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Planning, Scheduling and Delay Analysis of Construction Project

Authors
Neeraj Kumar[1], Raju Ratne[2], Vansh Chauhan[3]
[1]Student, Department of Civil Engineering, Pad. Dr. D. Y. Patil Institute of Engineering & Technology Pune, Maharashtra, India
Email: *anil21ashu@gmail.com*
[2]Student, Department of Civil Engineering, Pad. Dr. D. Y. Patil Institute of Engineering & Technology Pune, Maharashtra, India
Email: *rajuratne@gmail.com*
[3]Student, Department of Civil Engineering, Pad. Dr. D. Y. Patil Institute of Engineering & Technology Pune, Maharashtra, India
Email: *vanshchauhan013@gmail.com*

Abstract
Construction planning and scheduling is an important tool in a construction project. In every construction project a lot of activities are involved which need to be planned and scheduled properly to ensure the successful completion of the project. Therefore the study on construction planning and scheduling is important so as to provide a view on how it is to be implemented on construction project. This paper consists of study on the concept of planning and scheduling of various activities associated with building construction project. Also study of project management software (MSP) is done. To find out total project duration and critical path planning and scheduling technique is to be used. From the results of planning and scheduling delays that occur in the project are analyzed. In the next step controlling technique is for optimization of the completion time of the project.
Keywords: *Planning, Scheduling, Microsoft Project (MSP), Delay.*

Introduction

India is one of the developing country which is still concentrating in the development of the new buildings and at the same time maintaining all existing buildings. The government is spending a lot of money for the new infrastructure works especially the infrastructure that will provide the public facilities such as hospital, university and low cost housing project. With this opportunity it will cause the increasing number of new construction company. At the same time multinational companies are looking forward in exploring the construction project around Asian nation especially India. (2)

By looking for the expenditure of the constructions industry, the project management profession is being very valuable for the construction companies in order to make sure the project that currently running can be completed successfully. The project management becomes the critical part in the project because it contains the knowledge in controlling the cost, scheduling, and resources. In this project management field, project manager plays very important role in the construction project. Project manager is responsible personnel to ensure the project complete successfully thus it are important for the project manager to have experience and knowledge in project management technique (2).

Due to an increasingly competitive environment, construction companies are forced to be more efficient and achieve competitive operational advantage. Companies are always looking for improvements in equipment features, communication tools, efficient management techniques, and training human resources. Construction companies are also narrowing their focus, becoming specialists in certain types of construction projects. This specialization requires

more focused project planning and controlling techniques that prove to be better for certain type of projects while providing specialized construction services. The benefits of effective planning, scheduling and control of construction projects are: reduced construction time, reduced cost overruns and the minimization of disputes [6].

Methodology

Project management is the process and activity of planning, organizing, motivating, and controlling resources and procedures to achieve specific goals in scientific or daily problems. There are various methods for planning and scheduling such as bar charts, Line of balance technique (LOB), and advanced techniques such as Microsoft Project, PRIMAVERA. In the present study Microsoft Project has been used for planning and scheduling and for delay analysis As Planned vs. As Built technique has been used. Various data has been collected in the form of bar charts and drawings from site. The bar charts are converted into network by MSP and critical path is found out. For delay analysis monthly progress reports from the site engineer were collected and the actual progress of critical activities was compared with the planned schedule. Various causes of delays were studied and their classification was done.

Case Study

In this paper case study of Industrial Building near Chakan has been done.

Table 1: Site Information

Type of building	Industrial Building
Total built-up area	22000 sq. ft.
Number of floors	3
Estimated duration	6 Months
Completed work	60%
Increase in time	25 Days

Table 2: As planned critical activities

Sr. No	Task Name	Duration
1	Excavation for grid 71	1
2	Excavation for grid 73	1
3	Filling in grid 73	1
4	Filling in plinth Upto level 101	4
5	Balance filling	2
6	PCC or plum concrete grid 73	2
7	Footing concrete in grid 73	1
8	Stub column concrete grid 73	2
9	Lift shaft raft	1
10	LIFT WALL 1st floor	2
11	Plinth beam PCC	1
12	Plinth beam concrete	10
13	Floor metalling	2
14	Floor PCC	2
15	Column concrete Upto first floor	4
16	Beam bottom shuttering first floor	3
17	Slab shuttering first floor	6
18	Reinforcement work first floor	6
19	Slab casting first floor	1
20	Column concrete 2nd floor	4
21	Beam bottom shuttering 2nd floor	3
22	Slab shuttering 2nd floor	6
23	Reinforcement work 2nd floor	6
24	Slab casting 2nd floor	1
25	BBM Upto lintel level first floor	5
26	Lintel chajja & balance bbm first floor	3
27	BBM up to lintel level 2nd floor	5
28	Lintel chajja & balance BBM 2nd floor	3
29	BBM up to lintel level 3rd floor	5
30	Lintel chajja & balance BBM 3rd floor	3
31	BBM up to lintel level 4th floor	5
32	Lintel chajja & balance BBM 4th floor	3
33	Internal plaster	7
34	External plaster east side	7
35	External plaster west side	7
36	External plaster south side	7
37	External plaster north side	7
38	Toilet - flooring & dados	15
39	Sanitation and plumbing	7

Table 3: As Built critical activities

Sr. No	Task Name	Duration
1	Excavation for grid 71	1
2	Excavation for grid 73	2
3	Filling in grid 73	1
4	Filling in plinth Upto level 101	4
5	Balance filling	3
6	PCC or plum concrete grid 73	2
7	Footing concrete in grid 73	3
8	Stub column concrete grid 73	3
9	Plinth beam PCC	1
10	Plinth beam concrete	12
11	Floor metalling	2

12	Floor PCC	2
13	Column concrete Upto first floor	6
14	Beam bottom shuttering first floor	4
15	Slab shuttering first floor	8
16	Reinforcement work first floor	6
17	Slab casting first floor	1
18	Column concrete 2nd floor	5
19	Beam bottom shuttering 2nd floor	4
20	Slab shuttering 2nd floor	6
21	Reinforcement work 2nd floor	6
22	Slab casting 2nd floor	1
23	BBM Upto lintel level first Floor	8
24	Lintel chajja & balance BBM first floor	3
25	BBM Upto lintel level 2nd floor	6
26	Lintel chajja & balance BBM 2nd floor	4
27	BBM Upto lintel level 3rd floor	5
28	Lintel chajja & balance BBM 3rd floor	3
29	BBM Upto lintel level 4th floor	6
30	Lintel chajja & balance BBM 4th floor	3
31	Internal plaster	9
32	External plaster east side	7
33	External plaster west side	7
34	External plaster south side	8
35	External plaster north side	9
36	Toilet - flooring & dados	15
37	Sanitation and plumbing	7

Observation

From the present study delay analysis of critical activities has been found out with their causes.

Table 4: Delay events that affected the project duration

SN	Task Name	Delay	Delay Information	
			Description	Type
1	Excavation for grid 73	1	Contractor encountered unforeseen adverse ground condition during excavation	NN
2	Balance filling	1	Delay in compaction, material unavailability.	EC
3	Footing concrete in grid 73	2	Delay in installation of dewatering system.	NN
4	Stub column concrete grid 73	1	Low productivity of labour.	NN
5	Lift wall 1 st floor	1	Construction mistake and Defective Work.	NN
6	Plinth beam concrete	2	Unavailability of labour on time.	NN
7	Column concrete Upto first floor	2	Shuttering problem.	NN
8	Beam bottom shuttering first floor	1	Delay due to unavailability of skilled labours at site	NN
9	Reinforceme nt work first floor	2	Delay in placing of steel in position.	NN
10	Column concrete 2nd floor	1	Shuttering problem.	NN
11	Beam bottom shuttering 2nd floor	1	Delay due to unavailability of skilled labours at site.	NN
12	BBM Upto lintel level first floor	3	Financial problem	EC
13	Lintel chajja & balance BBM 3rd floor	1	Change in thickness of lintel.	EC
14	BBM Upto lintel level 4th floor	1	Delay in supply of bricks by brick supplier.	NN
15	Internal plaster	2	Defective brickwork so to give proper surface finish more quantity of plastering was needed.	NN
16	External plaster south side	1	Delay in erection of scaffolding	NN
17	External plaster north side	2	Delay in erection of scaffolding	NN

Note:

Non-excusable delays (NN)

Basically, these delays are caused by contractors or subcontractors or materials suppliers, through no fault of the owner. The contractor might be entitled to compensation from the delaying subcontractor or supplier, but no compensation is due from the owner. Therefore, non-compensable delays usually result in no additional money and no additional time being granted to the contractor. (3)

Compensable delays (EC)

Compensable delays are those that are generally caused by the owner or its agents. The most common form of compensable delay is inadequate drawings and specifications, but compensable delays can also arise from the owner's failure to respond in a timely fashion to requests for information or shop drawings, owner's changes in design or materials, and owner's disruption and/or change in the sequence of the work. The contractor is entitled to both additional money and additional time resulting from compensable delays. (3)

Result and Discussion

In the data analysis by using MSP, network is found out by CPM. From the network total scheduled duration of project is 153 days. After delay analysis total delay in the project comes out to 25 days, due to which the total duration exceeds to 178 days. The maximum delay occurred in the activity burnt brick masonry upto lintel level first floor which is 3 days. The results of delay analysis by as built vs. as planned technique is given in following table.

Sum of contractor-caused delays (NN)	20 Days
Sum of owner-caused delays (EC)	5 Days
Concurrent delay due to both parties (Minimum of NN and EC)	5 Days
Project delays for which the owner is responsible (NN-EC)	15 Days

Conclusion

From the present study it may be concluded that MSP is better than conventional methods as interdependence of the various activities can be easily shown absolute clearly and sequence of activities is clear, it gives optimum duration of the project and it is possible to locate critical activities. Critical activities play a major role in controlling the project. As built vs. as planned method may be efficient for doing delay analysis. After delay analysis new critical path is obtained which can be used for controlling the remaining project work.

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