided into digestible time periods or windows (e.g., monthly) and the delays that occurred in each windows of time are analyzed successively by focusing on the critical paths (Hegazy and Zhang, 2005).

E. As-planned versus as-built (Total time) method

Basically, the main concept is that the as-planned versus as-built method compares two schedules, which is why it is also called "the total time method or net impact method". In this method the assumption is that one party (contractor) causes no delays and other party (owner) causes all delays.

III.QUEISTIONAIRE SURVEY

The Survey is designed based on the objective of the study to find out the causes of delays in construction projects and effect of the delays on overall project. The Survey is framed in such a way that the personal view of different people involved in different projects (Architect, Consultant, Owner, Project manager, Contractor) is collected and analyzed. This questionnaire consists of 63 causes of delay on which a detailed analysis will be carried out by using statistical concept. These causes are classified into nine groups according to the sources of delay: Factors related to Project, Owner, Contractor, Consultant, Architect/design-team, materials, equipment, manpower (labor), and external factors.

A. Questionnaire Format

Respondents are asked to fill What is the frequency of occurrence for this cause?. The frequency of occurrence was categorized as follows: always, often, sometimes and rarely (on 4 to 1 point scale). Respondents are required to fill the respective places with only scale points (1, 2, 3 and 4) of their opinion. Frequency of Occurrence Always (4): Generally occurs in all the projects (70%-100%). Often (3): Occurs in 5 to 7 projects out of 10 projects (50%-70%). Sometimes (2): Occurs in 1 to 5 projects out of 10 projects (10%-50%). Rarely (1): Occurs only 1 time out of 10 projects (>10%).

B. Respondent's Profile

The questionnaires were distributed to Owners, Project Manager, Architect, Consultants and Contractors of Indian construction industry. The respondents involved in the survey had several years of experience in handling various types of projects. The characteristics of the respondents participated in survey are summarized below. Population sample of 15 was used in this survey. A total sample of 30 was deployed.

TABLE I. Ranking For Delay Causes

No	Cause Of Delay	Points	Rank %	Group
1	Very short original contract duration	15	12	Project team
2	Legal disputes between parties	20	16	
3	Inadequate definition of substantial completion	50	40	
4	Ineffective delay penalties	30	24	
5	Types of construction contract	40	32	
6	Types of project bidding	45	36	
7	Payment delay	70	56	Owner
8	Delay in delivering the site	50	40	
9	Change order	30	24	
10	Late approval of design document	50	40	
11	Late approval of sample material	50	40	
12	Lack of communication	80	64	
13	Late decision making	40	32	
14	Conflicts between partners	30	24	
15	Unavailability of incentives for contractor for finishing ahead of schedule	50	40	
16	Suspension of work	60	48	
17	Financing difficulty	40	32	

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18	Conflicts with sub-contractor	30	24	Contractor
19	Rework	40	32	
20	Poor site management and supervision	30	24	
21	Poor coordination with labor and subcontractor	30	24	
22	Ineffective planning and scheduling	20	16	
23	Improper construction method	25	20	
24	Delay in sub-contractor work	40	32	
25	Lack of knowledge	30	24	
26	Frequent change of subcontractor	25	25	
27	Poor qualification of technical staff	30	24	
28	Site mobilization delay	30	24	
29	Inspection and testing delays	20	16	Consultant
30	Approval delay	30	24	
31	Poor communication	40	32	
32	Conflict between consultant & architect	50	40	
33	Lack of experience	20	16	
34	Errors in design document	20	16	Architect
35	Delay in producing design documents	32	26	
36	Inadequate details in drawing	18	15	
37	Insufficient data collection & survey	28	23	
38	Misunderstanding of owners requirement	19	15	

39	Unused advanced design software	22	18	
40	Shortage of material	16	13	Materials
41	Change in specification	32	26	
42	Late delivery	26	21	
43	Damaged of required material	32	26	
44	Delay in manufacturing	22	18	
45	Late procurement	36	29	
46	Lack of material availability	55	44	
47	Shortage of equipment	41	33	Equipment
48	Equipment break down	24	19	
49	Poor operator skill	28	22	
50	Low productivity & efficiency	32	26	
51	Lack of high technology equipment	56	45	
52	Shortage of labor	46	37	Labour
53	Personal conflicts	13	11	
54	Lack of knowledge	23	19	
55	Lack of communication	18	15	
56	Lack of skilled labor	15	12	
57	Poor soil condition	37	30	External Factors
58	Delay in obtaining permits	44	36	
59	Climatic factor	22	18	
60	Unavailability of utilities	26	21	
61	Accidents during construction	12	10	
62	Changes in government regulation	19	16	
63	Delay in final inspection	23	19	

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C. Highest Percentage Of Delay Group

From the above finding and analysis using ranking method the group which is more responsible for the delay in the project is find out. According to the survey result it is found that resources are the main reason for the delay in the project along with external factors it is then followed by Contractor, then Owner and the others.

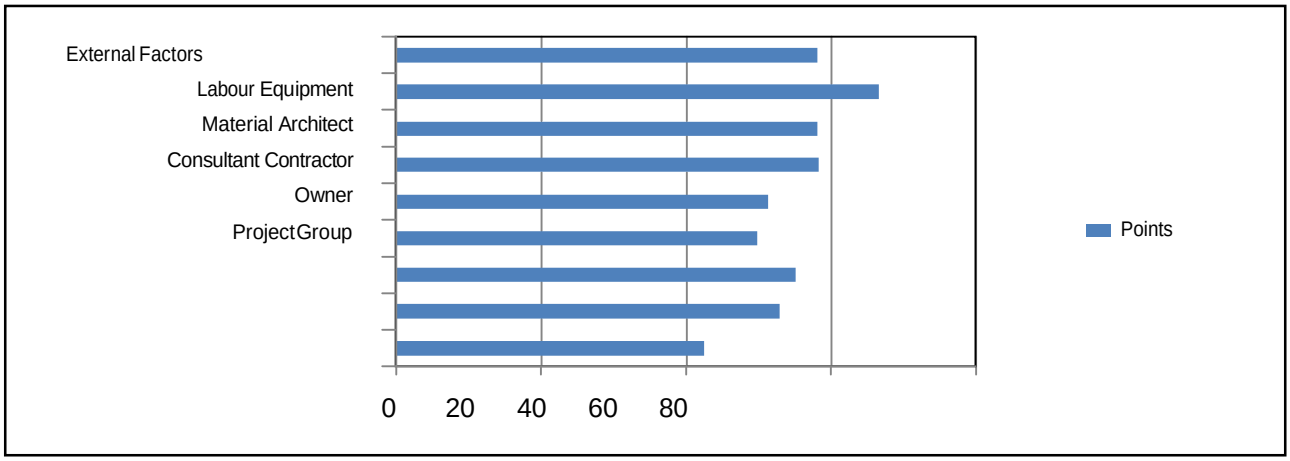


Fig. 1. Highest percentage of delay group

source ;(Ar Meena V" Study on Time Delay Analysis vol 4 03,march 2015)

D. Recommendatins

From the survey it is found that contractor has the highest percentage of cause of delay followed by owner and then consultant. So recommendation to control major causes of delay are listed below:

Table no .2 recommendation for causes of delay

Causes of delay	Recommendations
Weather condition	Conducting detailed and perfect surveys towards the field condition and previous weather data
External factors	Monitor the work done by the earlier contractors to make sure that delays outside your control are recognized and documented.
Lack of funds	Optimize cash flow in accordance with the requirements and make sure fund needed for project is available to execute the project
Deviation of scheduling	Develop detailed and accurate schedule to facilitate easy and controlled scheduled execution
Lack of communication	Planning and applying Management Information System(MIS)
Poor decision making process	Conduct routine/regular coordination meeting and develop a procedure regarding decision making.
Lack of coordination / Wrong delegation of authority	Develop a good, simple and easy to understand system to regulate coordination procedures and responsibility of units. Make organization chart with detail job description which includes responsibilities and roles of each function
Lack of inspection	Provide separate technical staff or site manager for periodic inspection and monitoring work process which includes starting late, late submission of drawings, mistakes or errors, resource availability, etc. then proper record has to be maintained to detect risk and mitigate.
Improper planning	Understand the level of supply and demand to produce detail planning and schedule. Implement automatic machine work to avoid shortage of labor such as automatic plastering machine, wall painting, precast concrete wall, etc.
Lack of knowledge	Contractor needs to aware of new technologyand techniques to reduce time duration for activity or labor force
Lack of facilities at site	Site management should be properly done to ensure proper resource; basic facilities for worker are available to increase productivity by doing detail study in site condition.
Poor selection of vendors	Consider supplier daily capacity and material quality for selecting vendors to avoid delay and conflicts.
Labor shortage	Early workforce planning is essential for owners and contractors to effectively manage project labor risks. Then providing incentives/awards for workers like best employer of the year/ month so that productivity and quality of work will be increased.
Skilled labor shortage	Providing training and upgrade skills to use new technology and techniques for unskilled labors to increase productivity and efficiency of the worker.

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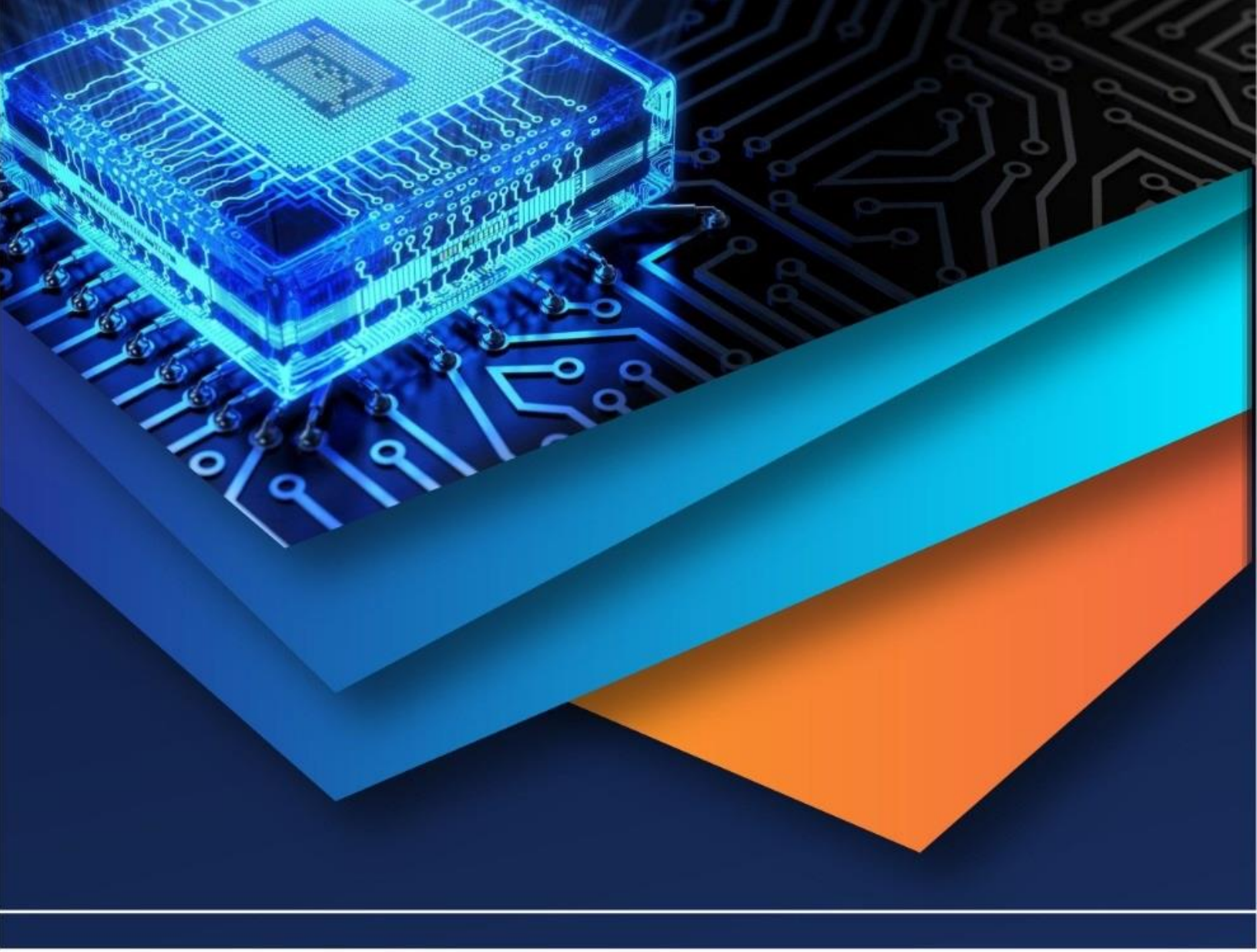
IV. CONCLUSIONS

The major causes of delay which is found repeating in almost every project are external factors, financial difficulties, shortage of labor, insufficient labor productivity, owner interference and improper planning. After analyzing the data it is clear that the contribution of Contractor in delay of the construction project is high then followed by client then consultant side and others. Resource allocation is the main criteria for doing schedule planning to allocate duration for each activity included in the project so that delay in the construction project can be reduced.

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