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ANALYSIS OF DELAYS IN CONSTRUCTION

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Abstract - *Construction Industry plays an important role in socio-economy development of any developing country. Cost and time overruns are the key problems of any construction projects. These issues are causing the negative impact on the development of country economic growth and prosperity. This paper has intended to identify the causes of delays, the effects of delays and methods of minimizing construction delays. This paper study has carried out based on literature review and a questionnaire survey. The thirty one questionnaire has been made on the basis of literature study, which has been distributed on various construction site and Interview has been taken .Then ranked based on their relative importance index. For major factor analysis has used to reduce all factors divided into eight groups: clients, consultants, contractors, design, equipment, labour, external and material. The methods to reduce delay are also included in the project along with a case study. The result of this paper should help construction practitioners, policy makers and researchers in construction field.*

Key Words*: *Delay, Causes, development, schedule

1. INTRODUCTION

Time, quality and economy constitute the three main factors in a construction project, of which time plays a significant role in construction. 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. Time delay is one of the biggest problems facing in many construction buildings in India. Completing projects on time is the key factor of the project. But the construction process is subject to many variables and unpredictable factors, which result from many sources such as availability of resources, external factors, performance of parties and type of building. Thus it's essential to study and analyse the causes of construction delays

2. AIM AND OBJECTIVES

The main aim of this project is to identify the main reasons of construction delay and the methods of minimizing it

The objectives to achieve the aim of this project are as follows:

- To identify delay factors in construction projects
- To sort the delay into different groups
- To rank the delays by using RII method
- To find out the most causative groups and factors which affect schedule.
- Making some recommendations for these problems to avoid or minimize the delays.

3. CONSTRUCTION DELAYS

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 and is considered as common problem in construction projects. To the owner, delay means loss of revenue through lack of production facilities and rent-able space or a dependence on present facilities.

3.1 TYPES OF DELAYS:

1. Critical or Non Critical.
2. Excusable or Non Excusable,
3. Compensable or Non Compensable
4. Concurrent or Non Concurrent.

3.1.1 Critical Delays (or non-Critical Delays)

A Critical schedule delay is one that impacts the project's delivery date. If a delay has no effect to activities on the project's Critical Path, then the delay may not warrant too much attention, unless of course there is some substantial money involved.

3.1.2 Excusable / Non-Excusable Schedule Delays

Excusable delays are caused by conditions that are reasonably unforeseen and not within the contractor's / owner's control.

Examples of this kind of delay include: Labor strikes, Fires, floods, earthquakes and most natural disaster, Changes initiated by the owner

Non-excusable delays are a result of a delay that was within control of the Owner/Contractor. The Owner/Contractor is fully responsible for the activity delays. Examples of non-excusable delays include: Delayed mobilization, Delayed submission of submittals, Overall late performance and execution, Late performance of subcontractors

3.1.3 Compensable Delays

A compensable delay is one where there's going to be some compensation involved for the delay to the project. That means that the owner or contractor is liable for a extension of time or cost compensation or both. The cost compensation is to account for damages or extra costs associated with the delay.

3.1.4 Concurrent Delays

There are many moving parts between an owner and a contractor (and subs or suppliers) on a construction project and, at times, a concurrent delay can occur. This type of schedule delay happens when 2 or more parties are at fault. The complexity here lies in determining to what extent each party contributed to the delay.

3.2 CAUSES OF DELAYS

Client Related Factors: Finance and payments of completed works, Delay in deliver of the site to the contractor, Frequent change of design as per clients requirements, Poor communication and coordination

Contractor Related Factors: Financial instability and management of the contractor, Improper planning and scheduling of the project(using CPM &PERT), Changing of subcontractors again and again, Improper construction methods and poor site management, Disputes between the main contractors and sub contractors

Consultants Related Factors: Late in reviewing and approval of the design documents, Inadequate experience of the consultants

Materials Related factors: Shortage in the construction materials, Changes in the construction materials types, Late delivery of materials on the site, Inferior quality of material production

Equipment Related factors: Equipment breakdowns, Shortage of equipments, Less efficiency of the equipment

Labour related factors: Shortage of labour**,** Strike**,** Poor skill of the labours

External Factors: Climatic changes, Price escalation of the materials, Permissions from concerned government authorities, Change in orders which are not included in contract, Accidents during construction, Festivals, Public Holidays

Design associated factors: Complication in design, Non existence of skill of design team, Errors and late in producing design papers, Design errors made by designers

3.3 EFFECTS OF DELAY

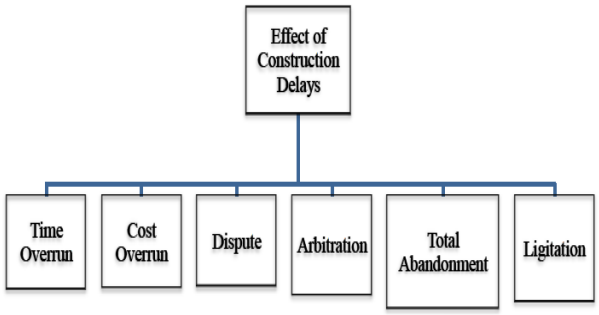
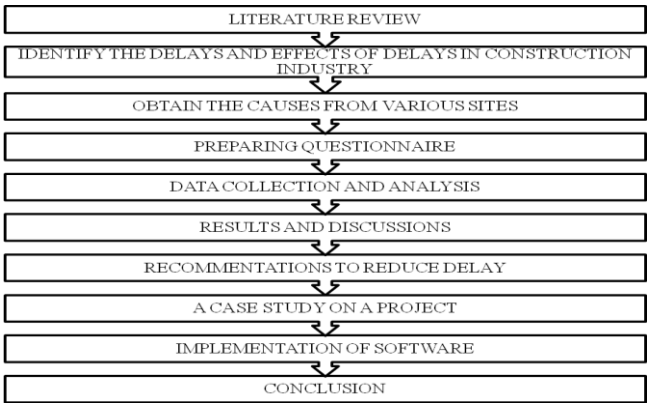


Fig 3.3 Effects of delay

4. METHODOLOGY



5. RESULTS AND DISCUSSIONS

Relative Importance Index (RII) technique was used.

$$RII = \frac{\Sigma W}{(AXN)}$$

W=respondent's reply for each of the factors
A = highest reply of the same factor
N = Numbers of respondents.
RII ranges from 0 to 1

5.1 TOP 10 FACTORS AFFECTING SCHEDULE ARE:

Sl No	Factors affecting schedule	Group of Factor	RII	Rank
1	Improper planning and scheduling of the project(using CPM &PERT)	Contractor Related	0.895	1
2	Climatic changes	External Related	0.880	2
3	Shortage of labour	Labour Related	0.805	3
4	Late delivery of	Material	0.785	4

	materials	Related		
5	Errors and late in producing design papers	Design Related	0.730	5
6	Finance and payments of completed works	Client Related	0.700	6
7	Changing of subcontractors again and again	Contractor Related	0.695	7
8	Strike	Labour Related	0.685	8
9	Price escalation of the materials	External Related	0.670	9
10	Accidents during construction	External Related	0.595	10

Table 5.1 Top 10 factors affecting schedule

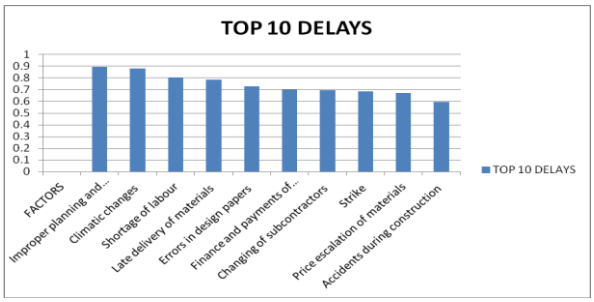


Fig 5.1 Top 10 delays

5.2 METHODS TO REDUCE DELAY

- Sound Implementation Planning
- Implement automatic machine work to avoid shortage of labor
- Develop detailed and accurate schedule
- Conducting detailed and perfect surveys towards the field condition and previous weather data
- Early workforce planning
- Providing incentives/awards for workers like best employer of the year/ month so that productivity and quality of work will be increased.
- Provide training and upgrade skills to use new technology and techniques
- Provide good quality of construction materials.
- Select experienced design team
- complex design and incomplete drawings should be avoided
- Appoint a design coordinator
- Assurance of Funds Resources
- Select the most appropriate contractor
- Stock the material in inventory when the price is low
- Make sure that there is enough lighting present at night concreting or any other work to reduce number of accidents

6. CASESTUDY

Software used: Primavera: A Primavera P6 schedule is often required at the start of a project, regardless of whether it is simple or complex, to forecast the duration of the project and its activities. A schedule should be made prior to the start of a project.
Creating a primavera P6 schedule

- Open Primavera and create a project
- Define Work Breakdown Structure
- Creating Calenders for Activities and Resources
- Define The Activities Coming in the Project
- Appointing Activity Durations
- Assigning Logic Links
- Performing Scheduling
- Allocating Resources/ Budgeting For Activities
- Creating Baseline for The Project
- Updating Schedule

6.1 Details of the work

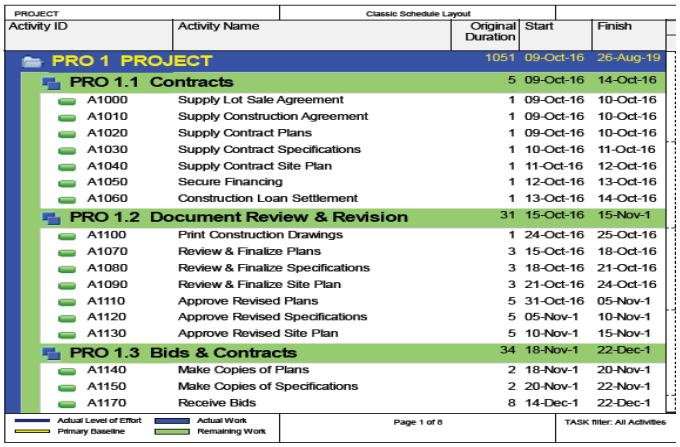
- Name of the work: Office building
- Area: 7000 sqft for one floor
- No of floors: G+2 floors completed
- Planned duration :1.5 years
- Actual duration : 2 years 3 months
- Budget : 4 crore

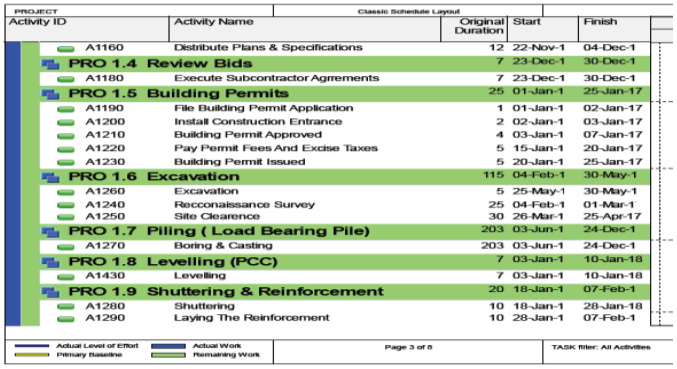
Expected Duration

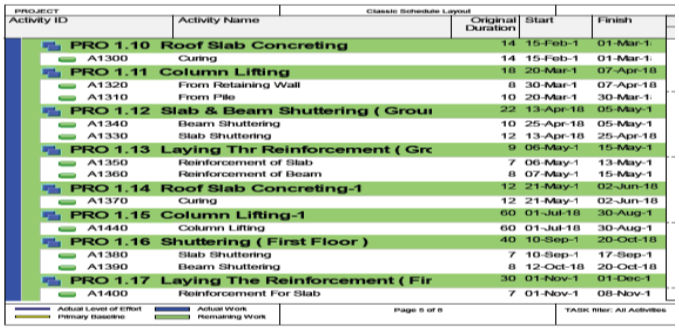
Sl No	Work	Start Date	End Date	Expected Duration
1	**Contracts**	9/10/2016	14/10/2016	5 Days
2	**Document Review & Revision**	15/10/2016	15/11/2016	25 Days
3	**Bids & Contracts**	18/11/2016	22/12/2016	24 Days
4	**Review Bids**	23/12/2016	30/12/2016	5 Days
5	**Building Permits**	1/1/2017	25/1/2017	17 Days
6	**Excavation**	4/2/2017	30/5/2017	2 Months
7	**Piling(Load Bearing Pile)**	3/6/2017	24/12/2017	6 Months
8	**Levelling (Pcc)**	3/1/2018	10/1/2018	3 Months
9	**Shuttering And Reinforcement**	18/1/2018	7/2/2018	
10	**Roof Slab Concreting**	15/2/2018	1/3/2018	
11	**Column Lifting**	20/3/2018	7/4/2018	
12	**Slab And Beam Shuttering(Ground Floor)**	13/4/2018	5/5/2018	
13	**Laying The Reinforcement (Ground Floor)**	6/5/2018	15/5/2018	15 Days
14	**Roof Slab Concreting**	21/5/2018	2/6/2018	48 Hours

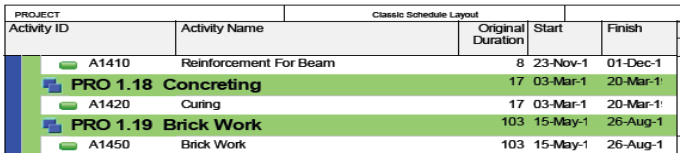
15	**Column Lifting**	1/7/2018	30/8/2018	1 Month
16	**Shuttering (First Floor)**	10/9/2018	20/10/2019	15 Days
17	**Laying The Reinforcement (First Floor)**	1/11/2018	1/12/2018	15 Days
18	**Concreteing**	3/3/2019	20/3/2019	48 Hours
19	**Brick Work**	15/05/2019	26/8/2019	1 Month

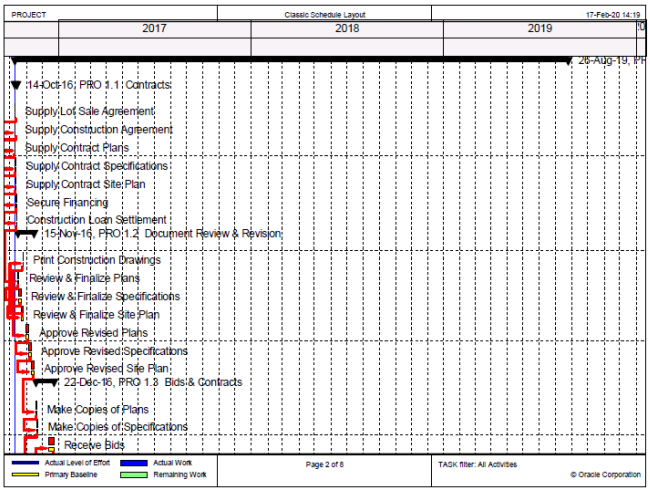
Table6.1 details of scheduled duration

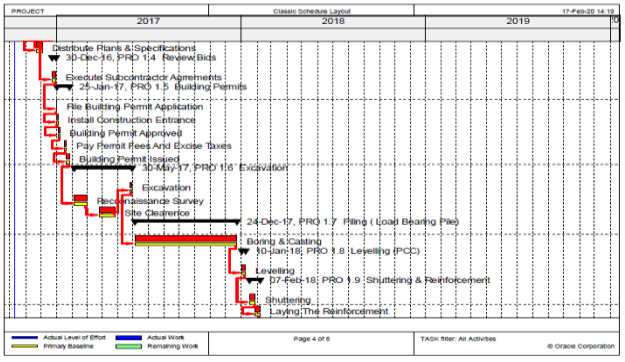


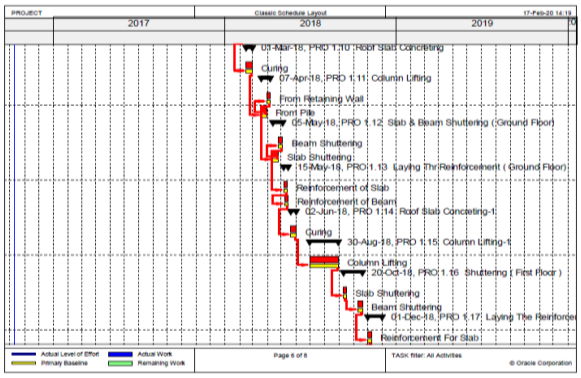












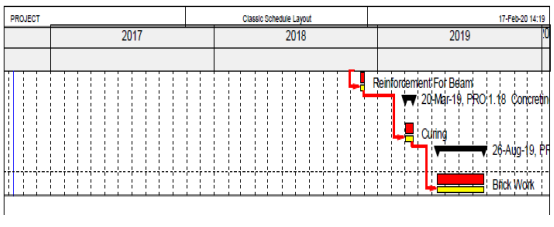


Fig 6.1 schedule of the project

6.2 Reasons for delay

- Improper material management
- Climatic changes (flood)
- Labour shortage

6.3 Methods to reduce delay

Improper material management:- An automated material management model can be developed. To facilitate planning, direction, control and co-ordination of various activities related to material in an enterprise there should be a separate department of materials management.

Climatic changes (flood) :- An increase in extreme climatic events would cause rapid damage requiring replacement of whole building elements, which is more visible and frequently more costly. An early planning and scheduling regarding the weather conditions is essential. The work should be planned accordingly considering it. All the preventive measures should be taken

Labour shortage:- A lack of skilled labour can present an array or problems and negative impacts. Introduce resource levelling for labour requirement. Although the training of young people in the industry must still be heavily addressed. Utilizing machinery in place of work traditionally done by hand. Using pumps and machines can help make bigger projects less labor intensive, enabling companies to take on more jobs and in turn increasing profitability and efficiency. Utilizing best-in-class machinery can help produce quality work at a faster pace with the same or a smaller workforce.

7. CONCLUSION

India is developing country, and population of the country is tremendously increasing. This intern increases pressure on the infrastructure and residential construction field. The successful execution of a project, effective planning is essential. Besides the successful planning it has been reported that 86 % construction projects get delayed. Reasons for such delay which cause cost and time overruns are enormous. Construction delays are disruptive and expensive. Project Management approach eliminates the thumb rule that is practiced in Indian construction industry. So, it is essential for any project to implement project management with the assistance of any software. In this way project may be more successful. Thus Planning, scheduling, tracking and controlling plays a major role in any project, if the project is not properly planned and tracked, the cost variance at different situations may increase. So, project management plays a key role in any construction project. Planning, monitoring and controlling, as well as the need and effectiveness of project management software like Primavera P6 in a construction project of this study was to understand the role of monitoring and control in the progress and timely completion of a construction project.

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