

Construction Scheduling of Civil Engineering Structure Using Primavera Software

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Abstract

Planning and scheduling is very important to complete any project successfully. This graduation project discusses planning and scheduling techniques used for civil engineering projects. A construction project is selected as a case study to apply scheduling technique. A questionnaire is designed to collect information about project scheduling techniques. Eight interviews were conducted with experts to collect information about planning and scheduling practices in Saudi Arabia. Construction projects demand precise planning, scheduling and management of resources. Due to the increase in workloads, scheduling software is used as a tool for managing and organizing a project work. Primavera p6 is one of such software used for project planning and scheduling. Primavera p6 is used to prepare schedule of the case study project. Additionally, the collected data is analyzed by using Excel to investigate planning and scheduling practices in the Saudi construction industry. Relative importance index (RII) was calculated for all the items in the questionnaire. Interviews recorded has supported these results of the questionnaire survey thus validating the quantitative analysis. Project team was able to practice Primavera P6 to some extent on the case study project.

Problem Statement

Planning and scheduling are critical to maintain project performance in competitive situations where construction and infrastructure projects are taking place. To be more explicit, both processes must be addressed appropriately and efficiently for projects to accomplish their goals. Furthermore, because they involve the selection of the most appropriate techniques and tools, the definition and organization of a wide range of activities, and the estimation and allocation of the most cost-effective resource deployment, these processes are critical in the life cycle of construction projects. scheduling is time-cost oriented process and constitute a challenge to project managers and planners when managing their applications. Scheduling represents a significant task within project management. Construction organizations with dispersed projects need coordinated approaches to planning, scheduling, and control to complete a single or more projects successfully on time and within cost.

Objectives

The following are the objectives for this graduation project:

- Understand project planning and scheduling with emphasis on responsibilities of owner, designers/consultants and contractors. Get acquainted with construction scheduling software including Primavera P6 to apply it on the case study project.
- Prepare and finalize a survey questionnaire, collect information from owners, consultants, and contractors about construction scheduling, and analyze the collected data to determine scheduling practices on construction sites.
- Prepare a questionnaire to conduct interviews with planning engineers and managers to understand and address scheduling issues. Analyze the conducted interviews and document results.
- Study quantitative and qualitative data analysis techniques, perform data analysis of the collected data from the questionnaire survey and derive inferences.

Methodology

The data collection method for this study is based on a survey, which makes use of quantitative methods. This work is carried out in accordance with the steps shown in Figure 1.

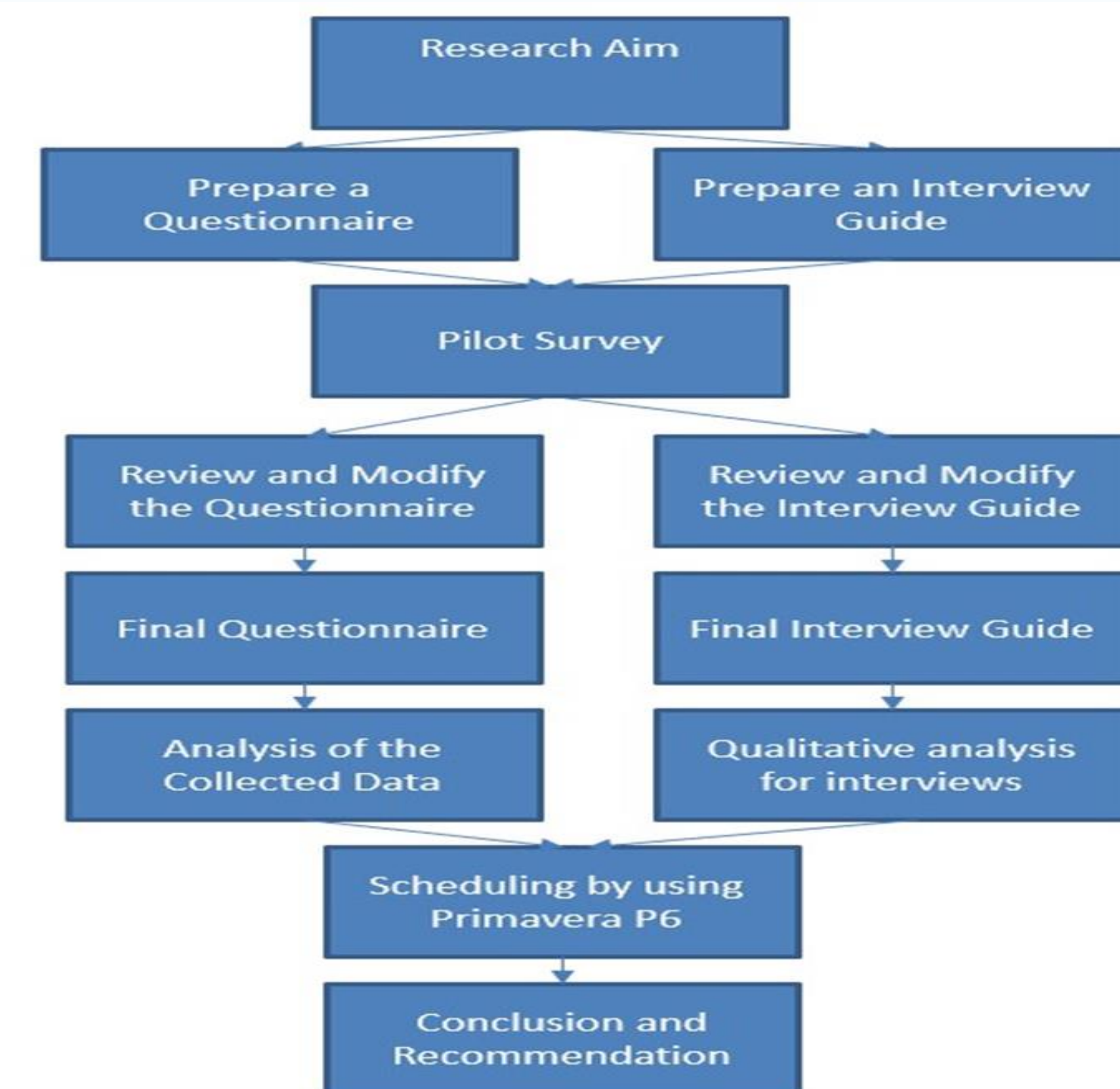


Figure 1. Research methodology flow chart

The questionnaire asks for general information and characteristics of the respondents. Main part of the questionnaire comprises on 17 questions related to the effectiveness of scheduling methods[1]. These 17 questions are designed on a 5-point Likert type scale (1= Strongly disagree, 2= Disagree, 3=Neither agree nor disagree, 4= Agree, and 5=Strongly agree) to facilitate statistical analysis of the responses. The final questionnaire is grouped into 4 domains as shown in Table 1.

Table 1. Categories of causes

Sr. No.	Domain	Number of Question
1	General Information	4 Entries (Name, Company, Telephone, Email)
2	Characteristics of respondents	4 Entries (Category, Position, Age, Experience)
3	Effectiveness of scheduling method	17 Questions
4	Overall schedule evaluation	1 Question

Collected data of the questionnaire was analyzed. Total number of valid respondents were 119. General information of the respondents was checked. Analysis indicates that 48% respondents were engineers, 23% were senior engineers, 13% were planning engineers and 16% were project managers in the data set (see Figure 2).

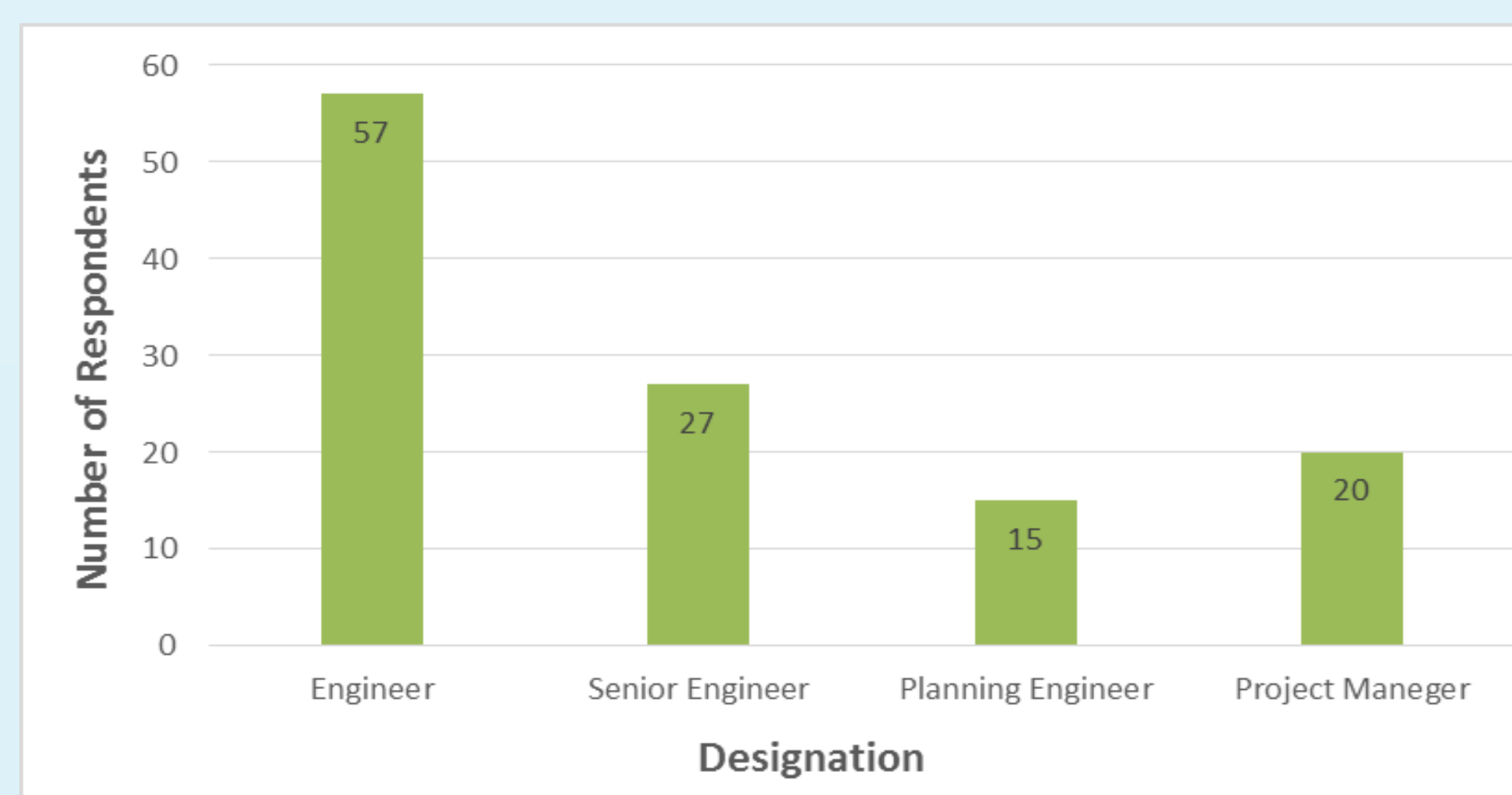


Figure 2. Experience or respondents

Results

Collected data from the questionnaire surveys were analyzed by using relative importance index (RII). The 17 questions of the questionnaire survey are ranked with respect to highest RII to the lowest. The results are shown in Table 2. The question comprises on effectiveness of scheduling methods. The Table 2 shows that "Required resources should be mobilized to complete the project according to the schedule." is ranked in the first position with highest (RII=0.711), "Accurate estimates of work tasks are necessary to avoid uncertainty in scheduling." is in the second highest ranked factor with (RII=0.676). Two factor were ranked at the 15th position and are "Planning and scheduling is a critical area in construction and in our company." and "My company uses bar charts or Gantt charts for scheduling." with (RII=0.603). The lowest ranked item is "My company uses primavera P6 software for scheduling." with (RII = 0.597).

Table 2. RII and ranking of causes

Sr. No.	Question.	RII	Rank
1	Planning and scheduling techniques are followed in my company.	0.607	14
2	Planning and scheduling is a critical area in construction and in our company.	0.603	15
3	My company uses Bar charts or Gantt charts for scheduling.	0.603	15
4	My company follow network scheduling and Critical Path Method.	0.618	13
5	We practice PERT (Program Evaluation and Review Technique), a probability-based schedule on our project or company.	0.635	9
6	My company uses primavera P6 software for scheduling.	0.597	17
7	Managers should have adequate understanding of planning and scheduling software.	0.629	10
8	Clients should have adequate understanding of planning and scheduling.	0.620	12
9	All constraints are properly identified in advance for updating the schedule	0.647	8
10	Project work needs to be broken down into activities for scheduling.	0.622	11
11	Realistic activity durations should be used in scheduling.	0.671	4
12	Well-defined WBS (work-breakdown structure) is essential to prepare a schedule.	0.672	3
13	Proper sequence, links and interrelationships between activities must be followed.	0.669	5
14	Critical path activities should be monitored and controlled.	0.664	7
15	Project milestone are fixed and monitored to follow the project schedule.	0.669	5
16	Accurate estimates of work tasks are necessary to avoid uncertainty in scheduling.	0.676	2
17	Required resources should be mobilized to complete the project according to the schedule.	0.711	1

An interview guide was used to conduct interviews in order to learn how to prepare a schedule using Primavera P6. The interview guide questions were written in such a way that responders can share their own narrative in their own style. Project managers and planning engineers' interviews were recorded. The grounded theory technique was used to analyze the interviews. In this graduation project, 8 interviews are conducted with experts who had experience of working with Primavera P6 software. Each student have conducted and analyzed 2 interviews. Table 3 shows results of the interviewees only for the selected 3 questions.

Table 3. Interviewee's response

Question	Interviewee's response
Please tell us about Critical Path Method.	The critical path is the path which is gives the completion date of the project. CPM is the technique that identify those activities which are on the critical path. From this method you will know the activities that cannot be delayed so that the project cannot be delayed.
Please comment on the importance of construction process awareness for preparing a project schedule.	The awareness of the construction process is very critical to project scheduler because if he know about the construction process then he can schedule the activities very effectively and he can estimate the resources that are required for activities of the project.
Please explain that how planning and scheduling is critical area in construction and in your company.	The planning and scheduling have most importance in the company. Therefore, every company needs to focus on two goals; first one is budget and the second is to do the task on time.

Results Cont'd

From the activities and their duration, the project team prepared schedule of the case study project. The project team prepared the WBS for the project separately for each section and floors. The case study project is comprising on a Commercial Tower having Multi Story Car Park. The main tower consists of 30 floors and the top 5 floors are of steel structure. The remaining 25 floors comprise on concrete structure. The Multi Story Car Park comprises on 11 levels including 3 levels of basement. SABB (Saudi Arabia British Bank) is the owner of the project. The Consultant is Arcadis (Hyder). ElSeif Engineering Contracting company is the contractor of the project. The project team prepare schedule of this case study project by using Primavera P6. Figure 3 shows the WBS of the commercial tower from Ground Floor to 26th Floor.

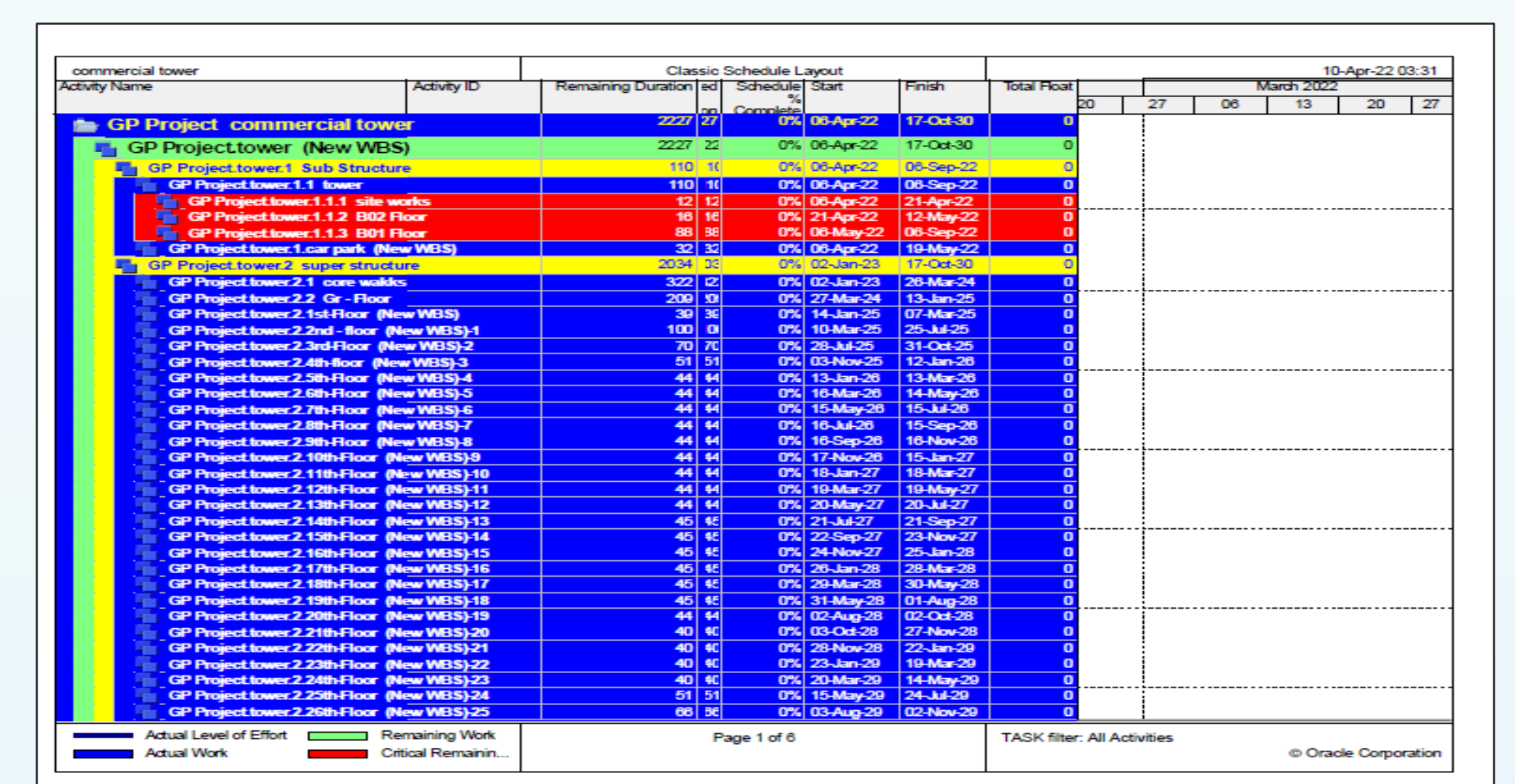


Figure 3 WBS for the case study project

Conclusion

This graduation project helped us to understand project planning and scheduling. In this project, 8 interviews were recorded to obtain opinion of Project Managers, Senior Engineers, Planning Engineers and Engineers. The conclusions of this study are the planning and scheduling are the most importance in any company. Every company needs to focus on two goals first one is the budget and the second is to do the tasks on time. milestone with project which determined with contract and BOQ. From BOQ you can determine productivity crates and the original durations. The critical path is the path that gives the completion date of the project. Critical Path Method (CPM) is a technique that identify those activities which are on the critical path. From this method you know the activities that cannot be delayed so that the project can be completed on time. The comparison between bar chart and network scheduling is that bar chart shows the project schedule in graphic representation, while network is a flow chart to show the sequence of the workflow. Items of the questionnaire surveys are analyzed and ranked by using relative importance index (RII). The 17 questions of the questionnaire survey are ranked with respect to highest RII to the lowest. The results are shown in Table 2.

Recommendations

- Required resources should be mobilized to complete the project according to the schedule.
- Accurate estimates of work tasks are necessary to avoid uncertainty in scheduling.
- Well-defined WBS (work-breakdown structure) is essential to prepare a schedule.
- Realistic activity durations should be used in scheduling.
- Proper sequence, links and interrelationships between activities must be followed.