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Delay Analysis

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***Abstract*—The objective of this study is to identify the major causes and effects of construction delays. This study is done based on literature review and a questionnaire survey. The questionnaire was formed based on the 32 factors and 9 effects of delay, targeting the contractors. The Likert's scale of five ordinal measures is used in this survey. The level of importance of each factor and effect of delays is established by computing Relative Importance Indices (RII).The analysis is made using Microsoft Excel and SPSS Software.**

Keywords— Delay factors, Delay effects, RII, SPSS

I. INTRODUCTION

Delay is the slowing down of work without entirely stopping construction and can lead to time overrun either beyond the contract date or beyond the date that the parties have agreed upon for the delivery of the project. Delays can be classified into non-excusable delays, excusable non compensable delays, excusable compensable delays and concurrent delays.

Non-excusable delays are delays which the contractor either causes or assumes the risk for. Excusable non-compensable delays are delays caused by factors that are not foreseeable, beyond the contractor's reasonable control and not attributable to the contractor's fault or negligence.

Compensable excusable delays are excusable delays, suspensions, or interruptions to all or part of the work caused by an act or failure to act by the owner resulting from owner's breach of an obligation, stated or implied, in the contract. Concurrent delays occur when both owner as well as the contractor are responsible for the delay.

II. PROBLEM STATEMENT

The contractor and the owner pay for the extra charge for the completion of the project due to delay. When the completion time of the construction project exceeds, it is known as construction project delay. It is needed to conduct detailed investigation and identification of delay factors, selecting the right actions to counter these delay factors within cost and maintaining quality.

III. SCOPE AND OBJECTIVES

- Reduce delays in road projects
- Reduce the effects of factors that cause delays.
- Timely completion of project.
- Reduce cost overruns.
- Leads to proper planning of projects regarding time.
- Construction of Delay Model.

IV. OUTLINE OF THE THESIS

Chapter 1: Introduction

Time delay is one of the biggest problem in many construction projects all over India. Timely completion is the key factor of the project, but the construction process is subject to many variables and unpredictable factors.

Chapter 2: Literature Review

Literature survey is carried out for identifying factors and effects that causes delays in construction industry and are also responsible for the harmful effects on projects.

Chapter 3: Research Methodology

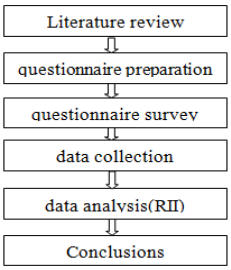

Fig 1. Methodology

Chapter 4: Result and Discussion

The causes and effects of construction delays were ranked by using relative important index. The important causes of delays are fluctuation of prices and bad weather conditions. The important effects of delay are cost overrun and loss of profit by the contractor.

Chapter 5: Conclusions

V. DATA ANALYSIS

The causes and effects of dealy obtained by survey were examined and werw ranked on the basis of Relative Importance Index (RII).

The relative importance index is given as:

$$RII = \frac{1n1+2n2+3n3+4n4+5n5}{5(n1+n2+n3+n4+n5} \quad (1)$$

n_1 = respondents answered strongly disagree
n_2 = respondents answered disagree
n_3 = respondents answered neutral
n_4 = respondents answered agree
n_5 = respondents answered strongly agree

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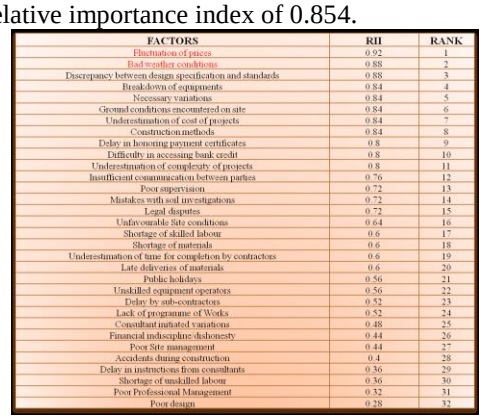
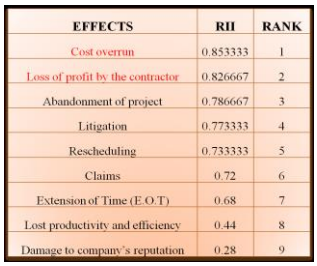
VI. RESULTS

The response of contractors were analysed based on their relative importance index. The relative importance index and ranks of factors and effects of delay are given in Figure 1 and 2.Fluctuation of prices was ranked as the most influential cause of delay with a relative importance index (RII) of 0.92. They also identified Cost overrun as the most critical effect of delay with a relative importance index of 0.854.



FACTORS	RII	RANK
Fluctuation of prices	0.92	1
Bad weather conditions	0.88	2
Discrepancy between design specification and standards	0.88	3
Breakdown of equipments	0.84	4
Necessary variations	0.84	5
Ground conditions encountered on site	0.84	6
Underestimation of cost of projects	0.84	7
Construction methods	0.84	8
Delay in honoring payment certificates	0.8	9
Difficulty in accessing bank credit	0.8	10
Underestimation of complexity of projects	0.8	11
Insufficient communication between parties	0.76	12
Poor supervision	0.72	13
Mistakes with soil investigations	0.72	14
Legal disputes	0.72	15
Unfavorable site conditions	0.64	16
Shortage of skilled labour	0.6	17
Shortage of materials	0.6	18
Underestimation of time for completion by contractors	0.6	19
Late deliveries of materials	0.6	20
Public holidays	0.56	21
Unskilled equipment operators	0.56	22
Delay by sub-contractors	0.52	23
Lack of programme of Works	0.52	24
Consultant initiated variations	0.48	25
Financial indiscipline/dishonesty	0.44	26
Poor Site management	0.44	27
Accidents during construction	0.4	28
Delay in instructions from consultants	0.36	29
Shortage of unskilled labour	0.36	30
Poor Professional Management	0.32	31
Poor design	0.28	32

Fig 2. RII of Delay factors



EFFECTS	RII	RANK
Cost overrun	0.853333	1
Loss of profit by the contractor	0.826667	2
Abandonment of project	0.786667	3
Litigation	0.773333	4
Rescheduling	0.733333	5
Claims	0.72	6
Extension of Time (E.O.T)	0.68	7
Lost productivity and efficiency	0.44	8
Damage to company's reputation	0.28	9

Fig 3. RII of Delay effects

VII. DELAY MODELLING

Linear regression try to model the relationship between two variables by fitting a linear equation to observed data. One variable is considered to be an explanatory variable, and the other is considered to be a dependent variable.

A linear regression line has an equation of the form

$$Y = a + bX, \quad (2)$$

Where,

X is the explanatory variable

Y is the dependent variable

b is the slope of the line

a is the y-intercept ,

a and b can be found using equation

$$a = \frac{(\Sigma y)(\Sigma x^2) - (\Sigma x)(\Sigma xy)}{n(\Sigma x^2) - (\Sigma x)^2}$$
$$b = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{n(\Sigma x^2) - (\Sigma x)^2} \quad (3)$$

Table 1: Coefficients for delay factors

	Coefficients	Standard Error	t Stat	P-value
Intercept	3.601612903	0.336904373	10.69031	9.45E-12
factors(x)	-0.024340176	0.017818397	-1.36601	0.182088

Table 2: Coefficients for delayeffects

	Coefficients	Standard Error	t Stat	P-value
Intercept	2.713	1.007453	0.025148	0.980553
values(y)	0.134	0.098851	14.89986	4.06E-07

Regression equation for delay factors by manual computation is as follows

$$y=3.602-0.0243x \quad (4)$$

Similarly, Regression equation for delay effects is

$$y=2.713+0.134x \quad (5)$$

VIII. CONCLUSION

It is found that fluctuation of prices is the most important delay factor while cost overrun is the important effect of delay.

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