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ANALYSIS OF DELAYS IN CONSTRUCTION PROJECTS

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Abstract:- Time , quality and economy constitute the three main factors in a construction project, of which time plays a significant role in construction. Delay in any task or operation is a time overrun which influences the completion of the work. The common problems in civil engineering projects all around the world are mainly due to delay in construction. These problems occur frequently during project duration leading to disputes and litigation. Thus it's essential to study and analyse causes of construction delays.This study is based on a list of construction delay causes retrieved from literature reviews. The feedback of construction experts was obtained through interviews. Subsequently, a questionnaire survey was prepared. The questionnaire survey was distributed to construction experts who represents consultants, and contractor's organizations. A case study is analyzed and compared to the most important delay causes in the research. Statistical analysis is carried out to test delay causes, obtained from the survey.

Keywords:- Questionnare, Likert Scale, Frequency Index, SPSS, Chronbach's alpha

INTRODUCTION

A typical construction project suffers from high risks associated with schedule delays and time-based disputes, since time is of the essence of the construction contract. For example, the unique nature of construction makes the work susceptible to unforeseen site conditions and severe weather changes. In addition, a construction plan created for a project relies on the performance of owners, designers, contractors, subcontractors, and suppliers, as well as the co-ordination among them. A single event that deviates from the plan, such as a change in the scope of the project, can disturb the overall performance and can create turbulence among the parties.

Delay in construction can have a number of consequences in a project, such as late completion, lost productivity, acceleration, consequential damages, increased cost and contract termination. The party experiencing damages from delays needs to be able to recognize the delays and the parties responsible for them in order to recover time and cost.
A number of methodologies have been developed to assess delays and their impacts, but honourable courts and administrative boards have not specified any standard method to evaluate delay impacts. Delay analysis can be conducted in a cursory manner or in such detail as to exceed the value of the underlying dispute. Each delay analysis method adopts a different approach to identify delay impacts and may yield different results. The most sophisticated delay analysis method using the highest level of detail does not guarantee success.

Delay Analysis

The objective of delay analysis is to calculate the project delay and work backwards and tried to identify how much of it is attributable to each party (contractor, owner, or neither) so that time and/or cost compensation can be decided.
The most widely used delay analysis techniques are

- Schedule Review/ Discussion
- As Planned Versus As Built Analysis
- Impact As Planned Analysis
- Collapsed As Built Analysis
- Time Impact Analysis
- Productivity Method

Schedule Review/ Discussion

Schedule review/discussion is the simplest method that involves arguing a claim with or without using a schedule, but relying mostly on the strength of the evidence and testimony. The method is an easy and inexpensive way to argue time-based claims when detailed

calculations cannot be conducted. But the results of such an analysis are not acceptable to most analysts because it ignores the nature of each delay event and assumes that every delay has an equal impact on the project duration.

As Planned versus as Built Analysis

The as-planned versus as-built schedule delay analysis involves comparing the baseline, or as-planned, construction schedule against the as-built schedule or a schedule that reflects progress through a particular point in time. This analysis method is typically utilized when reliable baseline and as-built schedule information exists.

Impact as Planned Analysis

The impact as-planned method of delay analysis is a technique which forecasts or predicts a delay's effect on a project's completion date. This delay analysis method involves the insertion or addition of activities representing delays or changes into the baseline schedule to determine the impact of those delay activities. Use of the impact as-planned schedule analysis method is generally restricted to the quantification of delays for contemporaneous requests for time extensions.

Collapsed as Built Analysis

The collapsed as-built delay analysis methodology is a retrospective technique that begins with the as-built schedule and then subtracts activities representing delays or changes to demonstrate the effect on the completion date of a project but for the delay or change. Generally, this method is applied in cases where reliable as-built schedule information exists, but baseline schedule and/or contemporaneous schedule updates either do not exist or are flawed to the extent that they are not reliable to support a delay analysis.

Productivity Method

The productivity method compares the productivity achieved in an activity against normal productivity rates. The intent is to seek damages on the grounds that site productivity has been negatively affected by a delay. However, historically speaking, courts and boards have often arbitrarily reduced claims based on published impact standards because of the uncertainty as to their accuracy

QUESTIONNARE ANALYSIS

A questionnaire is a research instrument consisting of a series of questions and other prompts for the purpose of gathering information from respondents. Although they are often designed for statistical analysis of the responses, this is not always the case.

When developing a questionnaire, items or questions are generated that require the respondent to respond to a series of questions or statements. Participant responses are then converted into numerical form and statistically analysed. These items must reliably operationalize the key concepts detailed within specific research questions and must, in turn, be relevant and acceptable to the target group. There are a range of scales and response styles that may be used when developing a questionnaire.

Within researches Likert-type or frequency scales are most commonly used. These scales use fixed choice response formats and are designed to measure attitudes or opinions.

The questionnaire designed for use in the survey comprised demographic information about respondents and 39 delay causes which were grouped to six categories: owner related, consultant related, contractor related, labor and equipment related, external related. The respondents were requested to choose one degree of frequency for each delay cause which is completely disagree, disagree, neither agree nor disagree, agree, completely disagree. The questionnaire was distributed to firms mainly under Builders Association of India Cochin Centre. The size of the sample required from the targeted population i.e. respondents was determined statistically.

The sample size required for the Questionnaire survey is determined from Taro Yamane Sample size Formula given by

$$n=\frac{Z\alpha\times Z\alpha\times p\times(1-p)\times N}{Z\propto\times p\times(1-p)+N\times e\times e}$$

- n – sample Size
- p – proportion of favourable result in the population (0.5)
- e – Standard error(0.1)
- N – Population(150)
- Z_α -Critical Value of desired confidence level (95%-1.96)

Thus the sample size required for the survey is set at **60** Sample.

The respondents were asked to determine the frequency of occurrence of each cause as follows: Completely disagree = 1, Agree = 2, Neither agree nor disagree = 3, Agree= 4, Completely agree. Reliability test for Questionnaire is conducted with the pilot survey response. Cronbach's alpha is the most common measure of internal consistency or reliability. It is most commonly used when there are multiple Likert questions in a survey/questionnaire that form a scale and to determine the reliability of the scale. Cronbach's alpha will generally increase as the inter-correlations among test items increase, and is thus known as an internal consistency estimate of reliability of test scores. Generally, a questionnaire with $\alpha > 0.7$ is considered reliable.

The test is conducted with the help of SPSS software, the Cronbach's Alpha value – **0.909** is obtained which is well above 0.7. Thus the questionnaire is proved to be reliable. Figure 3.1 shows the output of reliability test performed in SPSS

Reliability

```
[DataSet1] E:\AEDWIN\MTECH\PROJECT RESULTS\chronbchs test.sav
```

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	20	100.0
	Excluded[a]	0	.0
	Total	20	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.941	39

Fig 1:- Cronbach's alpha in SPSS

Table 1 Delay causes of construction projects.

OWNER RELATED	20. Inexperience
1.Slow decision making	21. Poor qualification of staff
2. Delay in delivering the site	22. In effective planning
3. Payment delay	23. Frequent change of subcontractor
4. Improper Planning and Scheduling	LABOUR & EQUIPMENT RELATED
5. Owner interference	24. Shortage of labours
6. Change in orders	25. Low productivity level OF labours
7. Suspension of work	26. In-experienced work force
8. Lack of communication	27. Delay in material delivery
9. Late decision making	28. Shortage of materials
10.Conflicts among partners	29. Shortage of equipment
CONSULTANT RELATED	30. Equipment break down
11.Inadequate experience	31. Low productivity & efficiency
12. Delay in approving drawings and samples	32. Poor operator skill
13. Inadequate detailing and clarity in drawings	33. Lack of communication
14. Quality assurance control	EXTERNAL FACTORS
15. Mistakes & discrepancies in design documents	34. Change in government regulations
CONTRACTOR RELATED	35. Poor soil conditions
16. Delay in payment	36. Delay in obtaining permits
17. Delays in sub- contractor work	37. Climatic factors

18. Poor site management and supervision	38. Accidents during construction
19. Rework due to errors	39. Delay in commissioning

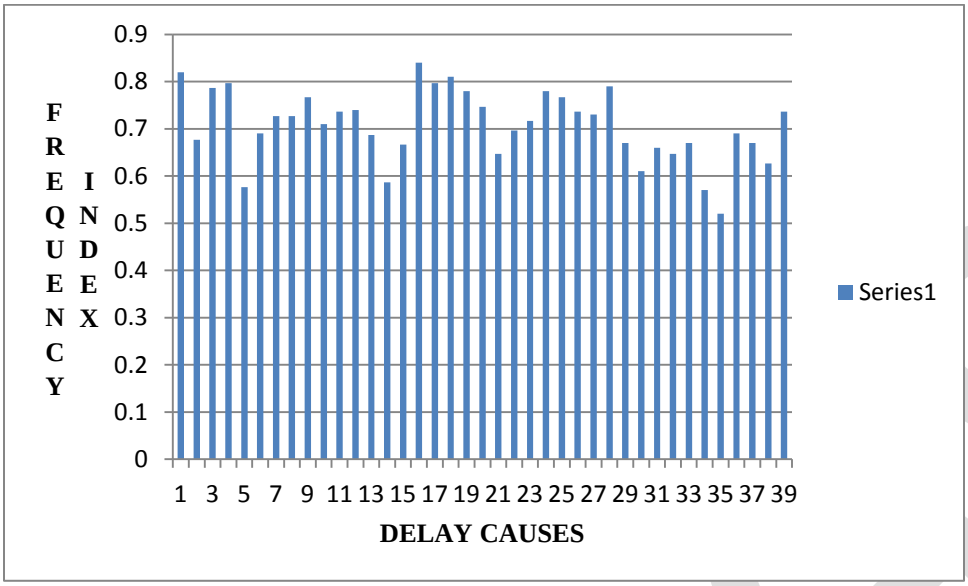

Fig 2:- Frequency Index of Delay Related Causes

Table 2: Top ten delay causes according to frequency index

Delay group	Delay causes
Contractor related	Delay in payment
Owner related	Slow decision making
Contractor related	Poor site management & supervision
Contractor related	Delays in subcontractor work
Labour & equipment related	Shortage of materials
Contractor related	Rework due to errors
Labour & equipment related	Low productivity level of labours
Owner related	Payment delay to contractors
Labour & equipment related	Delay in obtaining permits
External factors	Delay in commissioning

CASE STUDY

A contract was signed between the claimant (contractor) and the defendant (owner) to construct a commercial building including utilities and landscape in of 27000square feet plinth area at Ernakulam. The project was delayed for the following reasons:

- There was a six month delay from the authorities to obtain permits. Authorities are less aware of the rules and regulations of buildings and constructions, which created a huge role in the construction of the building.
- Strike of quarries in kerala affected the construction process a lot as it caused a delay in material supply tto the site.
- There was an accidental during concreting phase of one floor, as the formworks were not tightened properly it resulted in the collapse of formworks and further delayed the work for two weeks.

DISCUSSIONS

- Project parties should preview the site. Complete planning on how the works should be made before the start of project.
- Formal relationships among project parties should be identified, as well as roles and responsibilities.

CONCLUSION

This paper analysed causes of construction delays in Ernakulam (Cochin). The feedback of construction experts was obtained through interviews and questionnaire surveys. Frequency Index is calculated according to the highest values of them the top ten delay causes of construction projects in Ernakulam are determined.

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