International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 07 | July 2020 www.irjet.net p-ISSN: 2395-0072

Planning, Scheduling and Delay Analysis of a Healthcare and an Infrastructure Construction Projects

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Abstract - *Project Scheduling and delay analysis became an important part of any project for completion of the project among the planned time and cost. In this project an attempt is created in scheduling varied activities and delay analysis of factors concerned in a Healthcare and bridge infrastructure construction project in Tirur, Malappuram district, Kerala by using Primavera and SPSS Softwares. Here Primavera P6 software helps the planning, scheduling, Budgeting and time management of projects. To identifying the major causes of delays in projects (bridge and hospital) questionnaire surveys were conducted. Then the causes of delay assessed using Relative Importance Index (RII) and SPSS software so as to rank the factors and produce graphical representations. The results also include the most effective methods for minimizing construction delays.*

Key Words: Planning, Scheduling, Primavera, Delay analysis, Relative Importance Index, SPSS, Causes of delay

1. INTRODUCTION

Time management is important in construction because it organizes the allotted time set for the completion of the task for the purpose of meeting or beating the deadline.. Planning and scheduling of construction activities helps to complete the project in time and within the budget. Primavera Project Planner P6, a product from Oracle is a very powerful tool that helps in planning, scheduling and controlling of projects very efficiently. Delay in a construction project can be defined as the late completion of works as compared to the planned schedule or contract schedule. For further delay analysis, SPSS is the most user friendly and preferred quantitative data analysis software even if there are several others available in the market

In the present study Oracle Primavera P6 has been used for planning and scheduling and for delay analysis IBM SPSS Software. Various data has been collected in the form of reports and drawings from site. The datas are converted into schedules and Gantt chart using Primavera. Factors causing delays and to rectify delays are gathered from Literature studies and sorted out using Relative Important Index (RII) technique. Filtered factors are further used in the delay analysis by SPSS.

2. METHODOLOGY

- Literature and Data study: Maximum Collection and study of Literatures and project data along with the site visits.
- Planning and Scheduling: Detailed study of Primavera software. Planning and scheduling of project activities in Primavera resulting in the generation of final reports and Gantt charts
- Questionnaire Survey: From literature survey possible factors for the questionnaire are selected. Questionnaires are produced to different construction personnel for further filteration.
- Factor Analysis: From the questionnaire responses, using RII technique major factors are categorized .Further analysis is carried out in SPSS software and Bar charts are created.

2.1 Collection of project data

Initially all the relevant data has been collected like a Drawings, Specifications, quantities, photographs, etc.

2.2 Primavera

Oracle's Primavera P6 is the globally accessible and world's fastest, powerful, user friendly, easy to use robust and software application which is used to manage projects, programmes and port folios. Prioritizing, Managing, Scheduling, Planning can be done in favour of the globally located projects. It provides single solution to manage alter and update the project of any scale.

Steps involved

- Creating EPS
- Creating New project
- Creating WBS
- Creating Calendar
- Defining Activities
- Assigning relationships between activities
- Activity durations ,dates and milestones
- Creating Baseline and Gantt chart

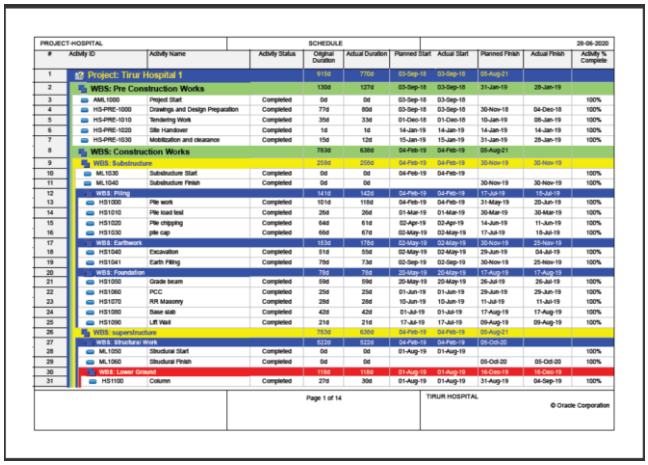

FIG -1: Activity sheet of Healthcare Building

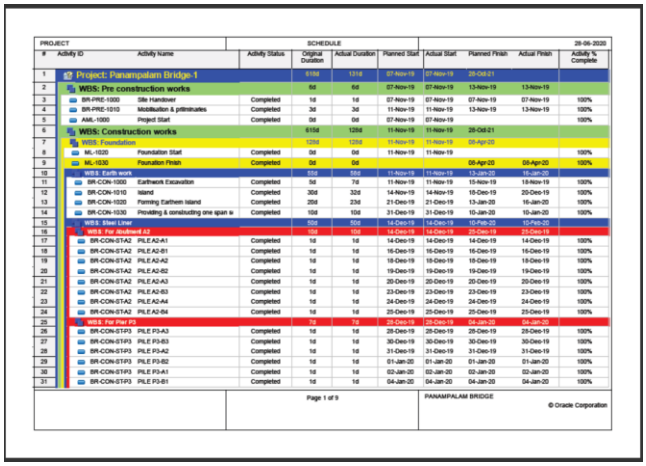

FIG -2: Activity sheet of Bridge

2.3 Questionnaire survey

A questionnaire is an analysing instrument consisting of a set of questions for the purpose of collecting information from the respondents. Analysis was employed using four point Likert scale and the weight is given as below:
0 – No effect, 1 – Low effect 2, – Medium effect, 3– High effect

The factors of causes for delays collected were distributed in the form of questionnaire to 33 officials. Further, opinions were obtained from different construction officials of total 21 respondents. Out of 22 factors selected from literature survey and considered for the questionnaire survey, 10 factors ranked high are extracted and tabulated after analysis using RII method.

2.4 Relative Importance Index Technique (RII)

Relative Importance Index method to find out importance of the various causes of delay of the project.
RII = ΣW / (A*N)

Where, W represents the weightage provided by the respondents to each factor (ranging from 0 to 3), A represents highest impact value (i.e. in this case, 3), and N represents respondents number. The value of RII ranges from 0 to 3, higher the range value of RII, more importance for the causes of delays.

DELAY FACTORS OF HOSPITAL BUILDING	RII	RANK
Shortage of labours	0.86	1
Delay in payments	0.83	2
Act of god	0.83	3
Materials and equipment nonavailability	0.76	4
Improper planning and scheduling	0.76	5
Poor communication between different bodies	0.75	6
Design changes and errors	0.73	7
Increase in land cost and acquisition	0.73	8
Project size or phase	0.71	9
Cost escalation	0.7	10

Table -1: List of identified top ten important Hospital delay factors

DELAY FACTORS OF BRIDGE	RII	RANK
Terrain conditions	0.92	1
Act of god	0.87	2
Design errors and changes	0.84	3
Parameters of bridge	0.74	4
Delays in shifting utilities	0.83	5
Increase in land cost and acquisition	0.79	6
Quantity increase due to actual site condition	0.75	7
Non availability of materials	0.75	8
Payment delays	0.75	9
Drainage problem	0.68	10

Table -2: List of identified top ten important Bridge delay factors

FACTORS TO MINIMISE DELAY	RII	RANK
Effective Preconstruction planning	0.89	1
Capable project manager	0.87	2
Accurate initial costs Estimates	0.87	3
Adequate and available source of finance	0.79	4
competent project team	0.79	5
Use of proper and modern equipment	0.78	6
Proper project planning and scheduling	0.75	7
Use of appropriate construction methods	0.71	8
Use of experienced subcontractors and suppliers	0.70	9
Site management and supervision	0.70	10

Table -3: List of identified top ten important delay control factors

2.5 SPSS

SPSS statistics is a software package used for logical batched and non-batched statistical analysis. This software is one of the most popular statistical packages which can perform highly complex data manipulation and analysis with simple instructions. SPSS can take data from almost any type of file and use them to generate tabulated reports, charts and plots of distributions and trends, descriptive statistics and conduct complex statistical analyses. This packages of program is available for both personal and mainframe computers.

3. RESULTS AND DISCUSSIONS

3.1 Planning and Scheduling

In this Project, planning and scheduling were done using primavera in which the deviations in time duration for completed activities from actual duration of the projects were achieved and assessed. Hence we can control the project in terms of duration which leads to cost optimization.

Fig. 4 & Fig.5 shows the Gantt charts with activities linked in primavera

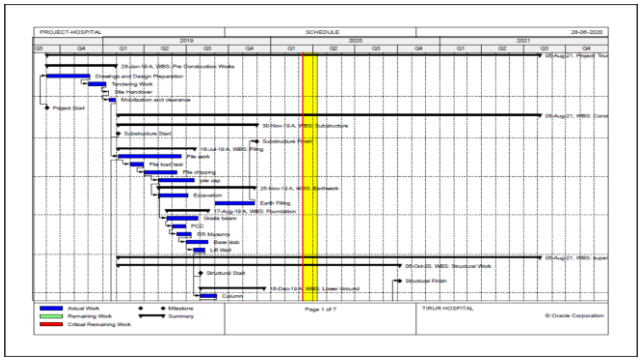

FIG -3: Gantt chart of Healthcare project activities

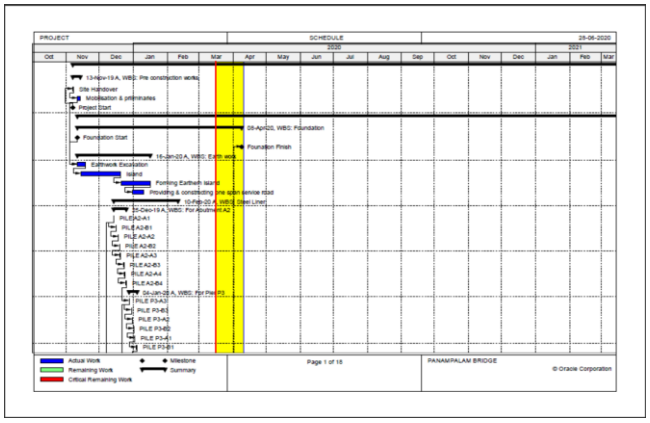

FIG -4: Gantt chart of Bridge project activities

3.2 Factor analysis

Using SPSS software factors causing delays are analysed, Ranked and graphically represented with the help of Barcharts. Also Effective common factors to minimise delays in construction are also analysed and ranked

3.2.1 Healthcare Building

FACTORS	Low Effect (L*1)	Medium Effect (M*2)	High Effect (H*3)	Total	Total No (N)	A*N	RII	RANK
Shortage of labour	0	18	36	54	21	63	0.86	1
Delay of payments	3	10	39	52	21	63	0.83	2
Act of god	0	22	30	52	21	63	0.83	3
Material and equipment nonavailability	4	14	30	48	21	63	0.76	4
Improper planning and scheduling	3	18	27	48	21	63	0.76	5
Poor communication	4	16	27	47	21	63	0.75	6
Design change and errors	5	14	27	46	21	63	0.73	7
Increase in land cost and acquisition	5	14	27	46	21	63	0.73	8
Project size or Phase	3	24	18	45	21	63	0.71	9
Cost escalation	6	14	24	44	21	63	0.70	10

Table -4: Delay factors of Healthcare construction using RII

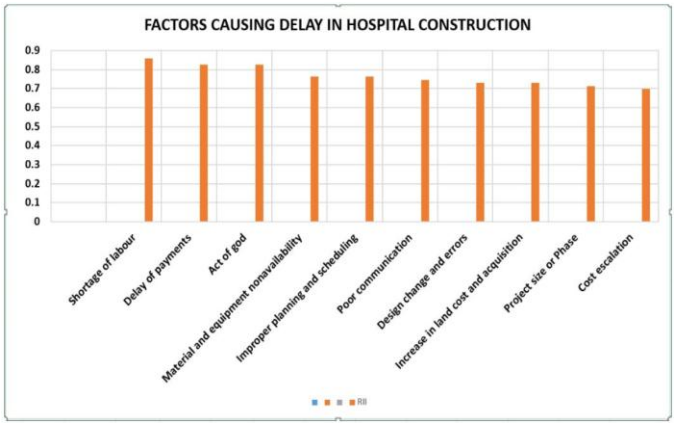

FIG -5: Bar chart of Delay factors of Healthcare v/s RII

3.2.2 Bridge

FACTORS	Low Effect	edium Effe	High Effect	Total	Total No	A*N	RII	RANK
	(L*1)	(M*2)	(H*3)		(N)			
Terrain conditions	0	10	48	58	21	63	0.92	1
Act of god	2	8	45	55	21	63	0.87	2
Design change and errors	1	16	36	53	21	63	0.84	3
Parameters of bridge	2	24	27	53	21	63	0.84	4
Delay in shifting utilities	2	20	30	52	21	63	0.83	5
Increase in land costs	3	14	33	50	21	63	0.79	6
Quantity increase due to actual site conditions	3	20	24	47	21	63	0.75	7
Non availability of materials	5	24	18	47	21	63	0.75	8
Delay in payments	6	26	15	47	21	63	0.75	9
Drainage problem	3	16	24	43	21	63	0.68	10

Table -5: Delay factors of Bridge construction using RII

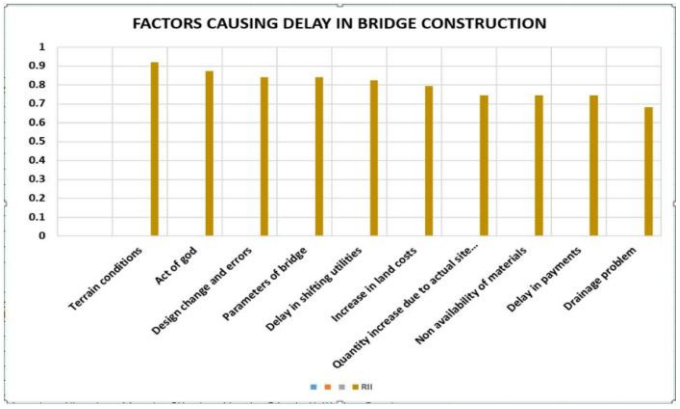

FIG -6: Bar chart of Delay factors of Bridge v/s RII

3.2.3 Delay control

FACTORS	Low Effect	Medium Effect	High Effect	Total	Total No	A*N	RII	RANK
	(L*1)	(M*2)	(H*3)		(N)			
Effective Preconstruction planning	2	6	48	56	21	63	0.89	1
Capable project manager	2	8	45	55	21	63	0.87	2
Accurate initial cost estimates	1	12	42	55	21	63	0.87	3
Adequate and available financial source	2	18	30	50	21	63	0.79	4
Competent project team	2	18	30	50	21	63	0.79	5
Use Proper modern equipments	3	16	30	49	21	63	0.78	6
Proper project planning and scheduling	3	20	24	47	21	63	0.75	7
Use appropriate construction methods	3	24	18	45	21	63	0.71	8
Use experienced subcontractors and suppliers	5	18	21	44	21	63	0.70	9
Site management and supervision	6	14	24	44	21	63	0.70	10

Table -6: Factors to minimise delays using RII

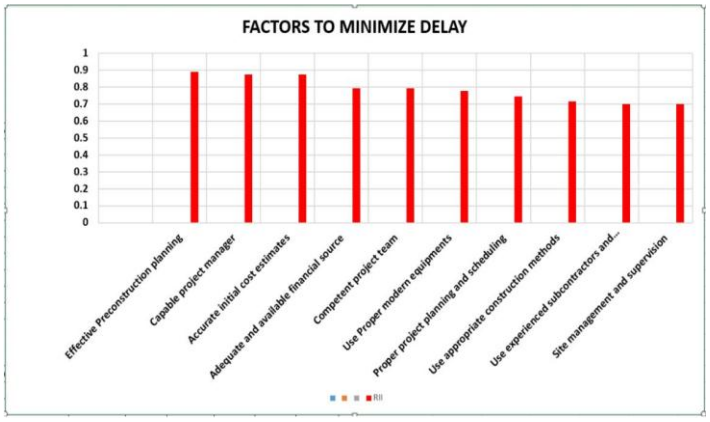

FIG -7: Bar chart of Factors to minimise delays v/s RII

4. CONCLUSIONS

Due to an increasing competitive environment, construction companies are focused to be more efficient and achieve competitive operational advantages. Companies are always looking for improvements in equipment features, communication tools, efficient management techniques, and training human resources. The benefits of effective planning, scheduling and controlling of construction project reduces construction time, cost over runs and minimizes the disputes. It also helps to avoid the construction interruption, keep the continuity of crew work, and avoid the delay of construction and cost.

Primavera P6 in a construction project helps to understand the roll of monitoring and control the progress and timely completion of a construction project. This objective was achieved through revision of literature and methodologies involved in monitoring and control. This project proves to be a guideline in understanding the progress of construction work.

To improve delay control in Healthcare and infrastructure construction projects, the influence of the main factors affecting it is identified and, based on the quantified relative importance indices, determined the influence ranks of 10 major factors causing delay in both construction projects. Methods to minimize or control delays in construction are also proposed for better management of construction projects.

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