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## Project Planning and Delay Analysis For 2x300 Mw EMCO Thermal Power Plant

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**Abstract:** Proper planning and scheduling are very important in construction projects for reducing and controlling delays in the project. Substantial amounts of time, money, resources are wasted each year in the construction industry due to improper planning and scheduling. With globalization, the construction projects have become big. Planning of such projects requires huge amount of paperwork, which can be reduced with the help of project planning software. The main objectives of this study are to plan, schedule, and track with help of primavera, and study the results generated. In addition, to recommend measures to the organization for enhancing the project planning skills for similar projects in future.

The construction delay is the main problem in the large construction industry of India. The Large construction industry is very important for the development, economy, and progress of India. Delay to projects is one of the foremost concerns of the construction industry in India. The delays to the projects are affecting the economies throughout the world. Delay to projects means the slowdown of development in all other related fields.

Construction project management is vital for accomplishing pre-determined objectives. Despite using construction management, most of the projects do not meet original time schedule or has been delayed. Delay is one of the biggest problems faced by the construction industry. This project is a study or research to approach and analysis to avoid and control the time delay in construction in India.

This research will review delay factors through literature review and schedule through Primavera. To carry out this research, comprehensive literature review is done to provide the background, history and delay factors of project management in construction. The information of literature review will be used for planning and scheduling and will be a great support to the planning department to control the delay in constructions.

**Keywords:** Planning, Scheduling, and Tracking, Project Planning Software: Primavera.

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### 1. INTRODUCTION

In today's competitive global economy, virtually all organizations are project-based, whether they are governmental, industrial or commercial ones, these organizations supply products or services intended to satisfy the needs and requirements of their clients by applying the principles and methodologies of project management to implement their projects. In the project management, the main components are Planning, Scheduling, and Control.

#### 1.1 Planning

A process during which efforts and decisions are made to achieve the goals at the desired time in the desired way. Construction project planning is a method of determining "What" is going to be done, "How" things are going to be done, "Who" will be doing activities and "How much" activities will cost. In this sense, planning does not cover scheduling, which addresses the "When", but once planning is complete scheduling can be done. Objectives of a construction project are

- To complete the construction work within the specified duration.
- To complete it within the budget assigned for the project.
- To complete the construction with technical and administrative specifications.

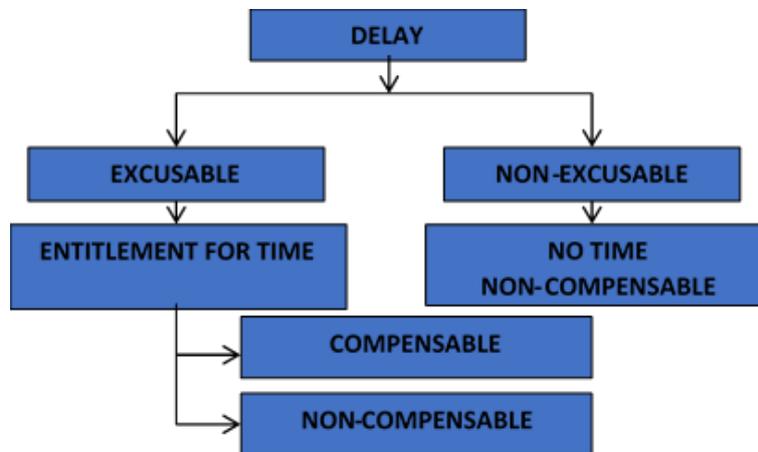
### 1.2 Scheduling

Scheduling is just one of the many tools available to project managers during the planning stages of a project. However, it may be one of the most important because it both lowers chance of delay and assists in recovering from delay, resolving responsibility. Indeed, delays often result simply from poor planning. Scheduling assists in reasoning about a huge number of details, and determines a lot of things, including expenditure estimates for crews and materials, expected opening dates, scheduling changes with sufficient flexibility to not affect the completion date, and others.

A schedule is also a good communication tool, between the managers, the owners, investors, and the public. Schedules give an overall sense of the project's expected progress. Without schedules, it is much more difficult to explain to someone unfamiliar with the project what is expected to take place.

### 1.3 DELAYS

Owners and contractors have one common objective to complete the project on time and within budget. It is a failure of this objective of time, which leads to failure of Budget and ultimately gives rise to disputes. "Time" is indicated invariably as of essence to the contract. There are circumstances compelling extension of time, which is granted but time does mean money. It is when the question of money as compensation comes up there comes up several disputes. Often owners pre-estimate their delay losses and name a sum recoverable from the contractor to meet delay damages. This provision is called "Liquidated Damages" for the delay. Contractors do not find any such clause on their side and are made to dispute their claims. The general types of delay in a construction project are shown in the Figure.



## 2. OBJECTIVES

The basic purpose of initiating a project is to accomplish some goals. The aim of the research is to improve project management performance in the construction industry in India. The objectives of the research are:

- To investigate the delay factors in the construction industry in India by revealing some problems affecting construction project performance.
- To determine general causes of construction delays through a literature survey,
- To improve planning strategy and control the delay factor by using smart Current programming software packages like Primavera.

## 3. METHODOLOGY

The study was designed to apply the most appropriate process to control the time delay on the case study project. At first, a literature survey was carried out on pertinent topics based on theses, books in libraries, scientific papers, articles and web sources. This literature survey was carried out on construction time delays, causes of time delays, their types, and time delay analysis techniques and was used to understand the difference between the concepts of project planning and project scheduling, and to determine the objectives of monitoring and tracking.

- Data collected from the construction site.
- Study and analysis of the data to fetch quantifiable results.
- Planning and scheduling using Primavera software.
- Establish reasons of delay of the project.

## 4. LITERATURE REVIEW

1. Divya. R, S. Ramya (2015) The causes, effects, and minimisation of construction delays were ranked by using the relative important index. The top affecting causes of delays category wise are late in revising and approving design documents by owner, ineffective planning and scheduling by contractor, mistakes, and discrepancies in design documents by a consultant, changes in material types and late procurement of materials, equipment breakdowns, personal conflict among labours, and rise

in prices of materials. When the causes were ranked overall, the main causes for delay are ineffective planning and scheduling by the contractor, the rise in prices of materials, late in revising and approving design documents by owner.

2. **Dr. D. K. Choudhury (2014)** identified and considered the project management models and project management information systems developed by researchers. Based on researchers' recommendation, the criteria for assessing the quality of the PMIS followed by NTPC was done and the study reveals that the employees of NTPC strongly feel that their PMIS is very effective and successful for implementation of projects.
3. **Pratik Vinod Salanke and Mohamed El-Gafy (2013)** Delays in construction projects are inevitable and could be a tribute to the inherently inaccurate nature of construction schedules. Currently, no mechanisms exist to capture the uncertainty in a schedule, except experience, historical data, and professional judgment. This paper presents a new risk analysis model, based on Bayesian Belief Networks (BBN), to estimate the likelihood of schedule delay resulting from different risk factors.
4. **Mubarak (2005)** states that project planning works for several functions such as cost estimating, scheduling, project control, safety management, etc. According to Arıkan and Dikmen (2004), the main purpose of planning is to provide the primary duties of the manager, namely, direction and control. The second objective of planning is to organize all the relationships and information systems among the many parties involved in the construction project. The authors further describe the third function of planning as enabling project control and forecasting.
5. **ARIKAN AND DIKMEN (2004)** give the definition of planning as "Trying to anticipate what will happen and devise ways of achieving the set of objectives and targets"; and point out that in planning concept there are always objectives to be reached in future. The authors describe planning as "a process during which efforts and decisions are made to achieve the goals at the desired time in the desired way.
6. **Oberlender (2000)** claims that a successful project planning is more difficult to organize than scheduling. If the activities are identified in project planning, then scheduling the project will become relatively easy.
7. **Faridi and El-Sayegh (2006)**, significant factors causing construction delays in the United Arab Emirates (UAE) were analysed. This research has determined the top ten most significant causes of construction delays.

## 5. PROJECT DETAIL

EMCO Energy Warora Power Project is a 600-megawatt (MW) coal plant in Maharashtra, India. The power station is near Warora, Maharashtra. It was originally operated by EMCO Energy, a subsidiary of the GMR Group. It has two 300 MW units  
Location: Warora Growth Center village, Chandrapur district, Maharashtra

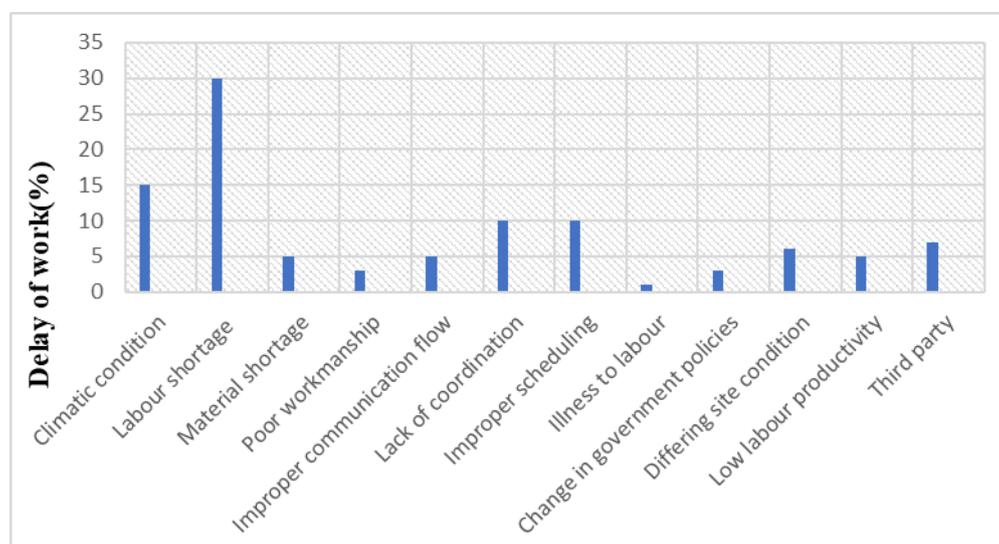
Sponsor: GMR Group

Coordinates: 20.2796562, 78.9753512 (exact)

Status: Operating

## 6. RESULT

**PERCENTAGE OF DELAY OF WORK :** The percentage of delay of work is prepared with causes of delay of work. There are many reasons for the delay of work in the project. The percentage of delay of work is calculated according to the delay of work due to the reasons like climatic condition, labour shortage etc. the percentage of delay of work due to the causes of delay is shown in Figure



		Activity Name	Original Duration	Actual Duration	Start	Finish	Activity % Complete
			505	524	01-Oct-15 A	14-Mar-17 A	
<b>GENERAL</b>			117	149	01-Oct-15 A	29-Feb-16 A	
	G1	LOI RECEIVED	1	1	01-Oct-15 A	01-Oct-15 A	100%
	G2	KICK OFF MEETING	1	1	09-Oct-15 A	09-Oct-15 A	100%
	G3	SITE SET UP INCLUDING ALL TEMPORARY INFRASTRUCTURE	103	122	29-Oct-15 A	29-Feb-16 A	100%
	G4	P&M AND LABOUR MOBILISATION	100	102	05-Nov-15 A	16-Feb-16 A	100%
<b>UNIT 1</b>			386	391	01-Oct-15 A	31-Oct-16 A	
<b>BOILER FOUNDATION</b>			182	182	15-Oct-15 A	14-Apr-16 A	
	B1	AFC DRAWINGS ISSUED BY GMR	37	37	15-Oct-15 A	20-Nov-15 A	100%
	B2	EXCAVATION	87	94	25-Nov-15 A	27-Feb-16 A	100%
	B3	PCC	55	55	15-Dec-15 A	09-Feb-16 A	100%
	B4	SHUTTERING / REBAR	59	59	20-Dec-15 A	18-Feb-16 A	100%
	B5	CONCRETING	48	48	27-Feb-16 A	14-Apr-16 A	100%
	B6	BACKFILLING	11	11	19-Feb-16 A	01-Mar-16 A	100%
	B7	BOILER-HANDOVER TO GMR	1	1	01-Mar-16 A	01-Mar-16 A	100%
<b>TG BUILDING FOUNDATION</b>			157	163	02-Nov-15 A	14-Apr-16 A	
	TG1	AFC DRAWING ISSUED BY GMR	57	57	02-Nov-15 A	28-Dec-15 A	100%
	TG2	EXCAVATION WORK	67	72	11-Jan-16 A	24-Mar-16 A	100%
	TG3	PCC	67	67	25-Jan-16 A	01-Apr-16 A	100%
	TG4	SHUTTERING / REBAR	61	66	08-Feb-16 A	14-Apr-16 A	100%
	TG5	CONCRETING	53	55	12-Feb-16 A	07-Apr-16 A	100%
	TG6	BACKFILLING & COMPACTION	37	39	02-Mar-16 A	10-Apr-16 A	100%
<b>CW PIT</b>			79	79	01-Oct-15 A	19-Dec-15 A	
	CW1	AFC DRAWINGS ISSUED BY GMR	1	3	01-Oct-15 A	05-Oct-15 A	100%
	CW2	EXCAVATION WORK	17	19	08-Oct-15 A	28-Oct-15 A	100%
	CW3	PCC	10	13	25-Oct-15 A	07-Nov-15 A	100%
	CW4	SHUTTERING / REBAR	27	27	04-Nov-15 A	30-Nov-15 A	100%
	CW5	CONCRETING	23	23	13-Nov-15 A	06-Dec-15 A	100%
	CW6	BACKFILLING & COMPACTION	13	13	06-Dec-15 A	19-Dec-15 A	100%

UNIT 2						
Activity ID	Activity Name	Original Duration	Actual Duration	Start	Finish	Activity % Complete
BOILER FOUNDATION		141	141	06-Dec-15 A	26-Apr-16 A	
BF1	AFC DRAWINGS ISSUED BY GMR	33	33	06-Dec-15 A	08-Jan-16 A	100%
BF2	EXCAVATION	30	33	26-Feb-16 A	31-Mar-16 A	100%
BF3	PCC	40	33	16-Mar-16 A	18-Apr-16 A	100%
BF4	SHUT TERING/ REBAR	47	47	09-Mar-16 A	24-Apr-16 A	100%
BF5	CONCRETING	43	41	16-Mar-16 A	26-Apr-16 A	100%
BF6	BACKFILLING	20	20	23-Mar-16 A	11-Apr-16 A	100%
BF7	HANDOVER TO GMR	1	1	12-Apr-16 A	12-Apr-16 A	100%
ESP FOUNDATION		119	122	06-Nov-15 A	07-Mar-16 A	
ESPF1	AFC DRAWINGS ISSUED BY GMR	1	1	06-Nov-15 A	06-Nov-15 A	100%

RCC MULTIFLUE CHIMNEY PACKAGE FOR 2X300 MW		Original Duration	Actual Duration	Start	Finish	Activity % Complete
		505	511	01-Oct-15 A	28-Feb-17 A	
GENERAL		78	78	01-Oct-15 A	18-Dec-15 A	
GEN1	LOI RECEIVED	78	78	01-Oct-15 A	18-Dec-15 A	100%
GEN2	SITE SETUP/ MOBILISATION / INFRASTRUCTURE FACILITIES	3	23	29-Oct-15 A	20-Nov-15 A	100%
CONTRACTUAL MILESTONES		393	393	01-Oct-15 A	02-Nov-16 A	
CON1	FOUNDATION COMPLETE	0	0	09-Jan-16 A	09-Jan-16 A	100%
CON2	SHELL COMPLETE	0	0	01-Aug-16 A	01-Aug-16 A	100%
CON3	STRUCTURAL PLATFORM & FLUE ERECTION	0	2	13-Aug-16 A	16-Aug-16 A	100%
CON4	COMPLETION OF BOTH FLUES WITH FINISHING WORK	0	0	02-Nov-16 A	02-Nov-16 A	100%
CON5	TAKEOVER AND FINAL ACCEPTANCE	0	0	01-Oct-15 A	01-Oct-15 A	100%

### CONCLUSION

By analysing the planning, scheduling, and control of the project, following observations were made.

- The master schedule of the site has been analysed and the schedule has been updated up to the completion of the project.
- From the updated schedule, delays have been identified and the causes for the delays such as climatic conditions, labour shortage and equipment shortage, material shortage, poor workmanship, improper communication flow, lack of coordination, improper scheduling, illness of labour, low labour productivity, third party, differing site condition have been assessed being the prime reasons for delay.
- From the bar chart of the percentage of delay of work, as the maximum of 30% of delay of work is due to a labour shortage, 15% of delay of work is due to climatic condition and as the minimum of 3% of delay of work is due to poor workmanship have been identified.
- The effects due to the delays, increase in the days of the project have been analyzed. From the increase in a number of days in the activity chart, the scheduled number of days for the activities like site mobilisation, excavation, material, column and slab casting, finishing work, etc. got delayed.
- The scheduled number of days of the construction was 505 days. Due to the delay, the number of days has increased to 524 days.

- To reduce the delay of the project the master schedule of the project has been rescheduled with an excess of working hours, with holidays, with resource required for that project, with the update of work till the last stage of the project.

Several effects will happen when delay work is there. The delays will affect mainly the cost and time of the project. Some effects in the project due to delay are

- Time over run in the project i.e. the scheduled time to finish the project is 505 days. But the actual duration is around 524 days.
- The cost of the project has been increased slightly due to the delay in the project.
- The direct cost and indirect cost of the project increased.
- The direct cost such as construction materials, construction equipment's, and manpower wages have been increased.
- 

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