PLANNING AND SCHEDULING
OF A HIGH RISE BUILDING USING PRIMAVERA

Submitted in fulfillment of the requirement of the degree of

Bachelor of Engineering

By

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Certificate

This to certify that Mr. Khan Muhammad Maaz Abdul Aziz (Roll No:12CE32), Mr. Khokar Abdul Razik Irshad (Roll No: 12CE39) and Mr. Khan Mubashir Mohammed Husain (Roll No:12CE42) are the student of semester-VIII of B.E. Civil have satisfactorily completed and delivered a special topic, seminar report on **'Planning and Scheduling Of a High Rise Building'** in fulfillment for the completion of B.E. in Civil Engineering coarse conducted by the University of Mumbai in Anjuman-I-Islam's Kalsekar Technical Campus, New Panvel, Navi Mumbai, during academic year 2015-2016.

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Project Report Approval for B.E.

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Declaration

We declare that this written submission represents our ideas in our own words and where other ideas or word have been included; we have adequately cited and referred the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. We have understand that any violation of the above will be cause for disciplinary action by the institute and can also evoke panel action from the source which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Abstract

With the onset of High Rise Buildings in metropolitan cities, planning and scheduling has become a major concept to be considered for a smooth execution of construction works. Oracle's Primavera P6 is an effective tool for determining an ideal schedule for construction activities. This project serves as a perfect reference frame for scheduling different High Rise Buildings. All the important steps like creating an EPS, creating a WBS, linking of activities according to their interdependence and availability of resources, reduction of float values, and determination of Critical Path are clearly exhibited in this report.

Keywords: Planning, Scheduling, High Rise Buildings, Primavera, Critical Path, Gantt Charts,

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Chapter 1

Introduction

1.1 General

Tall buildings throughout the world are becoming popular day by day. With the advent of modern day construction technology and computers, the basic aim has been to construct safer buildings keeping in view the overall economics of the project. A high-rise building, apartment tower, office tower, apartment block, or block of flats, is a tall building or structure used as a residential and or office use.

Emporis Standards defines a high-rise as "A multi-story structure between 35–100 meters tall, or a building of unknown height from 12–39 floors." According to the building code of Hyderabad, India, a high-rise building is one with four floors or more or one 15 meters or more in height.

In some areas they may be referred to as "Multi Dwelling Unit" or “Vertical cities”. They have the potential to decongest the urban sprawl on the ground level, and increase the urban density, housing higher number of families in lesser space.

In India, a building greater than 75ft (23 m), generally 7 to 10 stories, is considered as high-rise. Also a building is considered to be high-rise when it extends higher than the maximum reach available to fire fighters. According to the building code of India, a tall building is one with four floor or more or a high rise building is one 15 meters or more in height. The Mumbai Municipal Corporation (BMC) proposed that any building with a height of 30m (nine floors) be categorized as a high rise. This is an increase of 6m from the existing definition (24m or seven floors).

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.
Planning is the process of identifying all the activities necessary to successfully complete the project.

Scheduling is the process of determining the sequential order of the planned activities, assigning realistic durations to each activity and determining the start and finish dates of each activity.

The process of converting a general or outline plan for a project into a time-based graphics presentation given information on available resource and time constraints.

Construction Planning is the necessary forerunner to scheduling and it includes:

- defining work tasks
- determining general sequence
- defining construction methods
- assigning responsibility

1.2 Aim and Objective

To understand the scheduling and planning of a High Rise buildings and schedule the list of the planned activities using computer applications.

Indian cities are witnessing immense demographic expansion due to migration from surrounding villages, leading to urban sprawl, housing demand, rise in cost of land. Many citizens allover India migrate to the cities for better jobs and education. Industries, trade and commerce activities and number of educational centers in cities attract floating population from all their surrounding villages and districts. This has expanded the cities in all directions and all aspects of development. With an urban sprawl of kilometers, these face the problems of congestion, pollution, everyday commuting to work place, competition, deforestation etc.

Thus there is a necessity that for a young nation like India, its Civil Engineers must be well equipped with the knowledge of high rise buildings, since their proficiency in such structures is directly reflected on the overall infrastructure of the country.

1.3 Scope

Given Mumbai's population density, going vertical is the mantra these days as developers argue that high rises are the sole answer to the island city's housing problem.

Old, dilapidated structures are being pulled down to make way for skyscrapers, mall and glossy office buildings as high rises are seen as the answer to the unplanned, low-rise, hyper dense slum settlements which house at least 60 percent of the city's residents.

The emergence of these residential skyscrapers is not an unexpected trend. According to experts, as cities gear up to cope with the increasing population, the tall building may well become the new normal, not by choice, but by default. "No large city, which has a growing population to accommodate, can afford not to go tall,"

1.4 Methodology

Collection of data – A detailed analysis of the materials, man power, machinery, other resources used, and the sequence of activities (dependent or independent) executed from the beginning of the construction to its completion.

The methodology adopted to attain the project objective is as below:

- Inception of ideas.
- Literature study, for this the following sources are explored:
    1. Review of past study.
    2. Study of published books, technical and research papers, reports, etc.
- Site visit.
- Collection of raw data from visiting various sites.
- Studied the data. On the basis of it, prepared the plan and scheduled manually.
- Learnt the project management software- Primavera.
- Prepared the plan and scheduled by using various modules of software.
- Finally, understood the ease, sufficiency & flexibility that the project management software offers us.

The scheduling techniques include:

- Bar Chart
- CPM
- Networking scheduling techniques

Chapter 2

Review and Literature

2.1 Literature

CPM:

The Critical Path Method (CPM) is one of several related techniques for doing project planning. CPM is for projects that are made up of a number of individual "activities." If some of the activities require other activities to finish before they can start, then the project becomes a complex web of activities.

CPM can help you figure out:

- how long your complex project will take to complete
- which activities are "critical," meaning that they have to be done on time or else the whole project will take longer

If you put in information about the cost of each activity, and how much it costs to speed up each activity, CPM can help you figure out:

- whether you should try to speed up the project, and, if so
- What is the least costly way to speed up the project?

Activities

An activity is a specific task. It gets something done. An activity can have these properties:

- names of any other activities that have to be completed before this one can start
- a projected normal time duration

If you want to do a speedup cost analysis, you also have to know these things about each activity:

- a cost to complete
- a shorter time to complete on a crash basis
- the higher cost of completing it on a crash basis

CPM analysis starts after you have figured out all the individual activities in your project.

The critical path method (CPM) is a duration-driven technique in which the basic inputs are project activities, their durations, and dependence relationships. Activity durations are functions of the resources required (rather than available) to complete each activity. The CPM formulation assumes that resources are not restricted in any sense (Ammar and Mohieldin, 2002).

Advantages:

When comparing bar charts with networks, three advantages over bar charts(Mubarak, 2003):

- Network show logic, the relationships among the activities. Bar charts do not
- Networks can better represent large and complicated projects.
- Networks can estimate, or predict, the completion date of the project, or other dates, on the basis of mathematical calculations of the CPM

Computer programs eliminate the need to prepare a network, but the network notation provides an easily understood output format for management personnel.

The essential technique for using CPM is to construct a model of the project that includes the following:

- A list of all activities required to complete the project (typically categorized within a work breakdown structure),
- The time (duration) that each activity will take to complete,
- The dependencies between the activities and,
- Logical end points such as milestones or deliverable items.

Using these values, CPM calculates the longest path of planned activities to logical end points or to the end of the project, and the earliest and latest that each activity can start and finish without making the project longer. This process determines which activities are "critical" (i.e., on the longest path) and which have "total float" (i.e., can be delayed without making the project longer). In project management, a critical path is the sequence of project network activities which add up to the longest overall duration, regardless if that longest duration has float or not. This determines the shortest time possible to complete the project. There can be 'total float' (unused time) within the critical path. For example, if a project is testing a solar panel and task 'B' requires 'sunrise', there could be a scheduling constraint on the testing activity so that it would not start until the scheduled time for sunrise. This might insert dead time (total float) into the schedule on the activities on that path prior to the sunrise due to needing to wait for this event. This path, with the constraint-generated total float would actually make the path longer, with total float being part of the shortest possible duration for the overall project. In other words, individual tasks on the critical path prior to the constraint might be able to be delayed without elongating the critical path; this is the 'total float' of that task. However, the time added to the project duration by the constraint is actually critical path drag, the amount by which the project's duration is extended by each critical path activity and constraint.

A project can have several, parallel, near critical paths; and some or all of the tasks could have 'free float' and/or 'total float'. An additional parallel path through the network with the total durations shorter than the critical path is called a sub-critical or non-critical path. Activities on sub-critical paths have no drag, as they are not extending the project's duration.

CPM analysis tools allow a user to select a logical end point in a project and quickly identify its longest series of dependent activities (its longest path). These tools can display the critical

path (and near critical path activities if desired) as a cascading waterfall that flows from the project's start (or current status date) to the selected logical end point.

Although the activity-on-arrow diagram ("PERT Chart") is still used in a few places, it has generally been superseded by the activity-on-node diagram, where each activity is shown as a box or node and the arrows represent the logical relationships going from predecessor to successor as shown here in the "Activity-on-node diagram".

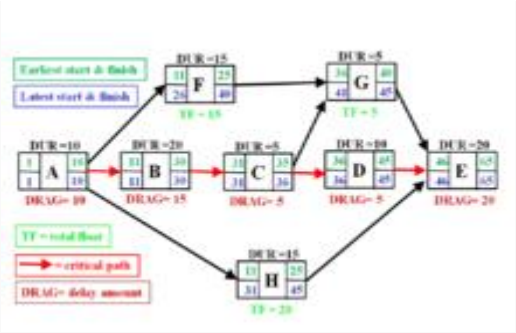

Fig. 2.1.1 Activity on node diagram (Source Google)

Activity-on-node diagram showing critical path schedule, along with total float and critical path drag computations

In this diagram, Activities A, B, C, D, and E comprise the critical or longest path, while Activities F, G, and H are off the critical path with floats of 15 days, 5 days, and 20 days respectively. Whereas activities that are off the critical path have float and are therefore not delaying completion of the project, those on the critical path will usually have critical path drag, i.e., they delay project completion. The drag of a critical path activity can be computed using the following formula:

- If a critical path activity has nothing in parallel, its drag is equal to its duration. Thus A and E have drags of 10 days and 20 days respectively.
- If a critical path activity has another activity in parallel, its drag is equal to whichever is less: its duration or the total float of the parallel activity with the least total float. Thus since B and C are both parallel to F (float of 15) and H (float of 20), B has a duration of 20 and drag of 15 (equal to F's float), while C has a duration of only 5 days and thus drag of only 5. Activity D, with duration of 10 days, is parallel to G (float of 5) and H (float of 20) and therefore its drag is equal to 5, the float of G.

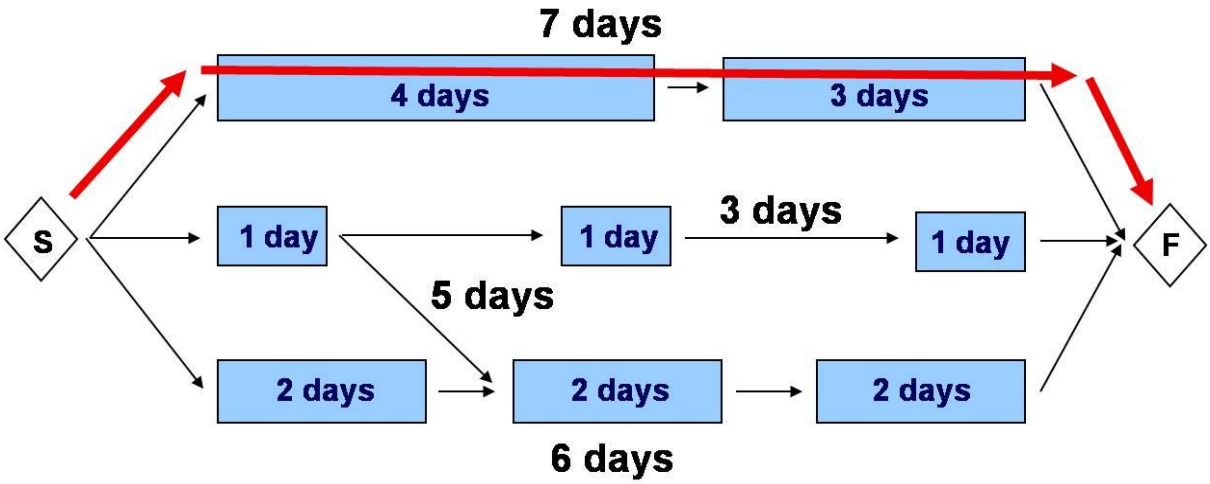

Fig. 2.1.2 CPM diagram (Source Google)

These results, including the drag computations, allow managers to prioritize activities for the effective management of project completion, and to shorten the planned critical path of a project by pruning critical path activities, by "fast tracking" (i.e., performing more activities in parallel), and/or by "crashing the critical path" (i.e., shortening the durations of critical path activities by adding resources).

Critical path drag analysis has also been used to optimize schedules in processes outside of strict project-oriented contexts, such as to increase manufacturing throughput by using the technique and metrics to identify and alleviate delaying factors and thus reduce assembly lead time.

Bar Chart:

The bar chart was originally developed by Henry L. Gantt in 1917 and is called a Gantt chart. A bar chart is —a graphic representation of project activities which are shown in a time-scaled bar line with no links shown between activities (Popescu and Charoenngam, 1995). It quickly became popular in construction industry because of its ability to graphically represent a project‘s activities on a time scale. A bar chart has become a vehicle for representing many pieces of a project‘s information. A project must be broken into smaller, usually homogeneous components, each of which is called an activity or task. Bar charts basically use the x-axis to depict time, and the y-axis is used to represent individual activities.

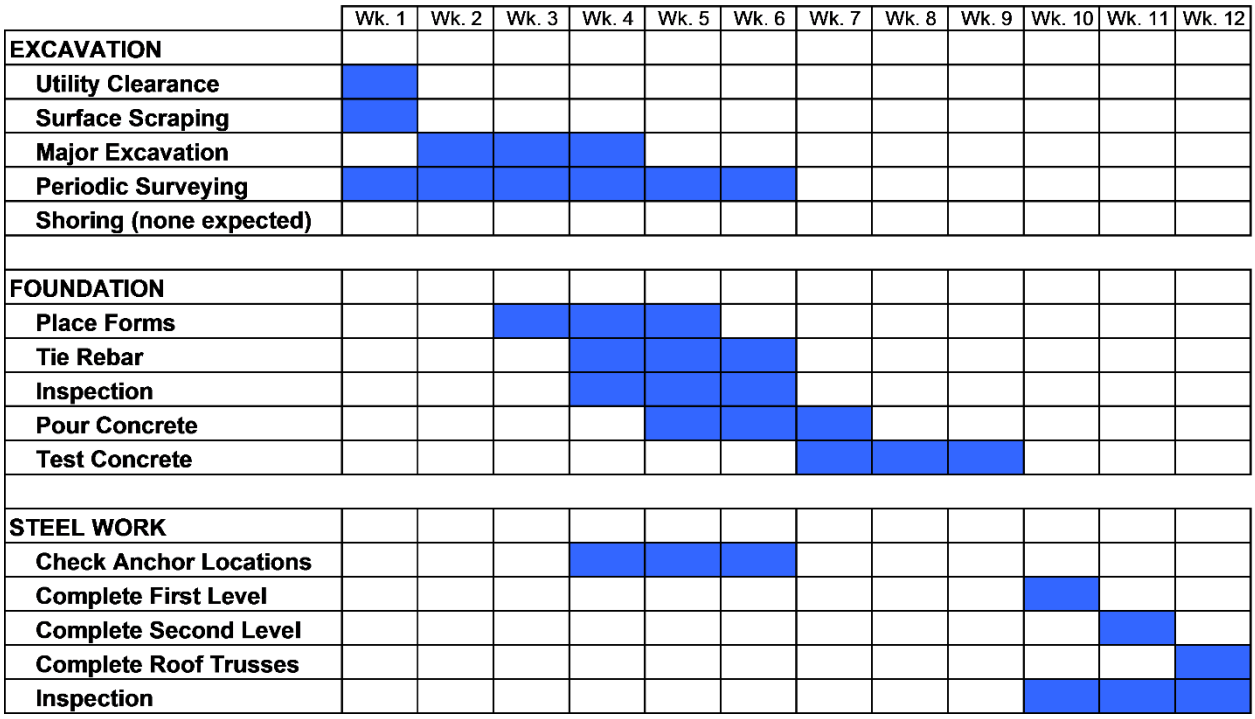

Fig. 2.1.3 Bar chart (Source Google)

Advantages of Bar Chart:

Bar charts have gained wide acceptance and popularity mainly because of their simplicity of and ease of preparation and understanding. No ―theory‖ or complicated calculations are involved. Anyone can understand them. Bar charts particularly appeal to persons who do not have a technical background. For example, some clients and upper-level managers may better understand the plan for carrying out a construction project by looking at a bar chart than by looking at a schematic of logic network. The advent of the critical path method (CPM) and the evolution of powerful computers, bar chart did not perish or lose importance. Instead, they evolved to a different supporting role that made them more valuable and popular. (Mubarak, 2003). The advantage of bar chart can be concluded as:

- Bar charts are time scaled, the length of the activity bar represents the time duration of the activity). Both the node, in the node networks, and the arrow, in the arrow networks, are not time-scaled.
- Bar chart are simple to prepare
- Bar chart are easy to understand

- Bar chart are acceptable for presentation, especially for field people and people who are unfamiliar with the CPM
- Bar charts can be loaded with more information, such as cash-flow diagrams and man-hours.

Network Scheduling Techniques:

The limitation in the bar chart called for the need to develop new technique in scheduling. Network techniques are either deterministic or probabilistic.

Deterministic Network Scheduling Technique:
The Arrow Diagram Method (ADM) and the Precedence Diagram Method (PDM) are the two deterministic network techniques available.
In, ADM activities are represented by arrows and then connected to nodes. In, PDM activities are the nodes themselves and the arrows represent the job logic.

Probabilistic Network Scheduling Technique:
As far as possible network scheduling techniques are concerned, the Program Evaluation and Review Technique (PERT) considers three different duration for each activity, the most optimistic time, the most likely and the most pessimistic time duration. This characteristic enables the scheduler to model the uncertainty associated with the duration of each activity.

Advantages:

- Network show logic, the relationships among the activities. Bar charts do not
- Networks can better represent large and complicated projects.
- Networks can estimate, or predict, the completion date of the project, or other dates, on the basis of mathematical calculations of the CPM.

Limitation of Network Scheduling Technique

- It does not take into account the learning curve effect.
- For complex project it is very extremely complex and detailed.
- It is observed that field personnel, who are not actually trained to understand the methodologies of network scheduling, get confused by complex schedule.

2.2 Case study

Introduction:

In this we have presented the study of the schedule generated for the construction of a high rise institutional building located in downtown, Montreal. The project is an academic building for the faculty of Engineering and visual arts of Concordia University. The case study was used primarily to assist in Planning and test and validate the system and its function.

Description:

The case study is Concordia University's newly constructed Engineer and Visual arts building, referred to later as the EV building located in downtown Montreal. There are many interesting aspects worth mentioning about this building. This building was financed through bonds issued by university. Beyond financing and other unique characteristic of this building the description included here focuses primarily on aspect that relate to planning and scheduling.

The building consists of two towers, one twelve floor, for visual arts and the other seventeen, for engineering and computer sciences. The two tower of the complex are completely integrated on every floor level through link and common corridor. The two tower are of concrete construction and rest on a 3-level base.

The concrete structure utilizes flat slab construction with slab thickness of 229mm (9 inches). The typical grid dimension is 9m x 9m. Each floor is 4.1m in height, from slab to slab. Mechanical rooms built of structural steel are at the top of each tower. The building envelop is primarily pre-glazed curtain wall, zinc cladding and aluminum panels. The interior features all-glass guide rail, five circular staircases, each link three floors.

2.3 Problem Definition

High rise construction is a project which involves huge number of activities to be performed by different teams belonging to various age groups, cadre, level of skills and expertise. Also since the range of activities to be carried out is highly varying and complicated in nature. Thus it is very important to harmonies the different resources on the site for its efficient and timely completion.

As stated earlier project management skills are of great use while managing such project.

We had made the plan of a multi-story commercial building. We listed out the different activities involved in the construction process of a building. Then we found out the relationship between the different activities and calculated the project duration and critical path. Further we tried to calculate the quantities of each material used and cost associated with each and finally the total approximate cost of building.

2.4 Primavera

2.4.1 Introduction:

Primavera Systems, Inc. was a private company providing Project Portfolio Management (PPM) software to help project-intensive organizations identify, prioritize, and select project investments and plan, manage, and control projects and project portfolios of all sizes. On January 1, 2009 Oracle Corporation took legal ownership of Primavera. Primavera Systems, Inc. was founded on May 1, 1983 by Joel Koppelman and Dick Faris. It traded as a private company based in Pennsylvania (USA), developing software for the Project Portfolio Management market. To help expand its product capabilities, Primavera acquired Eagle Ray Software Systems in 1999, Evolve Technologies (a professional services automation vendor) in 2003, Pro Sight (an IT portfolio management software vendor) in 2006, and, in the same year, Pert master (a project risk management software vendor).

Fig. 2.4.1.1 Primavera (Source Google)

In 2008, Oracle announced it was acquiring Primavera, turning it into the Primavera Global Business Unit (PGBU).Oracle Corporation announced the release of version 8.3 of Primavera P6 Enterprise Project Portfolio Management. This version was stated to enhance and extend previous work, improved reporting, and user experience and application integrations. This version incorporated material from Oracle acquisitions of Skire and Instantis in 2012.

In 2012 Primavera P6 EPPM, upgrade Release 8.2, added capabilities for governance, project-team participation, and project visibility. In addition, Primavera P6 Analytics Release 2.0 gained new enterprise-reporting tools and dashboards for monitoring and analyzing

performance data, including geospatial analysis. Organizations could also investigate comparative trends and cause-and effect in multiple projects with Primavera Contract Management Release 14 as it now includes the report-writing capabilities of Oracle Business Intelligence Publisher.

2.4.2 Planning and Controlling

Before implementing Primavera to schedule projects, team members and other project participants should understand the processes involved in project management and the associated recommendations that help smooth the Primavera implementation that supports your corporate mission. If you were driving to a place you had never seen, would you get in the car without directions or a map? Probably not. More than likely you'd take the time to plan your trip, consider alternate routes, and estimate your time of arrival. Planning the drive before you even left would help your trip be more successful. And, along the way, should you encounter road blocks or traffic delays, you would have already identified alternate ways to reach your destination.

Project management follows the same methodology and purpose—to achieve each project's goals, you need to plan them in advance. Good project management is no longer an option in today's corporate world. It is a critical tool to help your company stay on target and accomplish its goals. Simply stated, project management is the process of achieving set goals within the constraints of time, budget, and staffing restrictions. It allows you to get the most out of your available resources. Resources include

- People
- Material
- Money
- Equipment
- Information
- Facilities
- Role

Project portfolio management factors in all of these variables across multiple projects, enabling project managers and company executives to see an accurate picture of how each project‘s resource use affects other projects. The process of project management is guided by three key principles:

- Planning
- Controlling
- Managing

Planning a project the first step in project management is to define your project.

- What is the scope of the work? What activities will make up the project and what is their relationship to each other? You‘ll also want to identify the major milestones that will help you monitor the project‘s progress.
- What is the project duration? What are the dates when the project will begin and end?
- What resources are available to the project? Beyond labor, think about all the types of resources you will require.
- Who will perform what tasks? Determining your labor resources and their available work hours is a key part of building a successful project. You‘ll need to plan for downtime and holidays and determine the regular workweek for various staffing types.
- How much will the project cost? What are the costs per resource? Are there any hidden project costs?
- What is the estimated budget? Establishing a project budget estimate in advance helps you monitor possible cost overruns.

Controlling a project once you have built your project and estimated your budgeting needs, you save this original plan as a baseline, or target schedule, to help you control the project. A baseline provides a solid point of reference as your schedule changes over time. It allows you to compare the original schedule to the current one and identify significant changes and develop contingency plans. You control a project to keep it heading in the right direction. You‘ll want to track work progress and costs, compare them to your baseline, and then recommend what actions should be taken.

Primavera - Project Management Effective project control reaps many benefits. It allows you to keep a close eye on possible problems before they become critical. It lets the project team and senior management view cost and scheduling timeframes based on the reality of the schedule.

2.4.3 Managing a project:

The process of guiding a project from start to finish is the responsibility of a project manager. A good project manager wears many hats, acting at various times as a motivator, communicator, coordinator, and advisor. As you control the project‘s progress, it is your job to keep your team aware of changes to the schedule and possible consequences. In many ways, you are the project‘s ambassador, ensuring that your project organization is carrying out its responsibilities for the best possible outcome. To be an effective project manager also requires consistency when you update your projects. Select a day each week, or biweekly, when you will regularly update projects. This regular update will include progress on values such as

- Dates on which activities started or finished.
- Dates when resources are consumed.
- Changes to resource rates.

Determine a standard policy for the update and scheduling procedure, and for reporting progress. The Project Management module provides many tools to assist you in reporting progress to both team members and senior management. Use the Project Web Site option to create a central location where team members can view project progress.

Consider the many system reports as a means for communicating change. In addition, senior management can use Primavera Web Portfolio Management module to summarize project data and easily capture a snapshot of how a project or group of projects is progressing.

2.4.4 Application of Primavera

- Balance resource capacity.
- Monitor and visualize project performance versus plan.
- Plan, schedule and control complex projects.
- Conduct what-if analysis and analyze alternative project plan.
- Allocate best resource and track progress.

2.4.5 Advantages of Primavera

- Primavera P6 Reduces Risk

  When your schedule has inconsistencies, errors, or overrun issues, project expenses will grow. This could mean cutting more vital aspects of the project to compensate for the excess costs. Using Primavera P6 helps identify and mitigate risks in the course of planning, managing, and completing a project

- Easy to Use Software

  Primavera P6 offers many complex analyses and processes; however, accessing and managing the schedule remains simple. Simply input your information, and wait for the software to determine if any problems exist. For example, worker shifts may be uncovered, have too many employees, or additional raw materials may be needed. P6 may be used throughout an entire project, even large, multi-tier projects.

- Optimized Resources

  Primavera P6 allows all involved in a project to carefully monitor resource availability and adjust such resources to meet project demands. Furthermore, the software can help identify areas where resource costs may be reduced by analyzing resource trends and costs.

- Enhanced Visibility

  Visibility and compliance with political and environmental regulations are among the top priorities for project managers and business executives. Since Oracle Primavera P6 allows all data to be entered, tracked, and analyzed in one location, you can ensure your project does not pose any possible violations.

- Forecasting of Project Activities

  As a project evolves, the project may require additional resources, activities, and tasks to meet stakeholder demands. Within Oracle Primavera P6, project managers can create forecasts for resources, activities, and other project needs.

Chapter 3

Methodology

3.1 Introduction

Primavera software has been extensively used for Planning and Scheduling of our project. The plan with an area of 576 m^2 has been divided into two phases for RCC works. The schedule has been so constructed that the activities which are interdependent of one other start together, hence saving a commendable amount of time in the construction process. It has been looked after that activities like Brickwork, Plastering, Painting, Tiling, Sanitation and Electrical works are so linked that there is no considerable float or wastage of time. The following Plan has been considered by us for Planning and Scheduling of Project via Primavera.

For the purpose of planning and scheduling, we made our own plan and elevation to make our project unique. As it is not similar to any ongoing projects, we have made a list of all the activities by doing extensive surveys and interviews with the professionals.

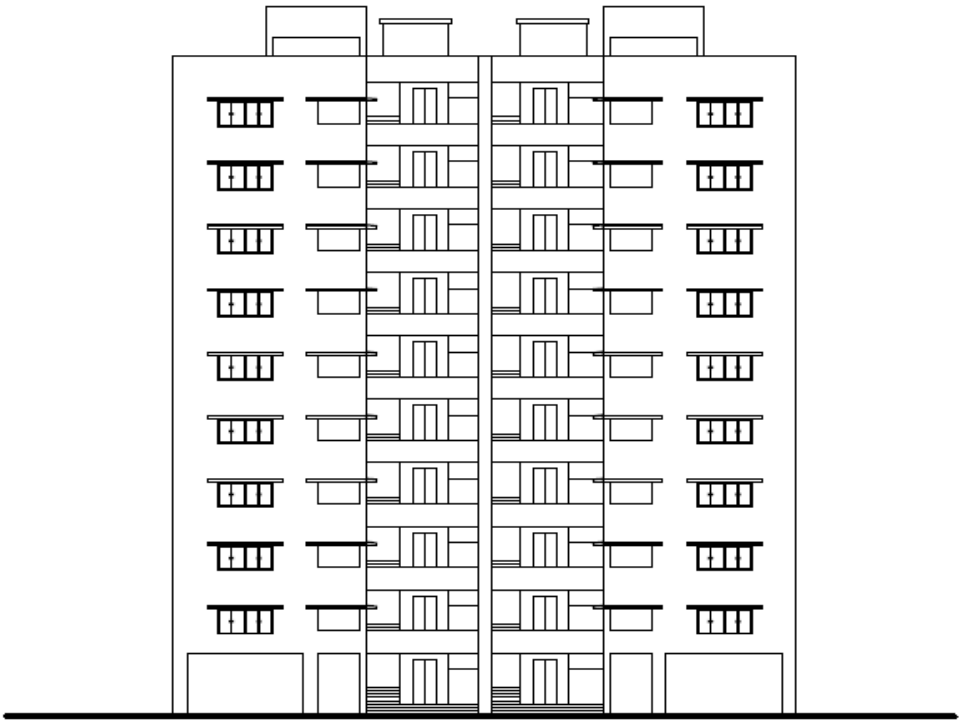

Fig.3.1.1 Plan of Project

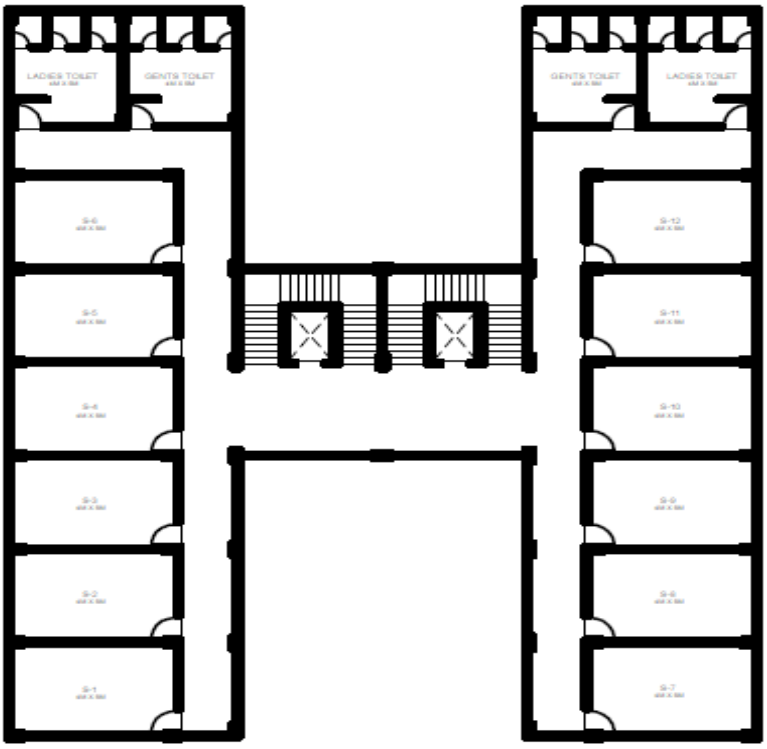

Fig.3.1.2 Elevation of Project

The following steps are included in the process of scheduling via Primavera:

3.2 Creating EPS

The EPS is a hierarchy used to organize projects, and to associate Organizational level security with that project structure.

When you create the enterprises project structure, you must identify an OBS element, or person responsible for each node and project within EPS.

A default root node displays in the top left position in the hierarchy. All project listed below it are the part of same structure. You can also define multi root nodes to separate various component of your of your enterprises. For example, you might want to exclude inactive or what-if project from the main enterprises. To define root node, click the left arrow key to move an EPS element to top left position in the hierarchy, and then add the hierarchy of project below this node.

Firstly we had created the EPS of our project i.e. Enterprise Project Structure.

Steps:

1. From the Enterprise column select EPS.
2. Create a new EPS by giving proper name and ID.
3. Go in project select the created EPS and add new project.
4. From the file command select New.
5. There will a dialogue box of select an EPS, select the created EPS.
6. Give a name and an ID to the project.
7. Specify start and must finish date of the project.
8. Select a responsible manager for the project.
9. Assign the rate type of the items.
10. It will ask for project architect, Yes or No if we are only planning then select No option.

In this way the project has been successfully created.

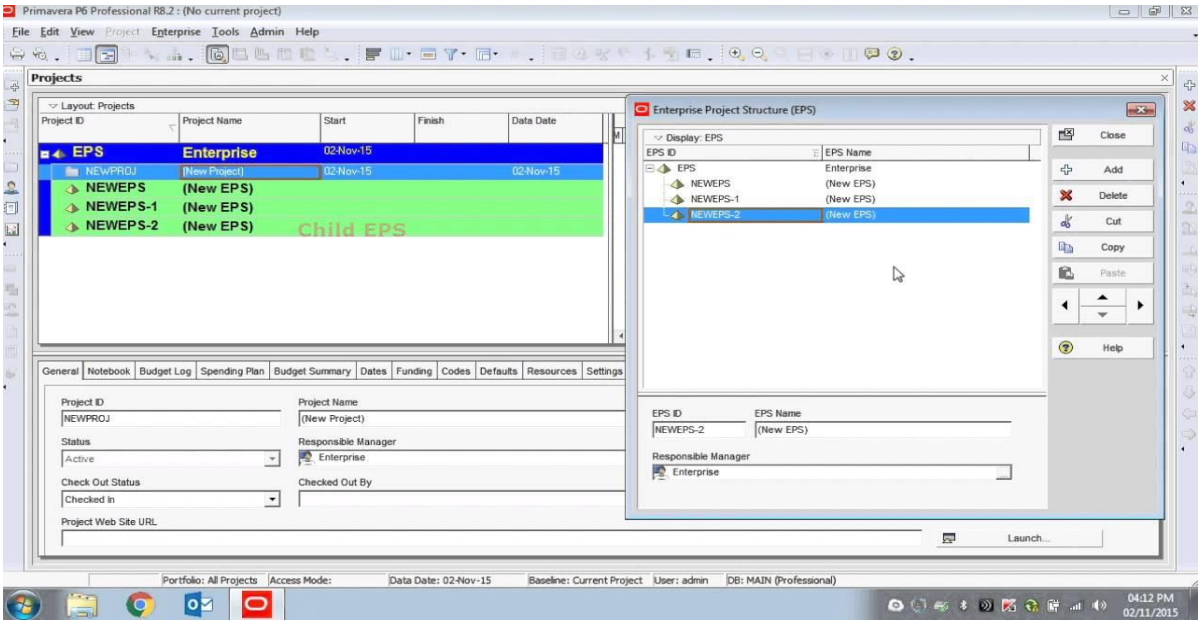

Fig. 3.2.1 EPS diagram (Source Google)

3.3 Creating WBS

The work breakdown structure (WBS) is a hierarchical system that represents the construction project in increasing levels of detail to define, organize and display the project work in measurable and manageable components.

One of the first steps in planning a project is to break down the project into its major deliverables i.e. major product or service components. This is known as the Work Breakdown Structure (WBS). After you have created the WBS, you can then create the activities required to achieve those deliverables.

Primavera P6 encourages you to create a work breakdown structure (WBS) at the beginning of the project. This is known as a top down approach. Primavera P6 recognizes the importance of the project management team keeping their “eye on the ball” throughout the project life cycle. This means that you maintain a focus on the end product or service, which is the whole purpose of the project.

The WBS helps you maintain this focus on the product. At its heart the WBS is a deliverable-oriented decomposition of the project into smaller components. So the WBS focuses on the deliverables, and it is simply a breakdown of all the components making up the product in a hierarchical fashion. Primavera P6 has you create the WBS first, so that the activities on the project schedule flow from the WBS in a top down method, and not the other way around.

Steps:

1. Click on WBS on left side in the directory.
2. Select the project in WBS section.
3. Start adding the WBS namely, Milestone, Engineering, Procurement etc.
4. Go in project, select the project and open it, it will open in activities section.

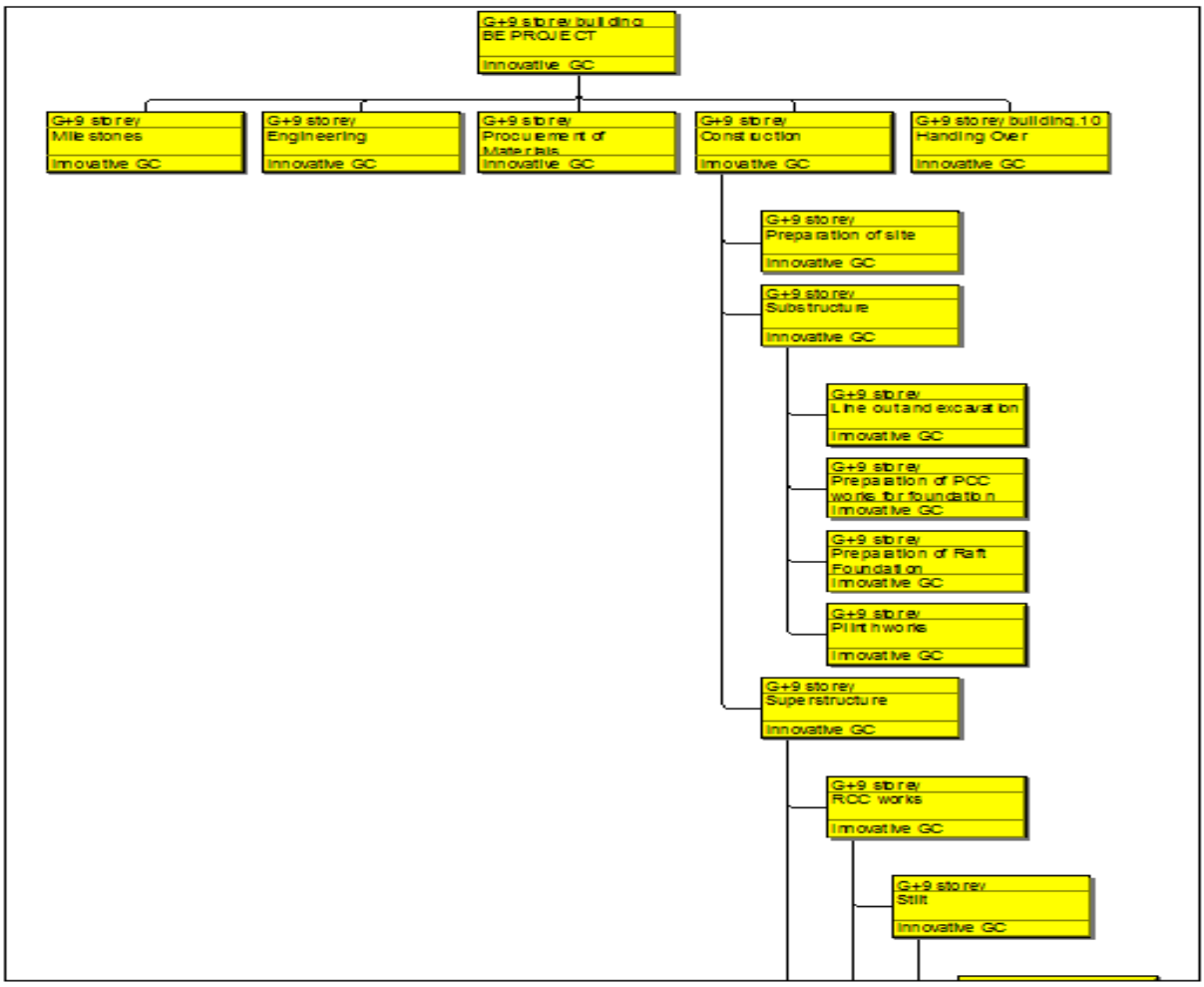

Fig. 3.3.1 WBS of Project G + 9 storey structure

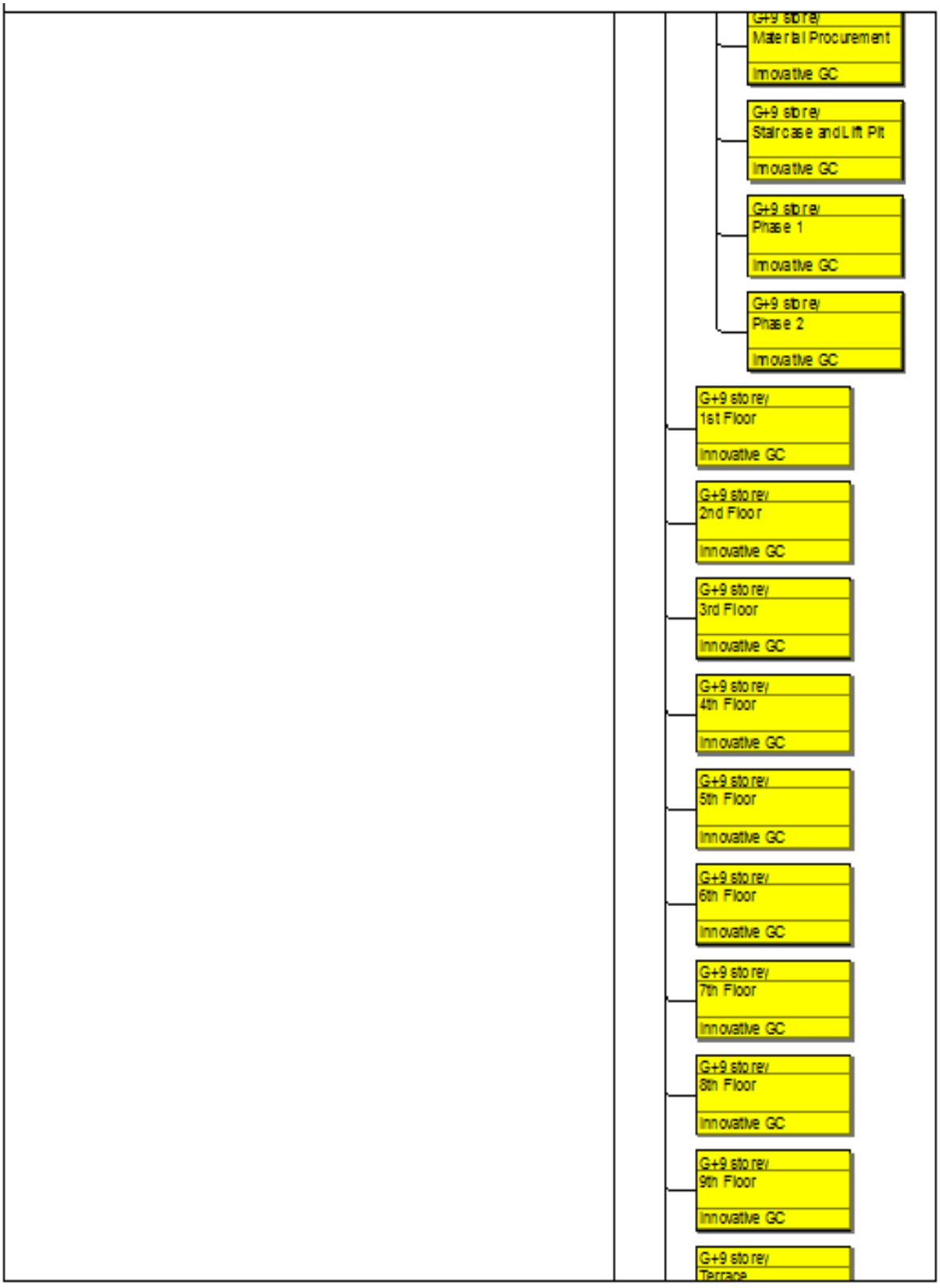

Fig. 3.3.2 WBS of Project G + 9 storey structure

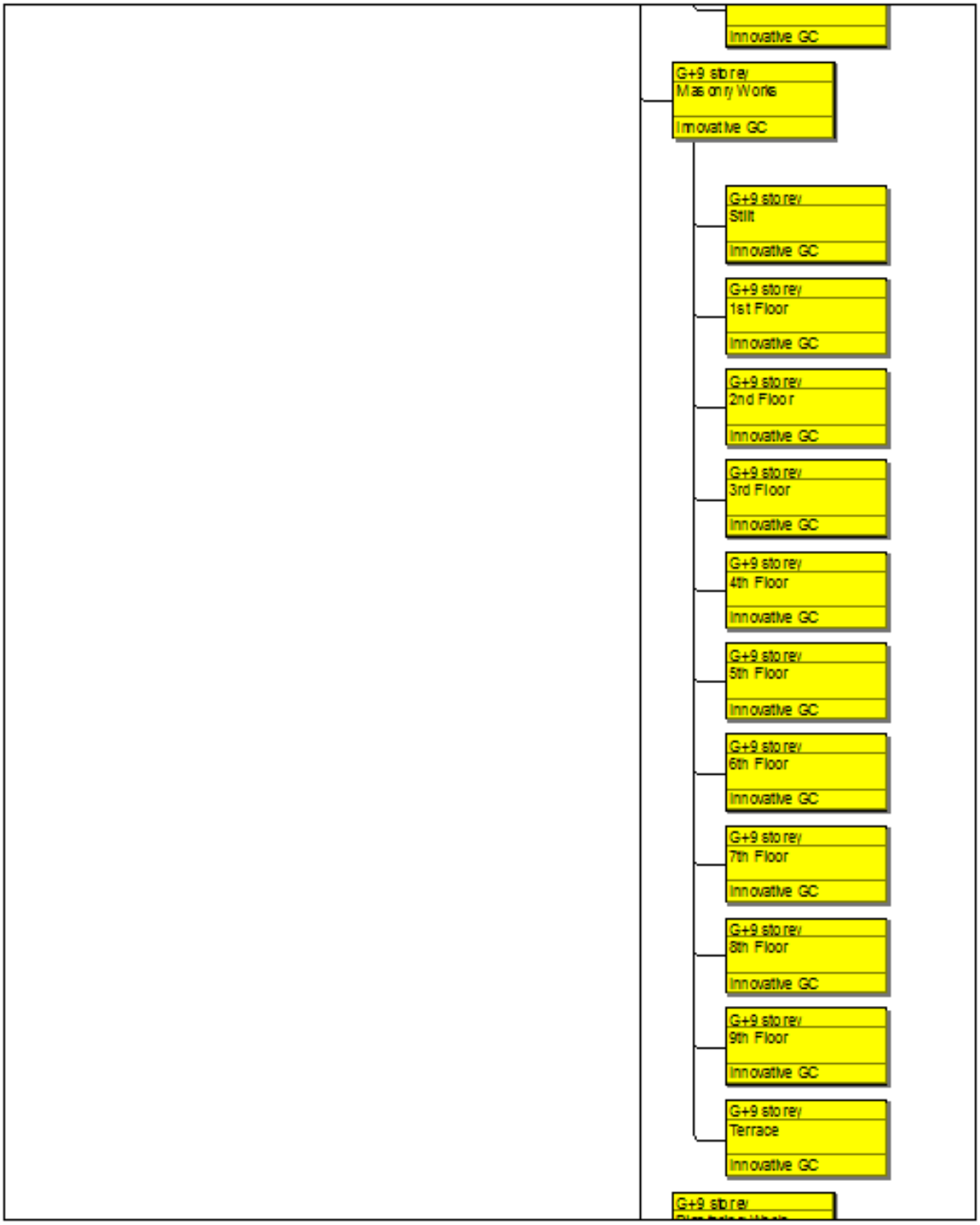

Fig. 3.3.3 WBS of Project G + 9 storey structure

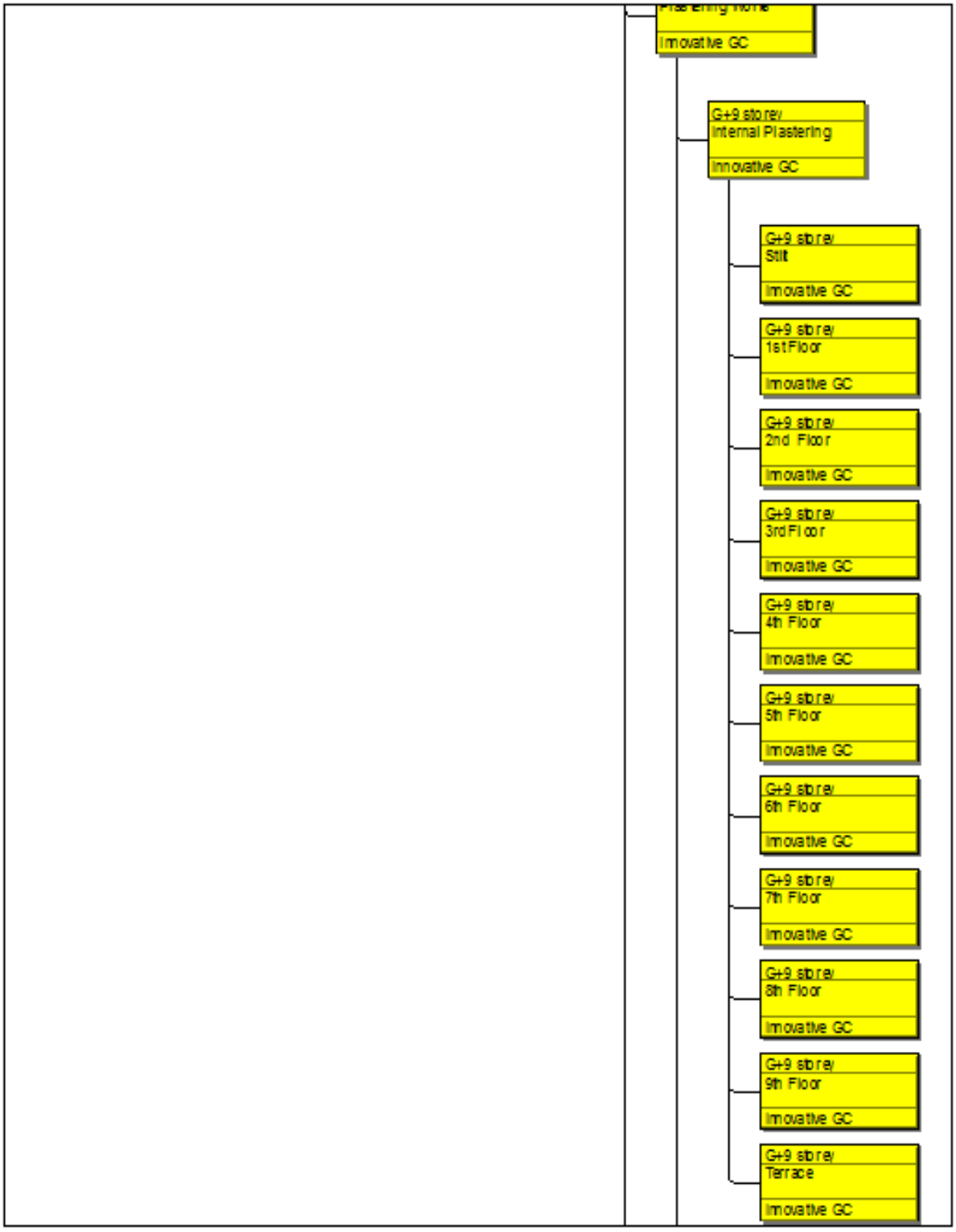

Fig. 3.3.4 WBS of Project G + 9 storey structure

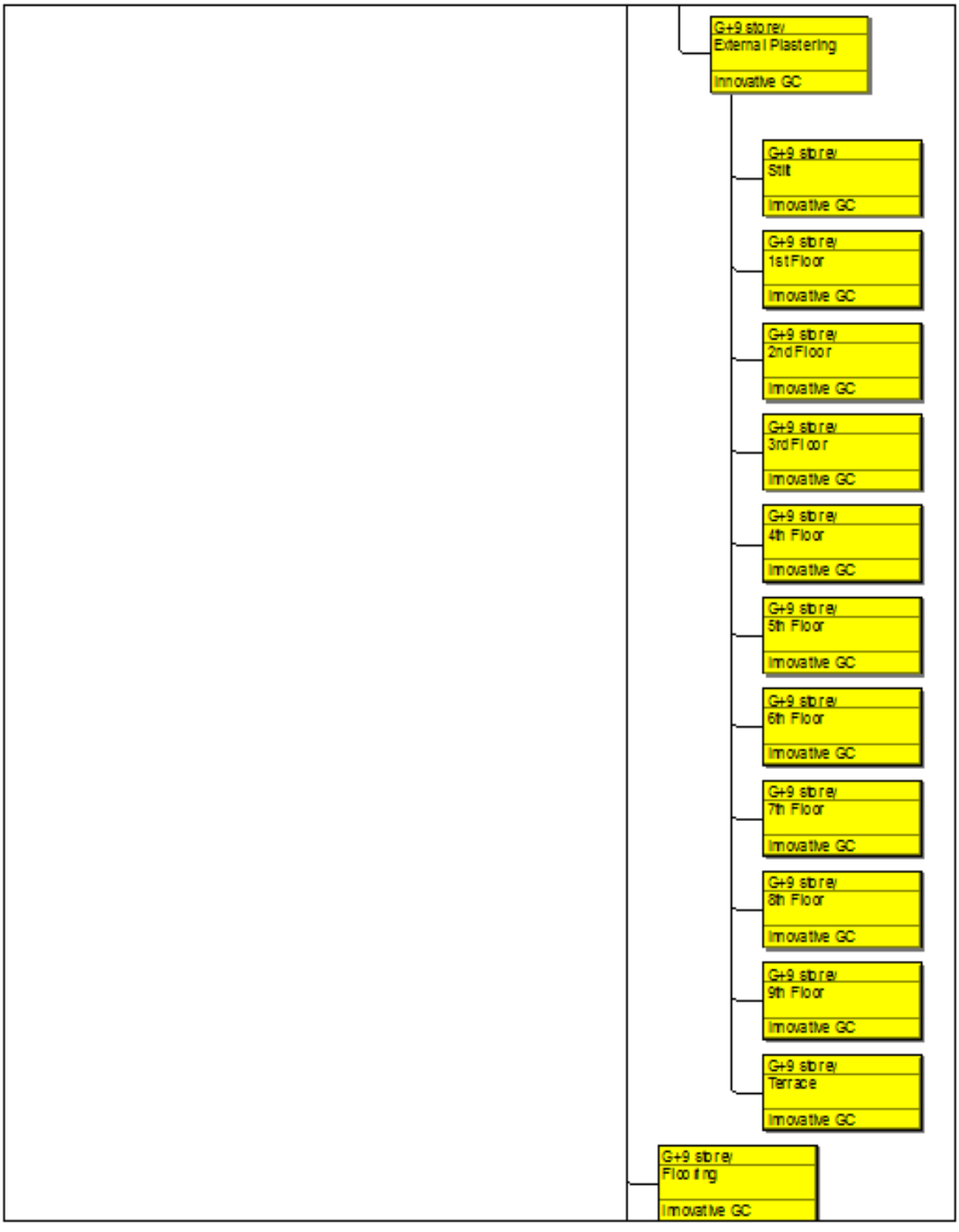

Fig. 3.3.5 WBS of Project G + 9 storey structure

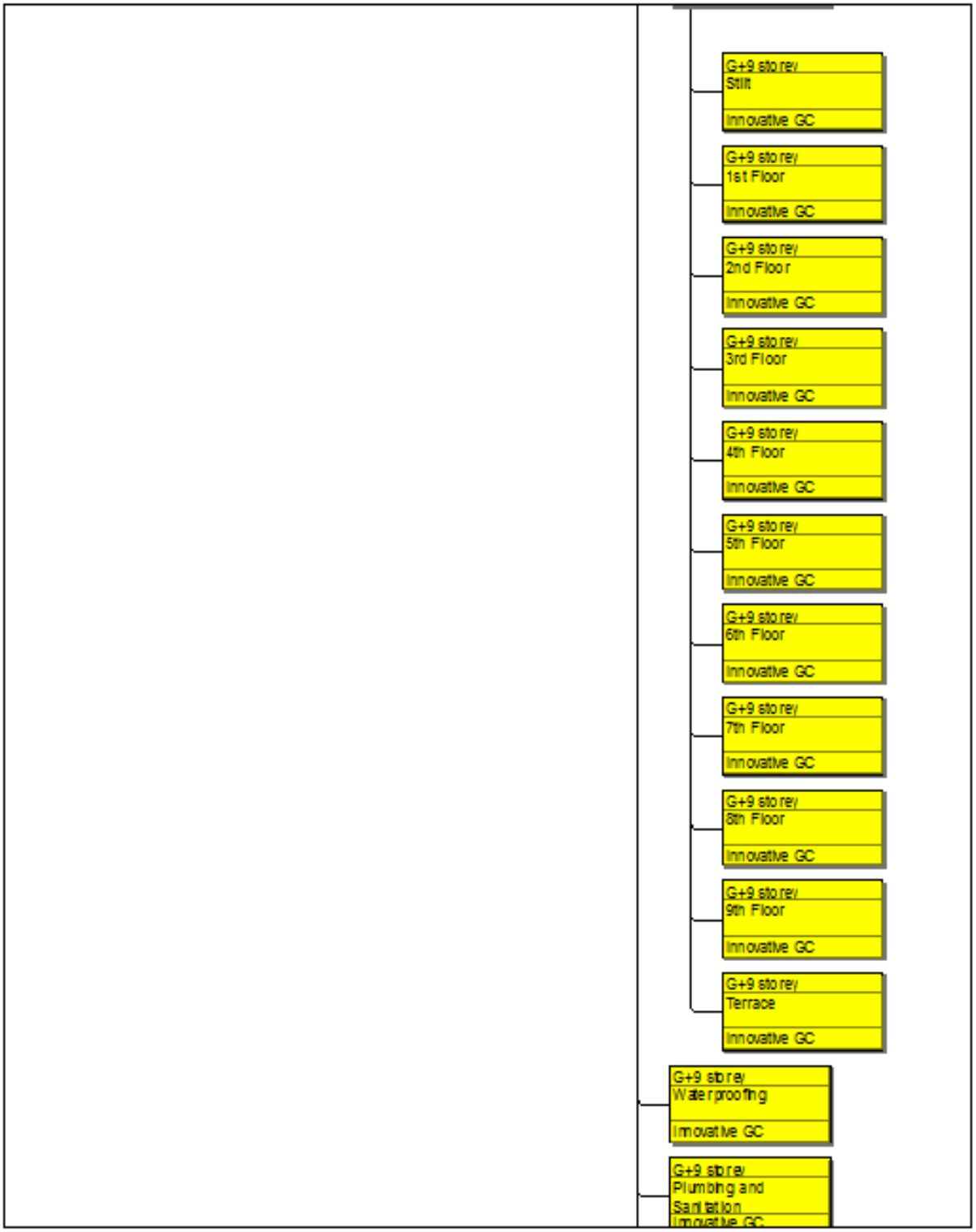

Fig. 3.3.6 WBS of Project G + 9 storey structure

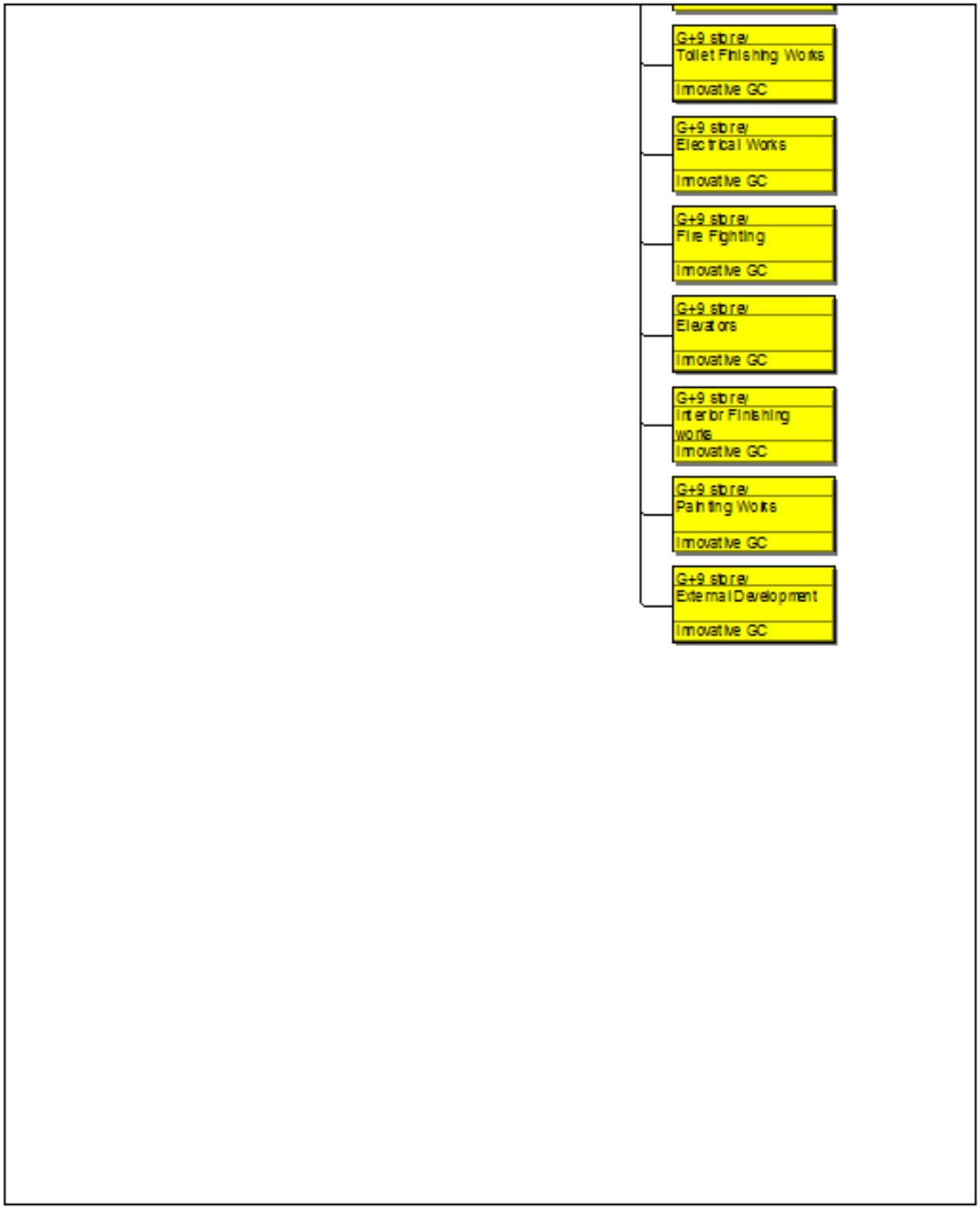

Fig. 3.3.7 WBS of Project G + 9 storey structure

3.4 Creating Calendar and Activities

Before assign activities firstly we have to create a calendar for the project.You can create and assign calendars to each resource and each activity. This calendar defines the available work hours in each calendar day. You can also specify national holidays, your organization's holiday, project specific work or non-work days, and resource vacation days.

- Calendars are assigned to activities, not projects
- Calendars have 3 different time levels to work with
- Primavera P6 Calendars come in 2 flavors – Activity and Resource
- Changing an Activity's Calendar can sometimes mess up your Durations

Steps:

1. From enterprises column select calendar.
2. Create a project calendar, for the current project.
3. Assign it default calendar for the project.
4. Now start adding activities to created WBS in project.
5. Start linking activities by assign the Predecessor and Successor to each activity.
6. Give relation to each activity namely, FS, SS, SF, FF.

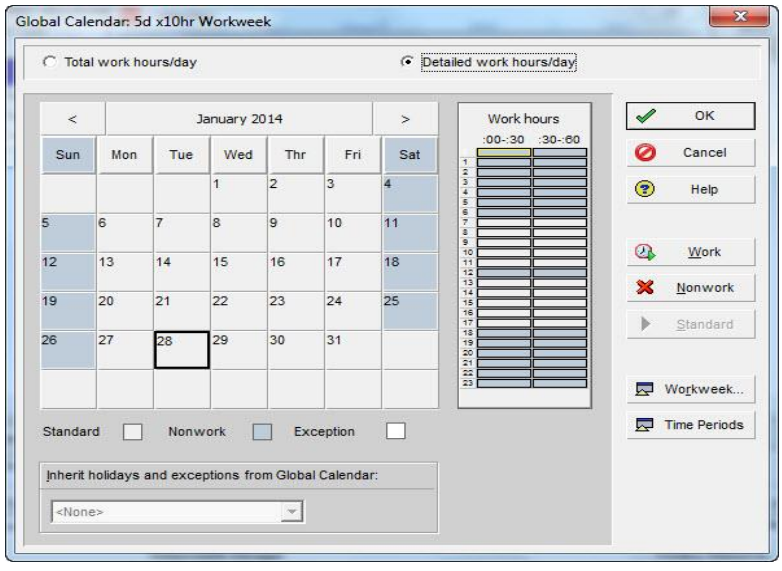

Fig. 3.4.1 Calendar (Source Google)

3.5 Creating Resources

Now we will allot the resources to activities.

Steps:

1. Select resources option from directory.
2. Start creating resources which will be require for our project.
3. Assign proper resource type i.e. labor, non-labor and materials.
4. Assign default resource calendar and default units/time and price/unit.
5. Start assigning the resources to the activities.

Now **SCHEDULE** the project (F9+Enter).

Chapter 4

Scheduling

4.1 Introduction

Scheduling is the process of determining the sequential order of the planned activities, assigning realistic durations to each activity and determining the start and finish dates of each activity.

The project schedule provides a graphical representation of predicted task, milestone, dependencies, resources requirement, task duration and deadlines. The project schedule should be detailed to show each WBS to be performed, the name of the person responsible to completing the task, the start and end date of each task, and the expected duration of the task.

Like the development of each of the project plan components, developing a schedule is an iterative process. Milestone may suggest additional task, task may require additional resources, and task completion may be measured by additional milestone. For large, complex project, detailed sub-schedules may be required to show an adequate level of detail for each task.

Below mentioned are the Bar Charts generated in our project after scheduling the activities.

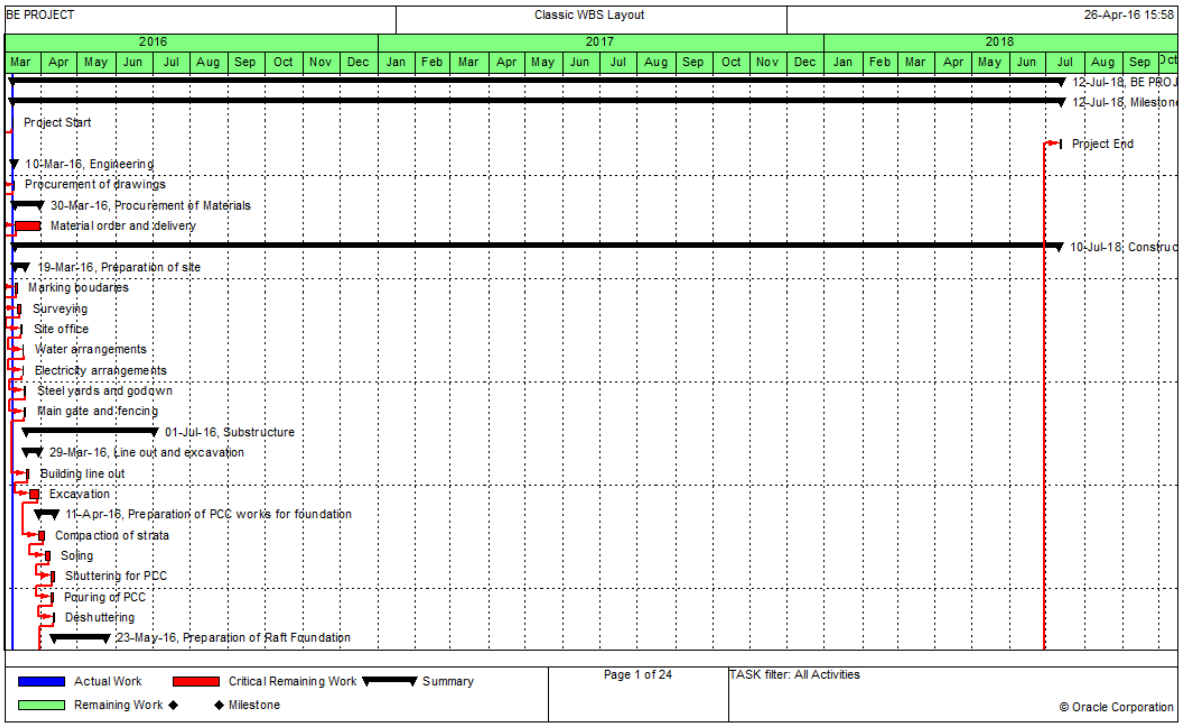

Fig. 4.1 Gantt Bar Chart of Project G + 9 storey structure

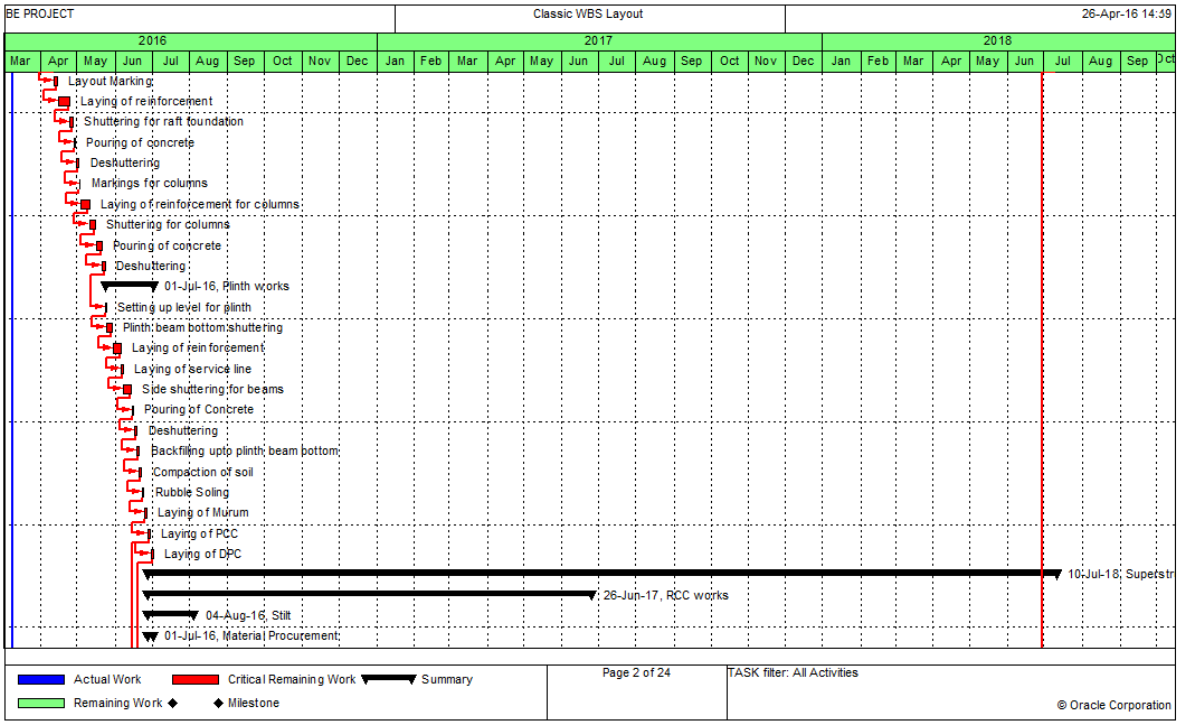

Fig. 4.2 Gantt Bar Chart of Project G + 9 storey structure

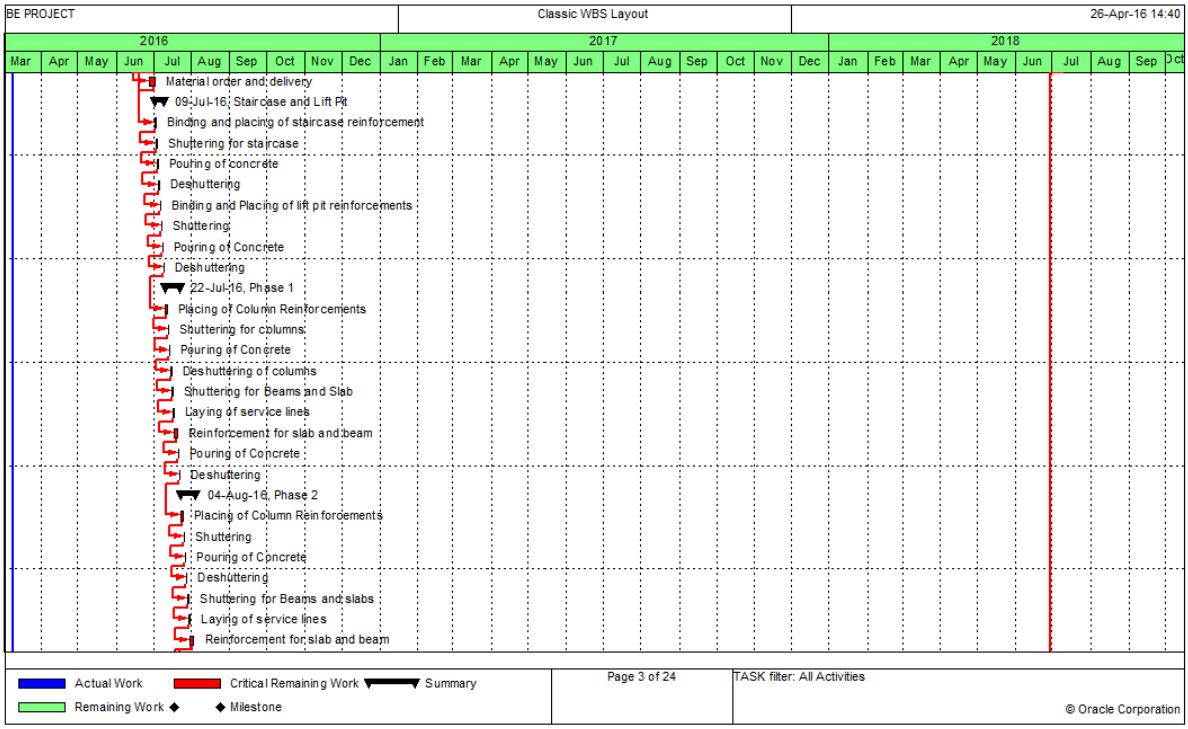

Fig. 4.3 Gantt Bar Chart of Project G + 9 storey structure

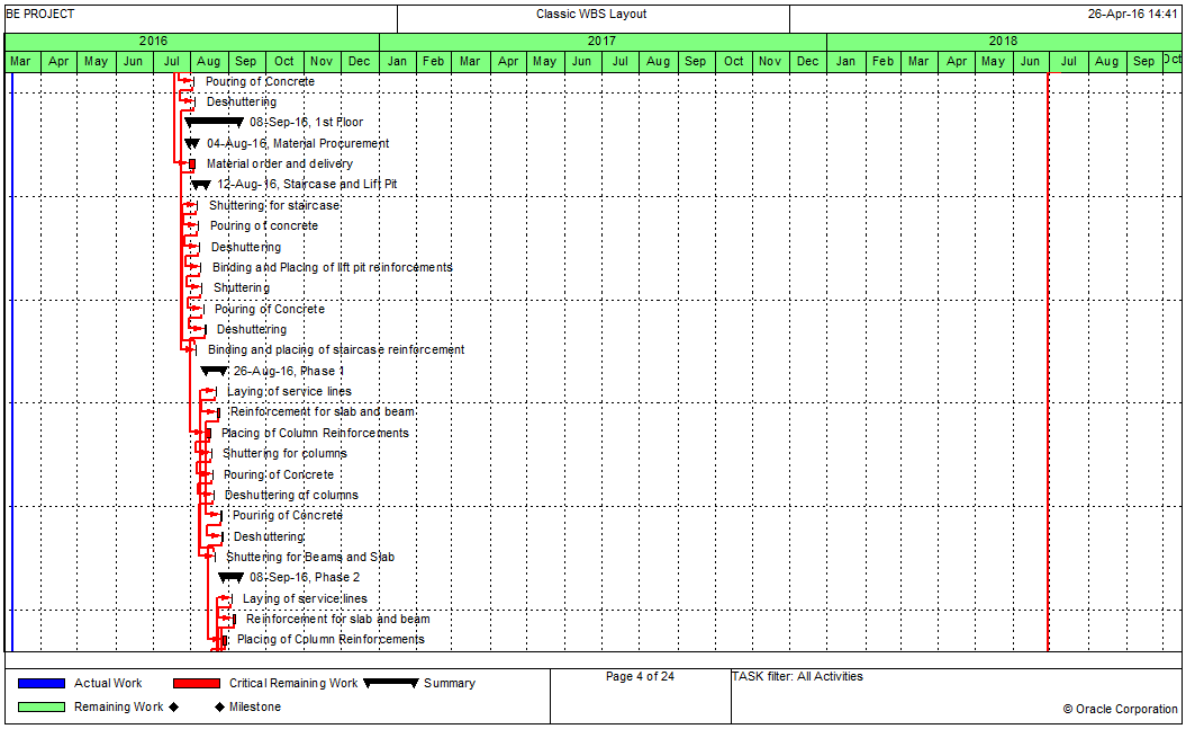

Fig. 4.4 Gantt Bar Chart of Project G + 9 storey structure

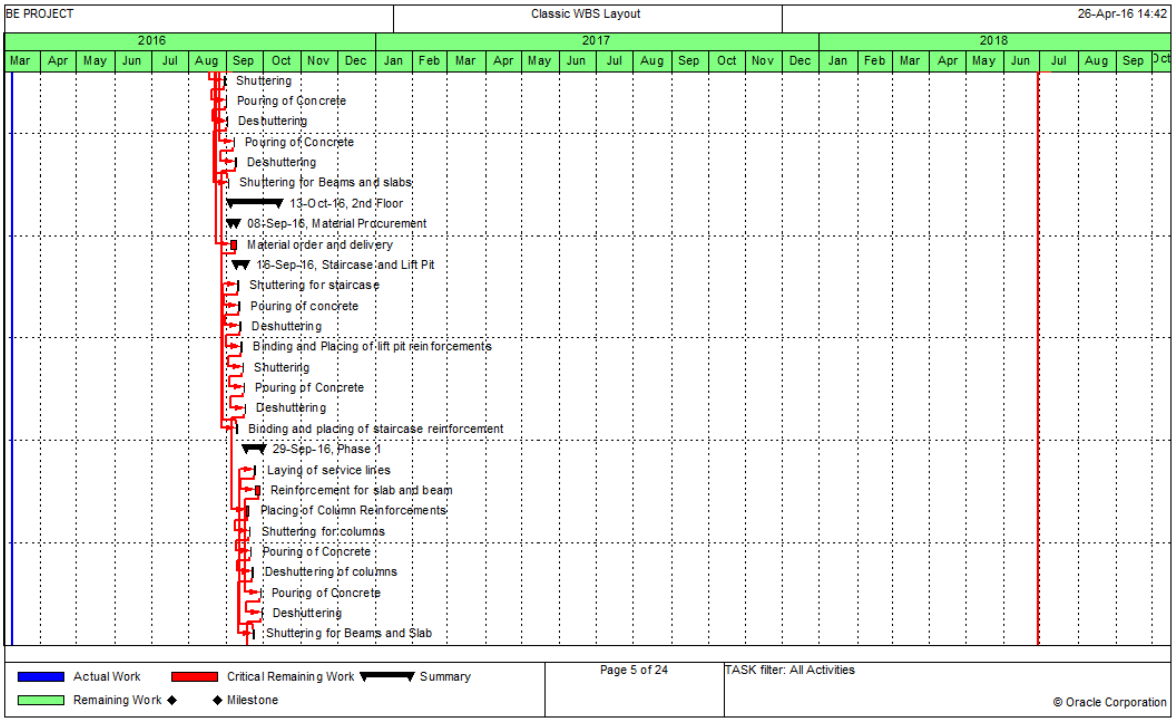

Fig. 4.5 Gantt Bar Chart of Project G + 9 storey structure

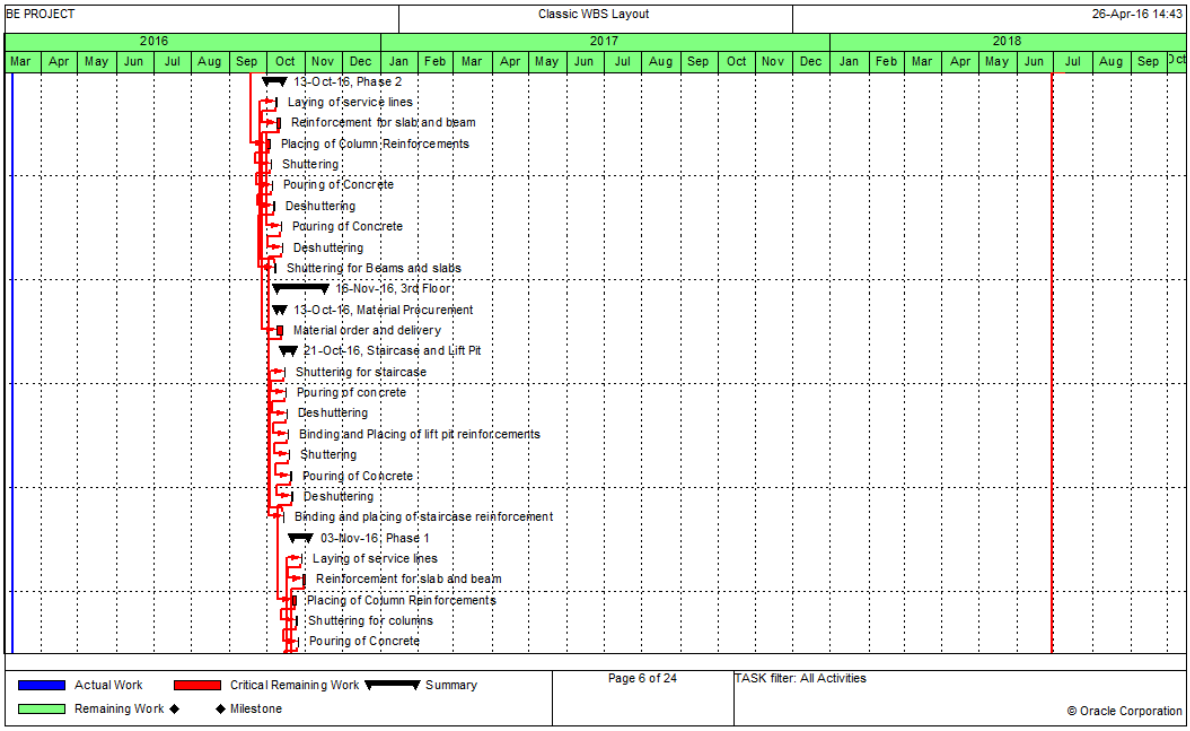

Fig. 4.6 Gantt Bar Chart of Project G + 9 storey structure

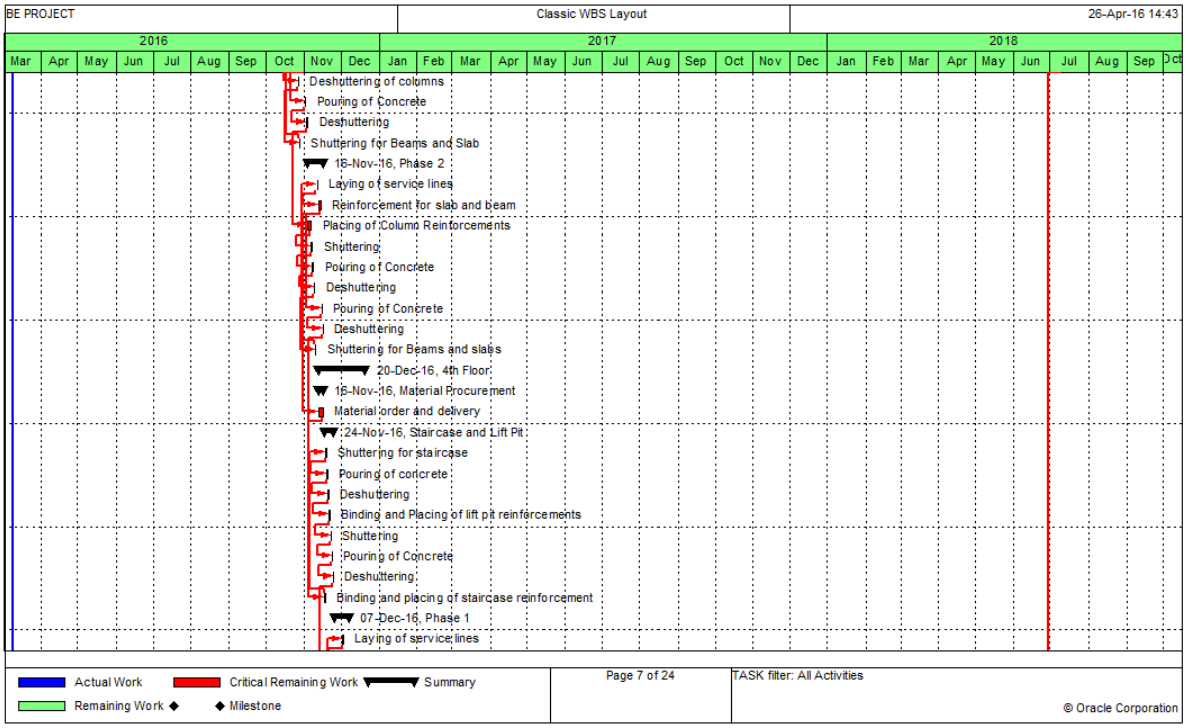

Fig. 4.7 Gantt Bar Chart of Project G + 9 storey structure

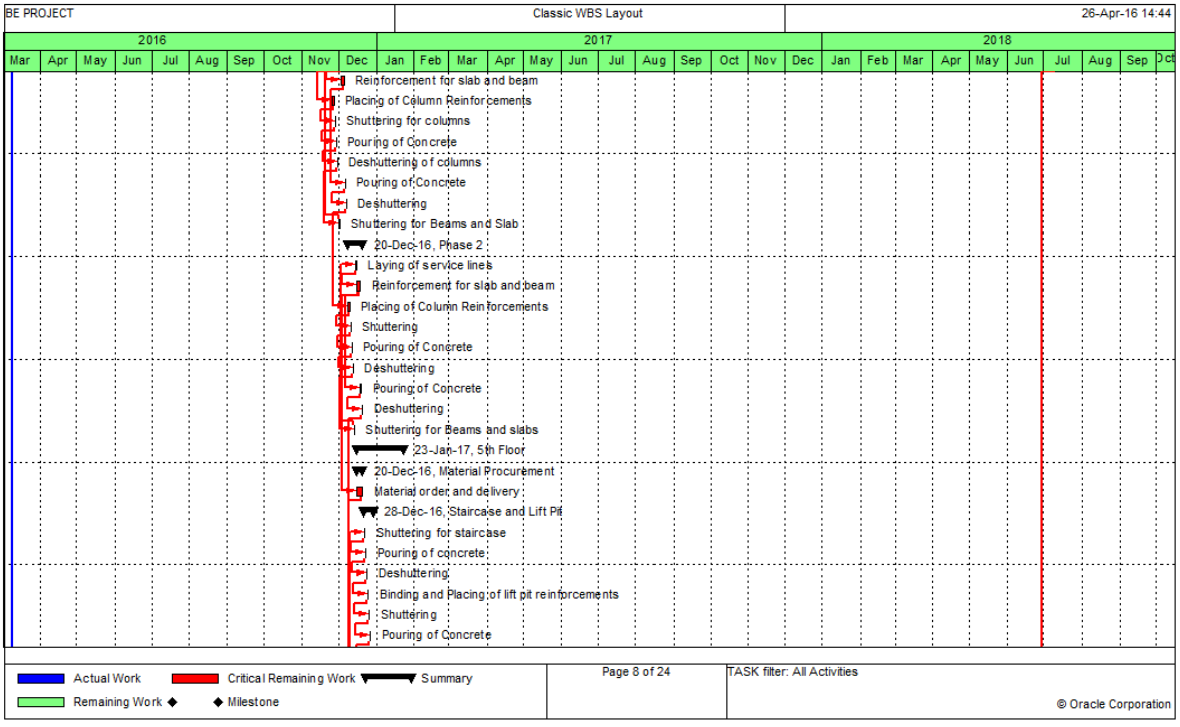

Fig. 4.8 Gantt Bar Chart of Project G + 9 storey structure

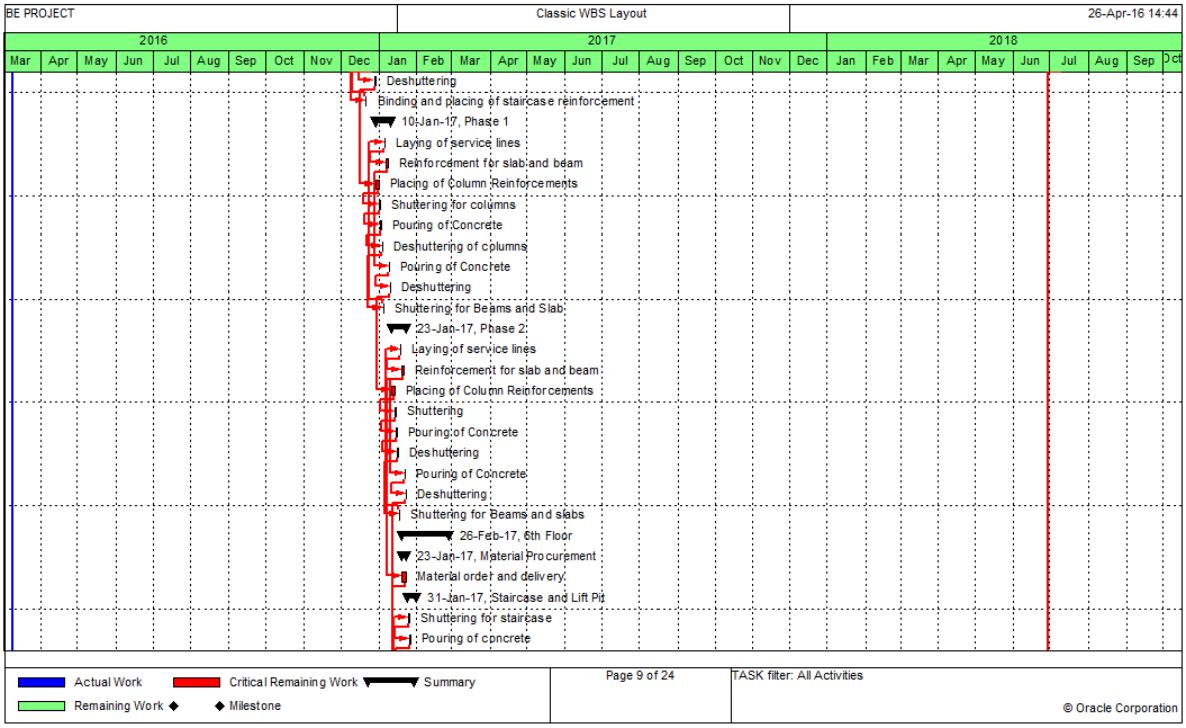

Fig. 4.9 Gantt Bar Chart of Project G + 9 storey structure

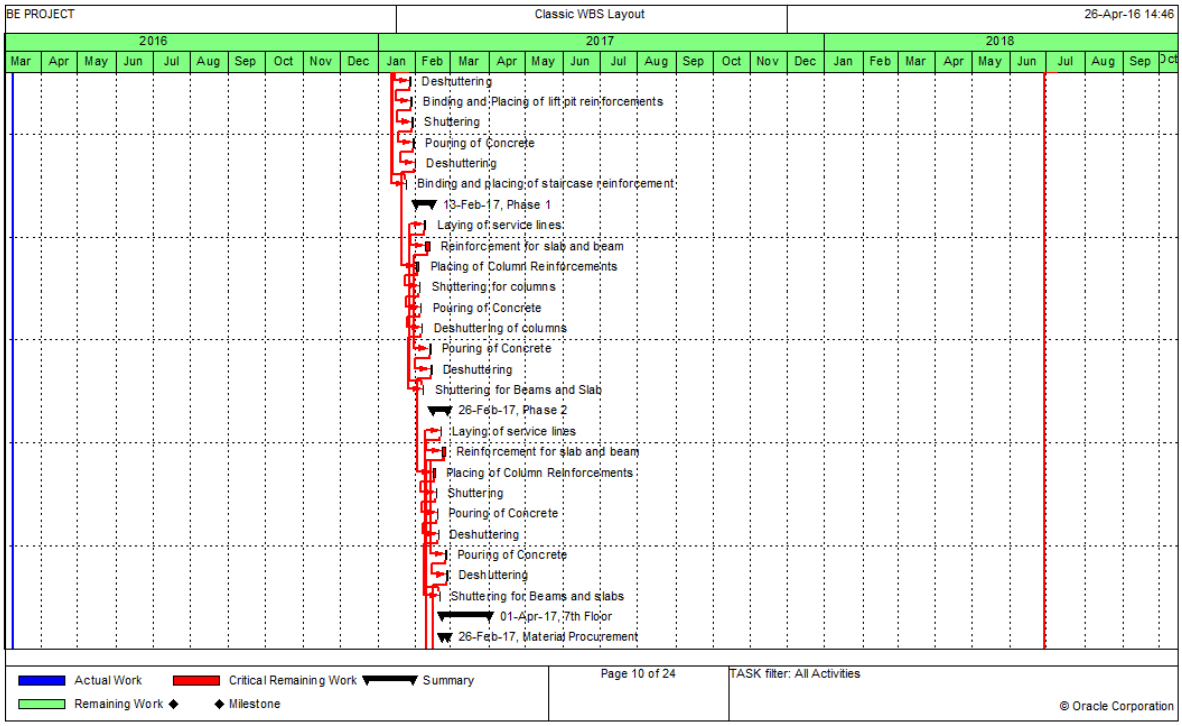

Fig. 4.10 Gantt Bar Chart of Project G + 9 storey structure

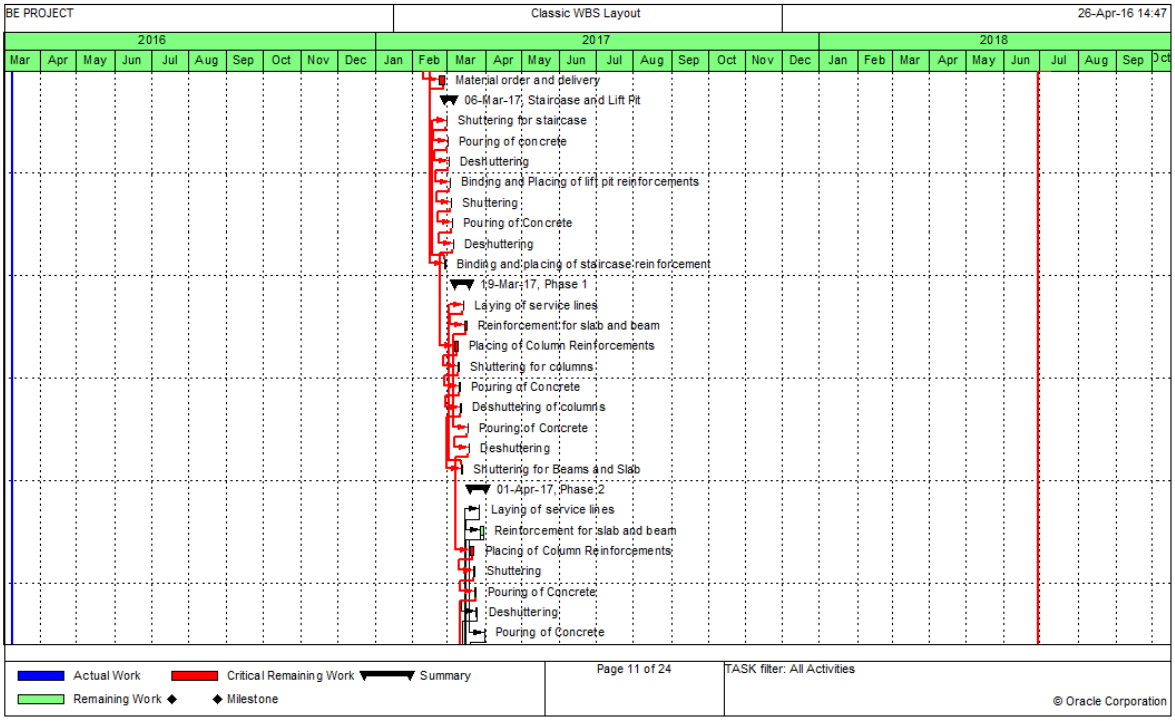

Fig. 4.11 Gantt Bar Chart of Project G + 9 storey structure

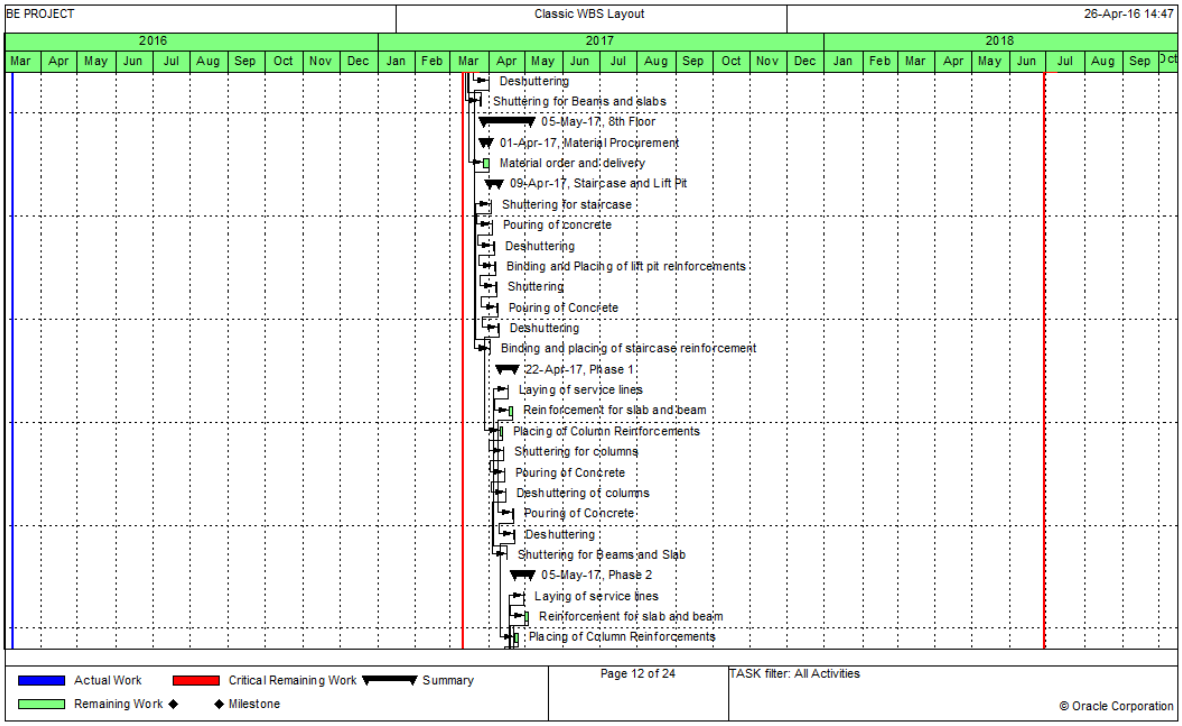

Fig. 4.12 Gantt Bar Chart of Project G + 9 storey structure

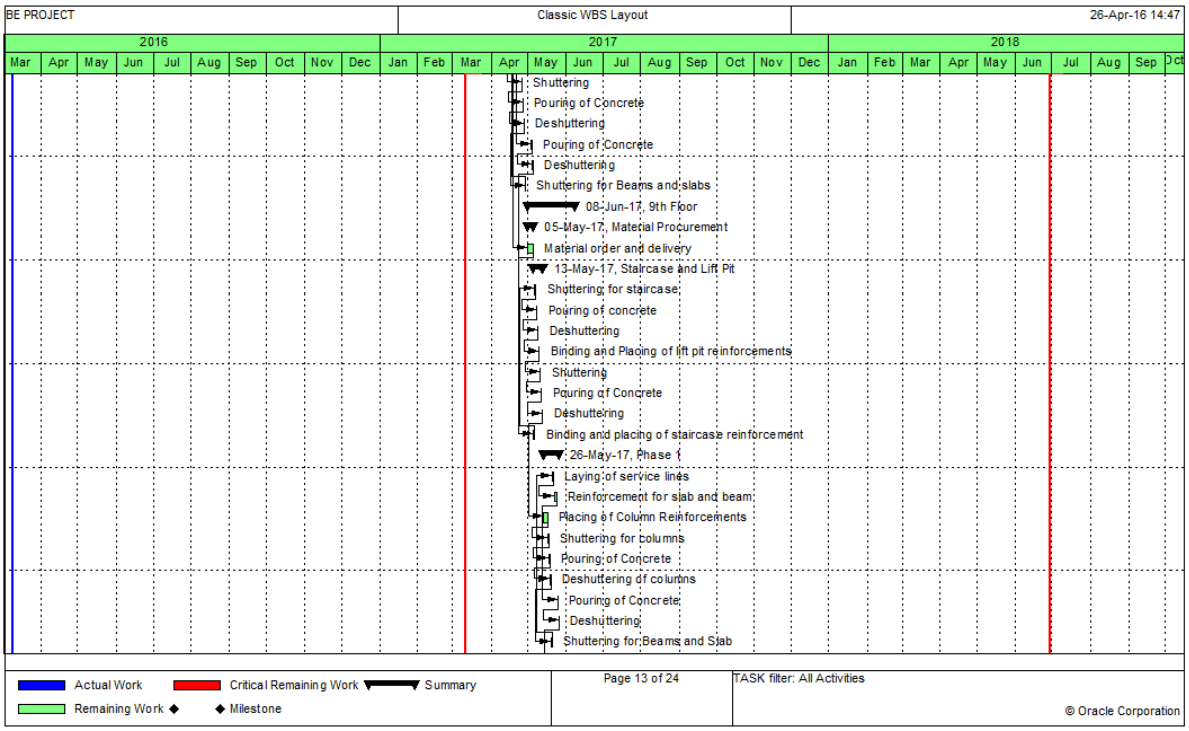

Fig. 4.13 Gantt Bar Chart of Project G + 9 storey structure

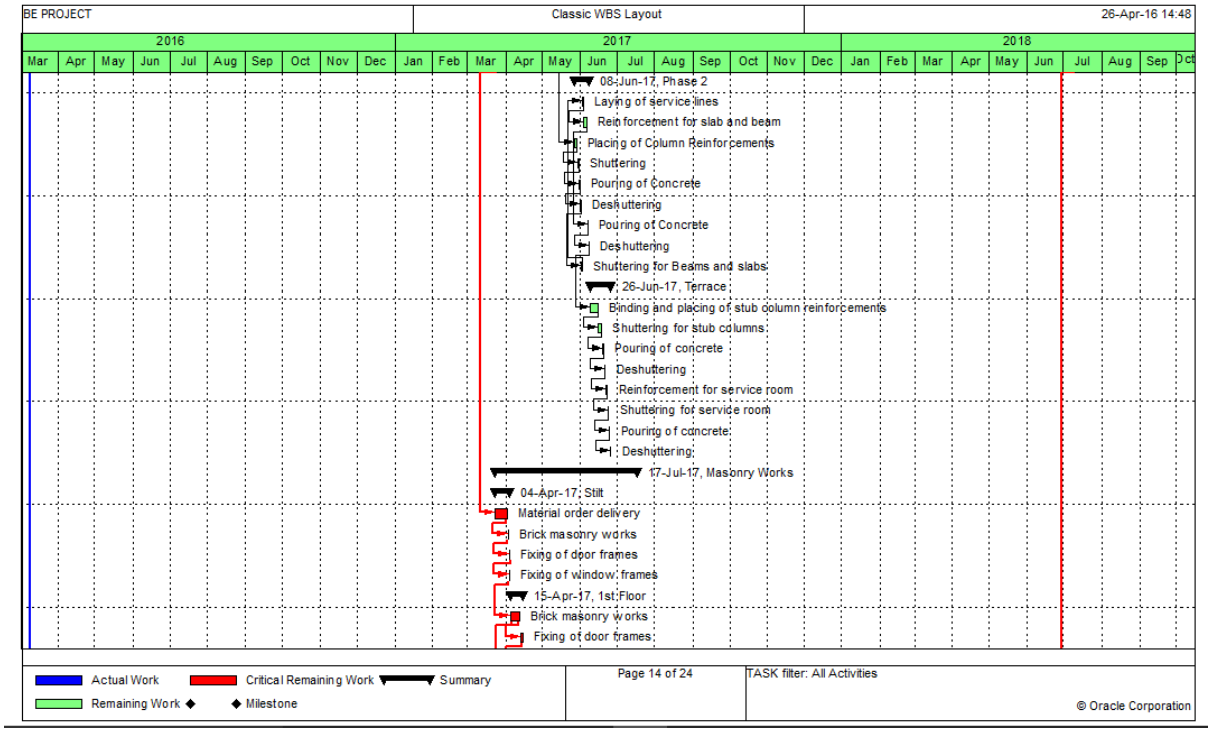

Fig. 4.14 Gantt Bar Chart of Project G + 9 storey structure

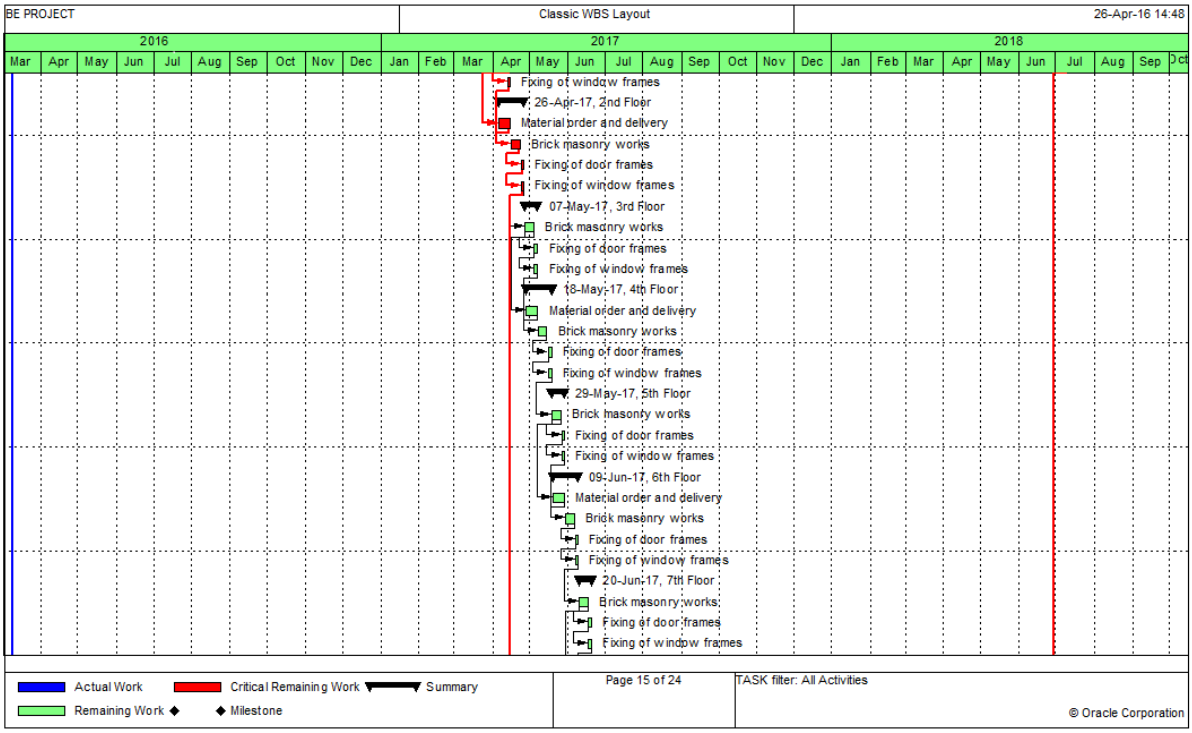

Fig. 4.15 Gantt Bar Chart of Project G + 9 storey structure

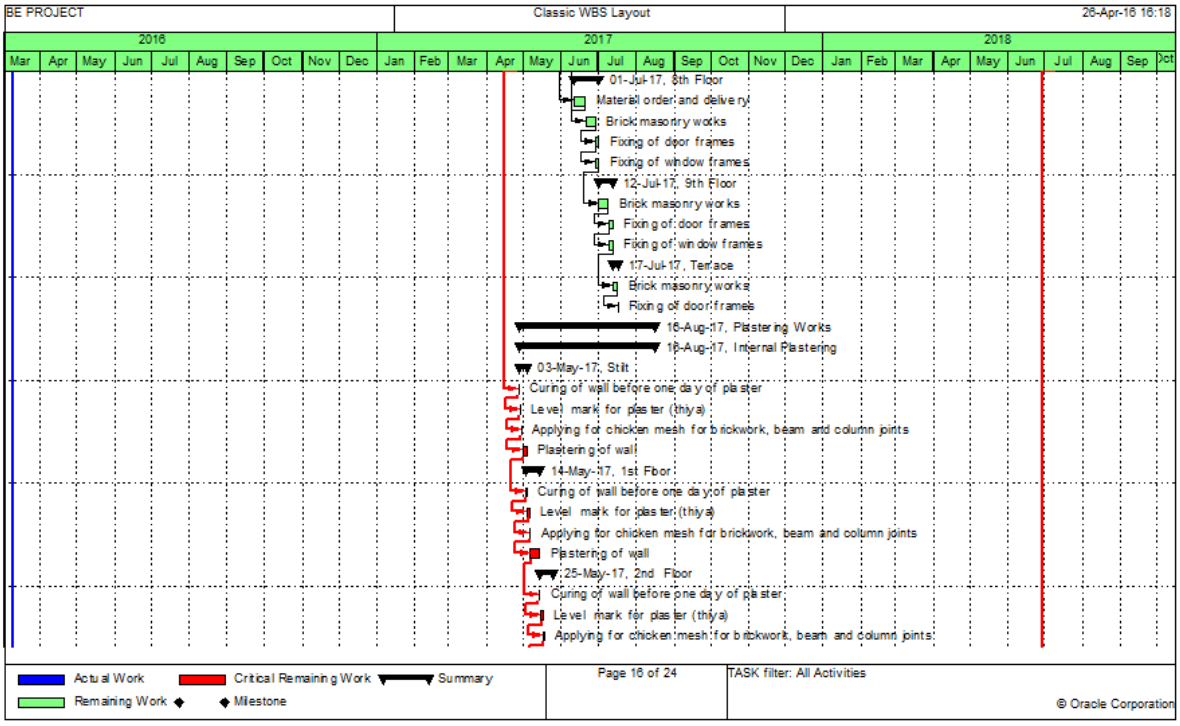

Fig. 4.16 Gantt Bar Chart of Project G + 9 storey structure

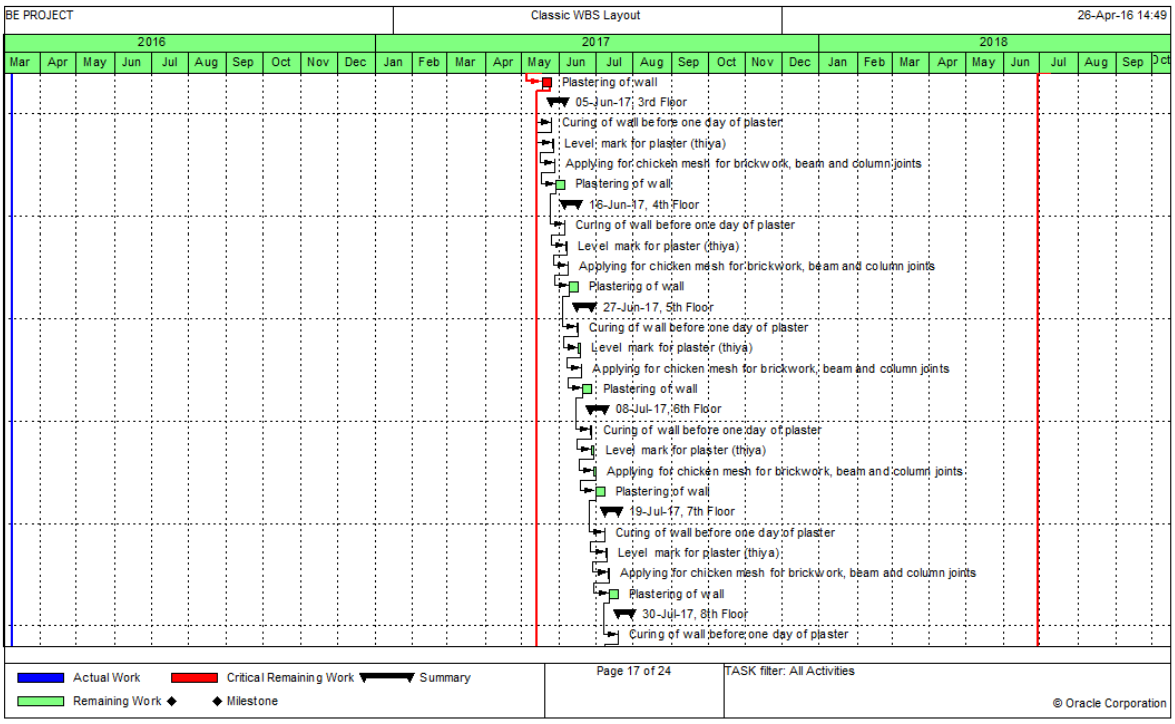

Fig. 4.17 Gantt Bar Chart of Project G + 9 storey structure

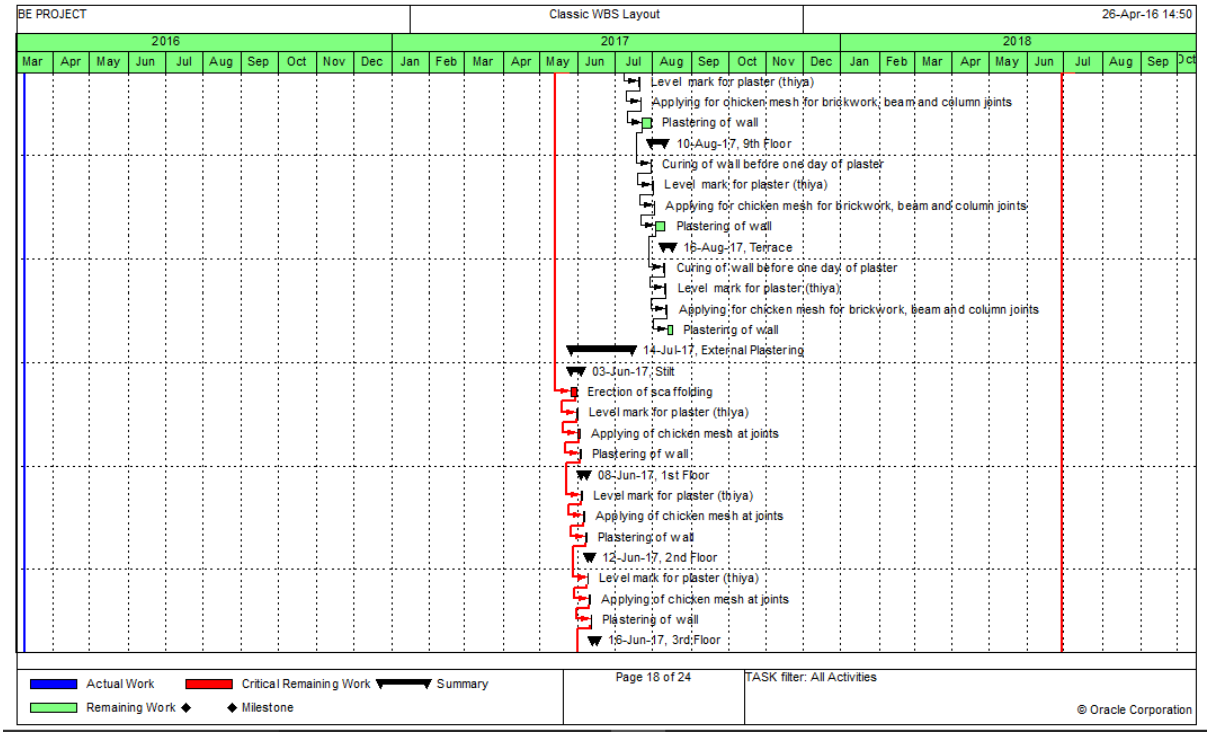

Fig. 4.18 Gantt Bar Chart of Project G + 9 storey structure

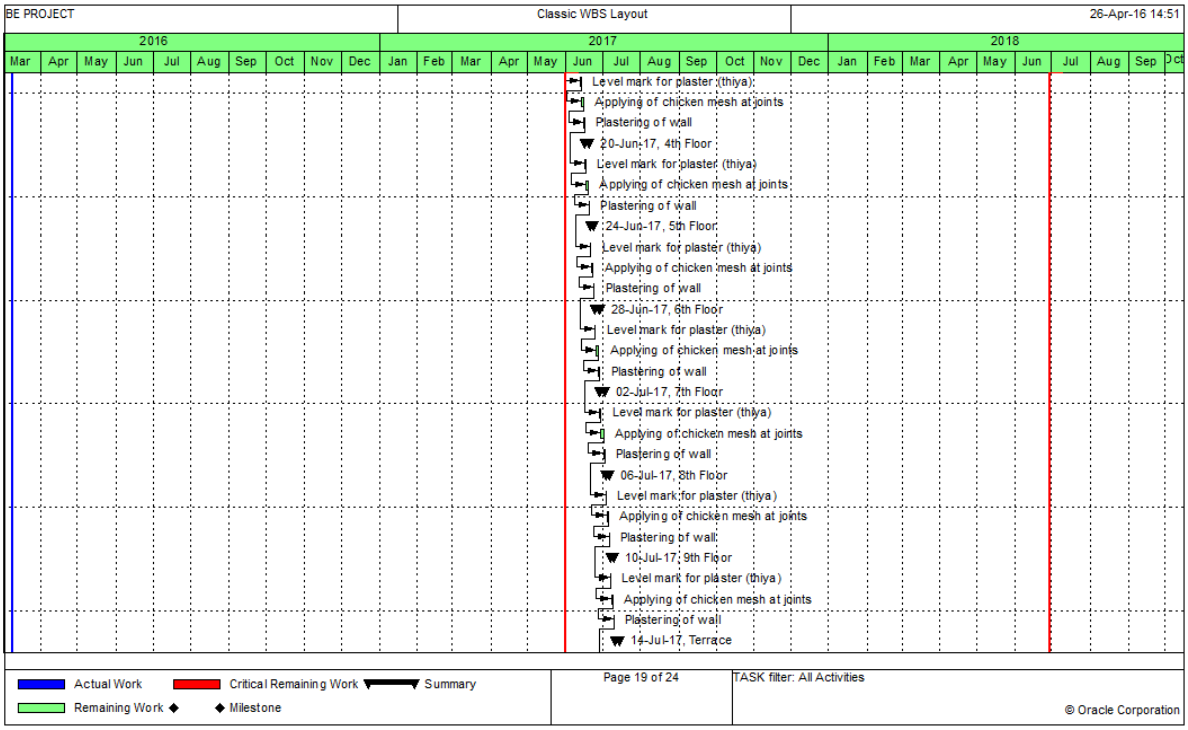

Fig. 4.19 Gantt Bar Chart of Project G + 9 storey structure

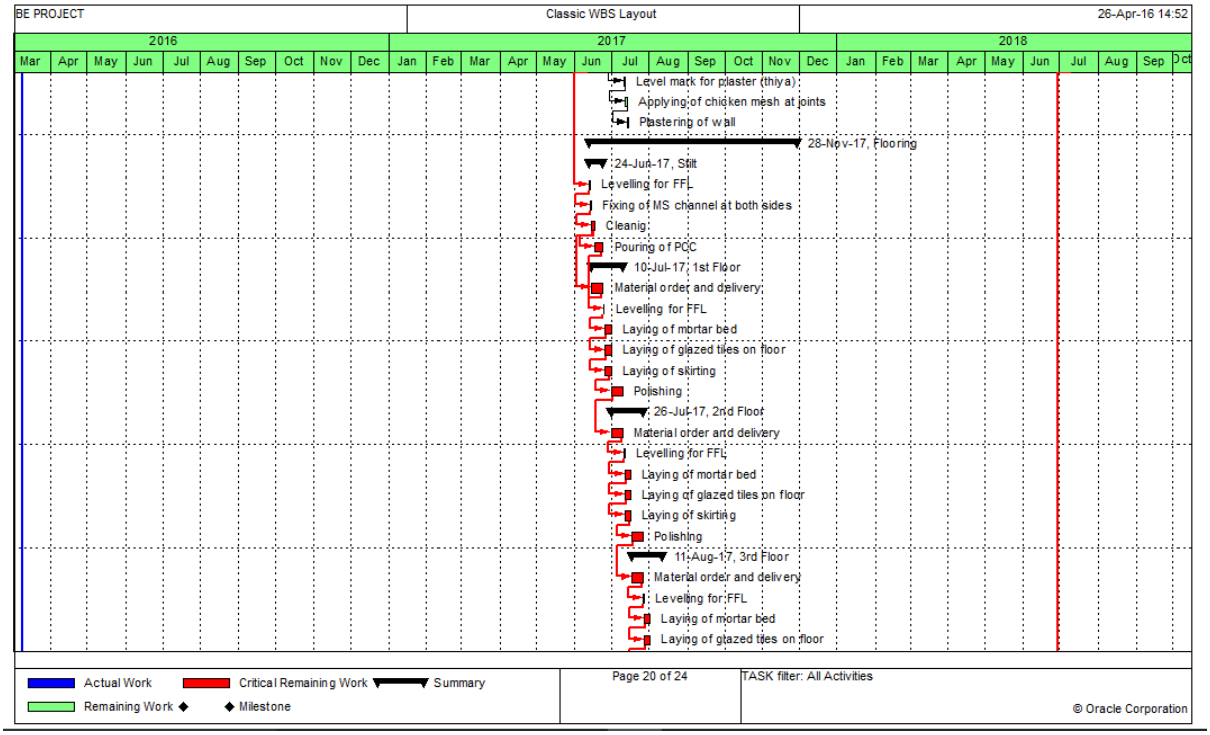

Fig. 4.20 Gantt Bar Chart of Project G + 9 storey structure

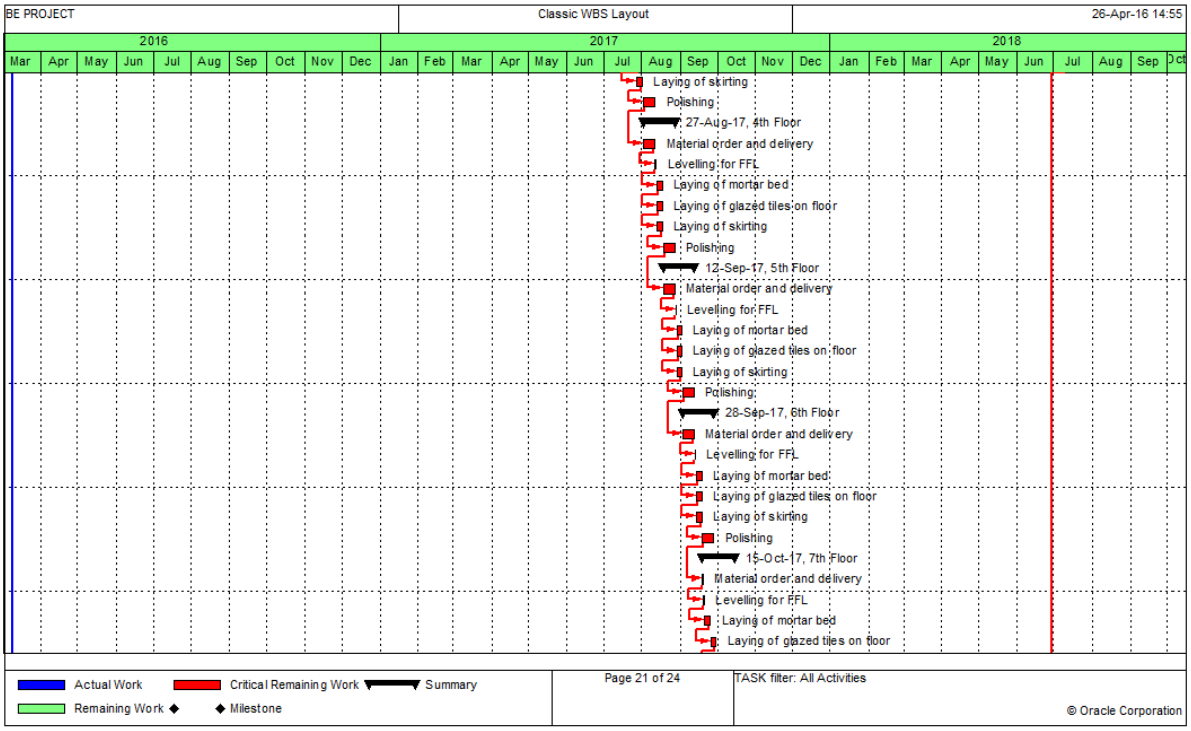

Fig. 4.21 Gantt Bar Chart of Project G + 9 storey structure

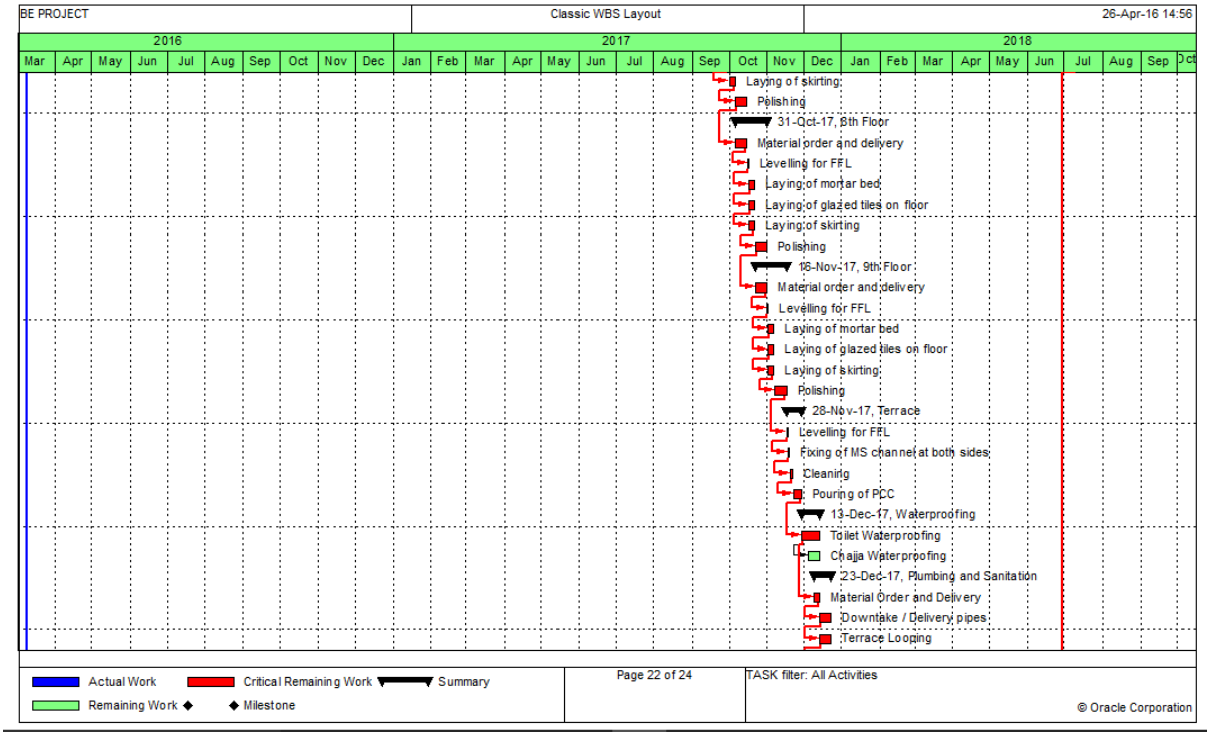

Fig. 4.22 Gantt Bar Chart of Project G + 9 storey structure

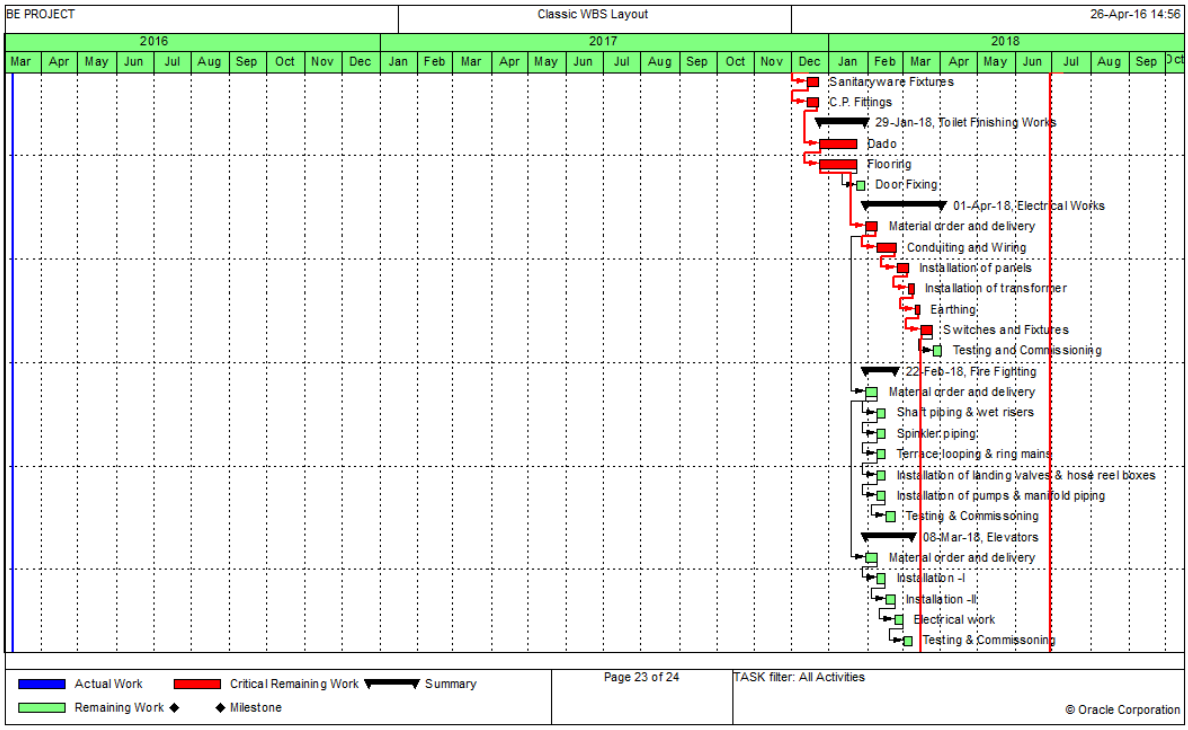

Fig. 4.23 Gantt Bar Chart of Project G + 9 storey structure

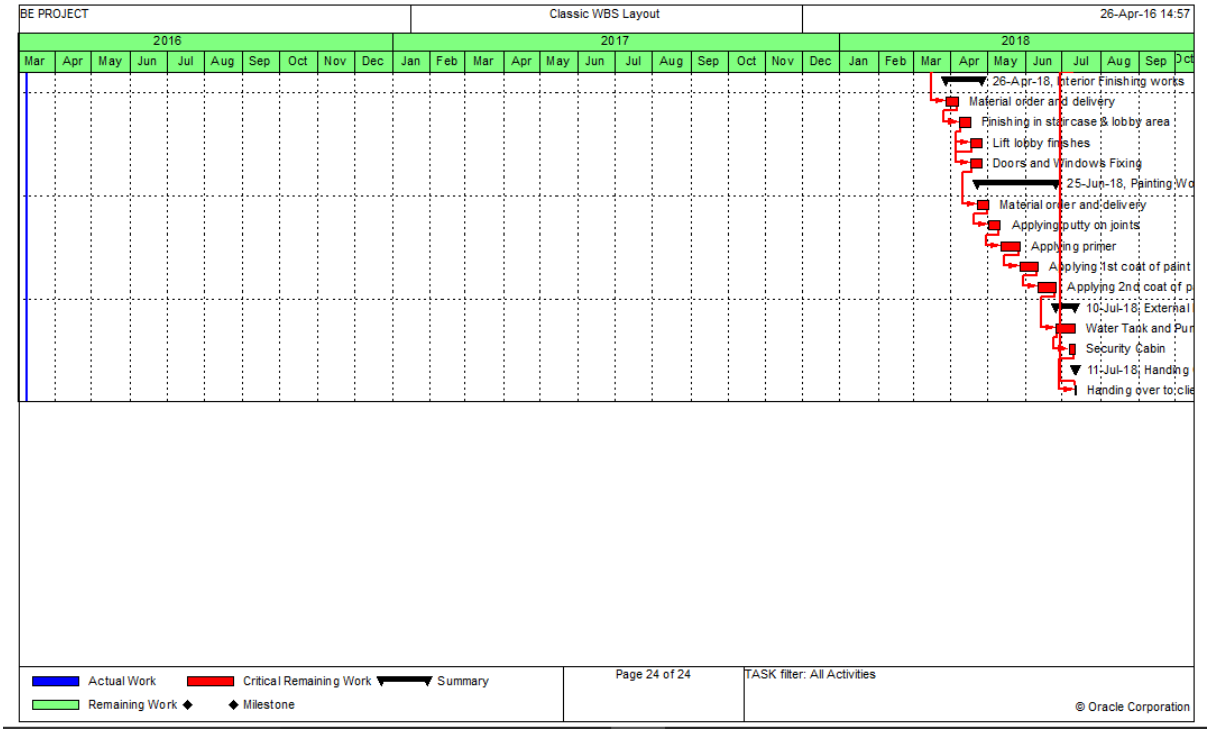

Fig. 4.24 Gantt Bar Chart of Project G + 9 storey structure

During the life of the project, actual progress is frequently compared with the original schedule. This allows for evaluation of development activities. The accuracy of planning process can also be assessed.

Basic efforts associated with the developing a project schedule including the following:

- Define the type of schedule
- Define precise and measurable milestone
- Estimate task duration
- Define priorities
- Define the critical path
- Documents assumption
- Identify risk
- Review result

The type of schedule associated with project relates the complexity of the implementation.
In project management, a schedule is a listing of a project's milestones, activities, and deliverables, usually with intended start and finish dates. Those items are often estimated by other information included in the project schedule of resource allocation, budget, task duration, and linkages of dependencies and scheduled events. A schedule is commonly used in the project planning and project portfolio management parts of project management. Elements on a schedule may be closely related to the work breakdown structure (WBS) terminal elements, the Statement of work, or a Contract Data Requirements List.

In many industries, such as engineering and construction, the development and maintenance of the project schedule is the responsibility of a full-time scheduler or team of schedulers, depending on the size of the project. Though the techniques of scheduling are well developed, they are inconsistently applied throughout industry. Standardization and promotion of scheduling best practices are being pursued by the Association for the Advancement of Cost Engineering (AACE), the Project Management Institute (PMI), and the US Government for acquisition and accounting purposes.

Establishing a project management schedule involves listing milestones, activities, and deliverables with intended start and finish dates, of which the scheduling of employees may be an element.

4.2 Relationship Types

Thus, if the start of one activity lags behind the start of another, or if one must lead the other by a period of time, these Construction scheduling is intended to give us an understanding of when activities are to start and finish so crews, materials, and equipment can be effectively managed to complete a project on time and on budget. Schedule logic indicates which activity or activities must be completed before another or others can start. Originally, Critical Path Method (CPM) schedules (Activity on Node (AON) and Activity on Arrow (AOA)) had only Finish-to-Start (FS) relationships. Construction scheduling software manufacturers responded to the need for flexibility in activity relationships in a schedule by creating features permitting construction schedulers to create much more than simple Finish-to-Start networks. Along with the typical Finish-to-Start relationship, other types of relationships (Start to- Start, Finish-to-Finish, and Start-to-Finish) are available to define the logic between work activities. In addition, these relationships may be customized to further define the relationship between the activities, known as lag or lead time.

Before we begin the discussion of Best Practices, let's define some of the basic types of activity relationships we will discuss:

• Finish-to-Start (FS):

A relationship between activities in which the start of a successor activity depends on the finish of its predecessor activity.

• Start-to-Start (SS)

A relationship between activities in which the start of a successor activity depends on the start of its predecessor.

• Finish-to-Finish (FF):

A relationship between activities in which the finish of a successor activity depends on the finish of its predecessor.

• Start-to-Finish (SF):

A relationship between activities in which a successor activity cannot completeuntil its predecessor starts.

• Lags (or Leads):

An offset or delay from an activity to its successor. A Lag can be positive or negative (from Primavera P3).

• Degree:

A positive or negative increment of the unit of time used in the schedule (also known as Lag).

The simplest of these relationships, is one in which one activity must be completed before the next one can begin. This is known as a Finish-to-Start (FS) relationship. In a simple, theoretical world, only Finish-to-Start relationships would be necessary.

For example, after footings are complete, structural steel can start and once the structural steel is complete, then the building envelope can proceed. Finally, when the envelope is complete, interior finishes can begin. However, this is not the manner in which projects are typically constructed. More typically, the schedule is developed to a level of detail that permits only FS relationships, nor is it typically feasible to do this. Scheduling mechanical, electrical, and plumbing trades (MEP) on an apartment building is typically done with a SS and lag to the next trade, with the activity defined to a floor or a reasonable number of units. If these trades were scheduled FS, then the detail would have to be far greater in order to allow the trades to perform their work within the contractual time, while not performing work in the same place as other trades. The use of only FS relationships has the potential to increase the number of activities to unmanageable levels. Lags and Leads may be used to customize the schedule logic. A Lag/Lead tie permits a scheduler to link activity relationships in a way that approximates the degree to which one activity must not be finished before another can start or the degree to which an activity should precede other relationships can be incorporated into the schedule. This means that the plumbing crew can have a SS relationship to the electrical crew, with a short lag to allow the electrical crew to follow the plumbing crew shortly after they start, instead of waiting for their completion. The use of Lag/Lead ties is a common software schedule feature used with various types of ties; however, caution must be used to avoid mistakes. One such mistake is the creation of non-overlapping Lags. This happens when a rough schedule is developed or a template is used where lags exist.

Chapter 5

Result and Discussion

The Report Wizard in Primavera P6 allows for the inclusion of detailed information about the schedule. This data can be organized in columns, which may then be further sorted and filtered. Both simple and complex filters may be created to display the activities of interest, such as Completed or In Progress activities.

In this chapter, we have generated logic report of our project. Its shows some of the reports generated in the project including the start and finish dates of the activities.

LG-01 Logic Report, By Project

User's Notes:

Activity ID	Activity Name	Early Start	Early Finish	Late Start	Late Finish
BE PROJECT					
A1000	Project Start	09-Mar-16	09-Mar-16	09-Mar-16	09-Mar-16
A1010	Project End	12-Jul-18	12-Jul-18	12-Jul-18	12-Jul-18
A1100	Marking boudaries	11-Mar-16	12-Mar-16	11-Mar-16	12-Mar-16
A1110	Surveying	13-Mar-16	15-Mar-16	13-Mar-16	15-Mar-16
A1120	Site office	16-Mar-16	16-Mar-16	16-Mar-16	16-Mar-16
A1130	Water arrangements	17-Mar-16	17-Mar-16	17-Mar-16	17-Mar-16
A1140	Electricity arrangements	17-Mar-16	17-Mar-16	17-Mar-16	17-Mar-16
A1150	Steel yards and godown	18-Mar-16	19-Mar-16	18-Mar-16	19-Mar-16
A1160	Main gate and fencing	18-Mar-16	19-Mar-16	18-Mar-16	19-Mar-16
A1190	Compaction of strata	30-Mar-16	03-Apr-16	30-Mar-16	03-Apr-16
A1200	Soling	04-Apr-16	08-Apr-16	04-Apr-16	08-Apr-16
A1210	Shuttering for PCC	09-Apr-16	11-Apr-16	09-Apr-16	11-Apr-16
A1220	Pouring of PCC	09-Apr-16	10-Apr-16	09-Apr-16	10-Apr-16
A1230	Deshuttering	11-Apr-16	11-Apr-16	11-Apr-16	11-Apr-16
A1250	Building line out	20-Mar-16	22-Mar-16	20-Mar-16	22-Mar-16
A1260	Excavation	23-Mar-16	29-Mar-16	23-Mar-16	29-Mar-16
A1280	Layout Marking	12-Apr-16	14-Apr-16	12-Apr-16	14-Apr-16
A1290	Laying of reinforcement	15-Apr-16	24-Apr-16	15-Apr-16	24-Apr-16
A1300	Shuttering for raft foundation	25-Apr-16	27-Apr-16	25-Apr-16	27-Apr-16
A1310	Pouring of concrete	28-Apr-16	29-Apr-16	28-Apr-16	29-Apr-16
A1320	Deshuttering	30-Apr-16	02-May-16	30-Apr-16	02-May-16
A13360	Brick masonry works	05-Apr-17	12-Apr-17	05-Apr-17	12-Apr-17
A13370	Fixing of door frames	13-Apr-17	15-Apr-17	13-Apr-17	15-Apr-17
A13380	Fixing of window frames	13-Apr-17	15-Apr-17	13-Apr-17	15-Apr-17
A13399	Material order and delivery	06-Apr-17	15-Apr-17	06-Apr-17	15-Apr-17
A1340	Markings for columns	03-May-16	03-May-16	03-May-16	03-May-16
A13400	Brick masonry works	16-Apr-17	23-Apr-17	16-Apr-17	23-Apr-17

Fig 5.1 Logic Report

BE PROJECT
Report Date 27-Apr-16 15:01

Project Start 09-Mar-16
Project Finish 12-Jul-18
Data Date 09-Mar-16

LG-01 Logic Report, By Project

User's Notes:

Activity ID	Activity Name	Early Start	Early Finish	Late Start	Late Finish
A13940	Plastering of wall	09-Jun-17	16-Jun-17	05-May-18	12-May-18
A13960	Curing of wall before one day of plaster	16-Jun-17	16-Jun-17	12-May-18	12-May-18
A13970	Level mark for plaster (thiya)	17-Jun-17	18-Jun-17	13-May-18	14-May-18
A13980	Applying for chicken mesh for brickwork, beam and column joints	19-Jun-17	19-Jun-17	15-May-18	15-May-18
A13990	Plastering of wall	20-Jun-17	27-Jun-17	16-May-18	23-May-18
A1400	Setting up level for plinth	24-May-16	24-May-16	24-May-16	24-May-16
A14010	Curing of wall before one day of plaster	27-Jun-17	27-Jun-17	23-May-18	23-May-18
A14020	Level mark for plaster (thiya)	28-Jun-17	29-Jun-17	24-May-18	25-May-18
A14030	Applying for chicken mesh for brickwork, beam and column joints	30-Jun-17	30-Jun-17	26-May-18	26-May-18
A14040	Plastering of wall	01-Jul-17	08-Jul-17	27-May-18	03-Jun-18
A14060	Curing of wall before one day of plaster	08-Jul-17	08-Jul-17	03-Jun-18	03-Jun-18
A14070	Level mark for plaster (thiya)	09-Jul-17	10-Jul-17	04-Jun-18	05-Jun-18
A14080	Applying for chicken mesh for brickwork, beam and column joints	11-Jul-17	11-Jul-17	06-Jun-18	06-Jun-18
A14090	Plastering of wall	12-Jul-17	19-Jul-17	07-Jun-18	14-Jun-18
A1410	Plinth beam bottom shuttering	25-May-16	29-May-16	25-May-16	29-May-16
A14110	Curing of wall before one day of plaster	19-Jul-17	19-Jul-17	14-Jun-18	14-Jun-18
A14120	Level mark for plaster (thiya)	20-Jul-17	21-Jul-17	15-Jun-18	16-Jun-18
A14130	Applying for chicken mesh for brickwork, beam and column joints	22-Jul-17	22-Jul-17	17-Jun-18	17-Jun-18
A14140	Plastering of wall	23-Jul-17	30-Jul-17	18-Jun-18	25-Jun-18
A14160	Curing of wall before one day of plaster	30-Jul-17	30-Jul-17	25-Jun-18	25-Jun-18
A14170	Level mark for plaster (thiya)	31-Jul-17	01-Aug-17	26-Jun-18	27-Jun-18
A14180	Applying for chicken mesh for brickwork, beam and column joints	02-Aug-17	02-Aug-17	28-Jun-18	28-Jun-18
A14190	Plastering of wall	03-Aug-17	10-Aug-17	29-Jun-18	06-Jul-18

Fig 5.2 Logic Report

BE PROJECT
Report Date 27-Apr-16 15:04

Project Start 09-Mar-16
Project Finish 12-Jul-18
Data Date 09-Mar-16

LG-01 Logic Report, By Project

User's Notes:

Activity ID	Activity Name	Early Start	Early Finish	Late Start	Late Finish
A15410	Applying putty on joints	02-May-18	11-May-18	02-May-18	11-May-18
A15420	Applying primer	12-May-18	26-May-18	12-May-18	26-May-18
A15430	Applying 1st coat of paint	27-May-18	10-Jun-18	27-May-18	10-Jun-18
A15440	Applying 2nd coat of paint	11-Jun-18	25-Jun-18	11-Jun-18	25-Jun-18
A15450	Handing over to client	11-Jul-18	11-Jul-18	11-Jul-18	11-Jul-18
A15459	Material order and delivery	01-Jul-17	10-Jul-17	01-Jul-17	10-Jul-17
A15460	Levelling for FFL	11-Jul-17	11-Jul-17	11-Jul-17	11-Jul-17
A15470	Laying of mortar bed	12-Jul-17	16-Jul-17	12-Jul-17	16-Jul-17
A15480	Laying of glazed tiles on floor	12-Jul-17	16-Jul-17	12-Jul-17	16-Jul-17
A15490	Laying of skirting	12-Jul-17	16-Jul-17	12-Jul-17	16-Jul-17
A15500	Polishing	17-Jul-17	26-Jul-17	17-Jul-17	26-Jul-17
A15509	Material order and delivery	17-Jul-17	26-Jul-17	17-Jul-17	26-Jul-17
A15510	Levelling for FFL	27-Jul-17	27-Jul-17	27-Jul-17	27-Jul-17
A15520	Laying of mortar bed	28-Jul-17	01-Aug-17	28-Jul-17	01-Aug-17
A15530	Laying of glazed tiles on floor	28-Jul-17	01-Aug-17	28-Jul-17	01-Aug-17
A15540	Laying of skirting	28-Jul-17	01-Aug-17	28-Jul-17	01-Aug-17
A15550	Polishing	02-Aug-17	11-Aug-17	02-Aug-17	11-Aug-17
A15559	Material order and delivery	02-Aug-17	11-Aug-17	02-Aug-17	11-Aug-17
A15560	Levelling for FFL	12-Aug-17	12-Aug-17	12-Aug-17	12-Aug-17
A15570	Laying of mortar bed	13-Aug-17	17-Aug-17	13-Aug-17	17-Aug-17
A15580	Laying of glazed tiles on floor	13-Aug-17	17-Aug-17	13-Aug-17	17-Aug-17
A1559	Binding and placing of staircase reinforcement	02-Jul-16	02-Jul-16	02-Jul-16	02-Jul-16
A15590	Laying of skirting	13-Aug-17	17-Aug-17	13-Aug-17	17-Aug-17
A1560	Shuttering for staircase	03-Jul-16	03-Jul-16	03-Jul-16	03-Jul-16
A15600	Polishing	18-Aug-17	27-Aug-17	18-Aug-17	27-Aug-17
A15609	Material order and delivery	18-Aug-17	27-Aug-17	18-Aug-17	27-Aug-17
A15610	Levelling for FFL	28-Aug-17	28-Aug-17	28-Aug-17	28-Aug-17

Fig.5.3 Logic Report

BE PROJECT
Report Date 27-Apr-16 15:02

Project Start 09-Mar-16
Project Finish 12-Jul-1
Data Date 09-Mar-16

LG-01 Logic Report, By Project

User's Notes:

Activity ID	Activity Name	Early Start	Early Finish	Late Start	Late Finish
A6510	Dado	24-Dec-17	22-Jan-18	24-Dec-17	22-Jan-18
A6520	Flooring	24-Dec-17	22-Jan-18	24-Dec-17	22-Jan-18
A6530	Door Fixing	23-Jan-18	29-Jan-18	06-Jul-18	12-Jul-18
A6539	Material order and delivery	30-Jan-18	08-Feb-18	30-Jan-18	08-Feb-18
A6540	Conduiting and Wiring	09-Feb-18	23-Feb-18	09-Feb-18	23-Feb-18
A6560	Installation of panels	24-Feb-18	05-Mar-18	24-Feb-18	05-Mar-18
A6570	Installation of transformer	06-Mar-18	10-Mar-18	06-Mar-18	10-Mar-18
A6590	Earthing	11-Mar-18	15-Mar-18	11-Mar-18	15-Mar-18
A6600	Switches and Fixtures	16-Mar-18	25-Mar-18	16-Mar-18	25-Mar-18
A6610	Testing and Commissioning	26-Mar-18	01-Apr-18	06-Jul-18	12-Jul-18
A6729	Material order and delivery	30-Jan-18	08-Feb-18	05-Jun-18	14-Jun-18
A6730	Shaft piping & wet risers	09-Feb-18	15-Feb-18	29-Jun-18	05-Jul-18
A6740	Spinkler piping	09-Feb-18	15-Feb-18	29-Jun-18	05-Jul-18
A6750	Terrace looping & ring mains	09-Feb-18	15-Feb-18	29-Jun-18	05-Jul-18
A6760	Installation of landing valves & hose reel boxes	09-Feb-18	15-Feb-18	29-Jun-18	05-Jul-18
A6770	Installation of pumps & manifold	09-Feb-18	15-Feb-18	29-Jun-18	05-Jul-18
A6780	Testing & Commissoning	16-Feb-18	22-Feb-18	06-Jul-18	12-Jul-18
A6789	Material order and delivery	30-Jan-18	08-Feb-18	05-Jun-18	14-Jun-18
A6790	Installation - I	09-Feb-18	15-Feb-18	15-Jun-18	21-Jun-18
A6800	Installation - II	16-Feb-18	22-Feb-18	22-Jun-18	28-Jun-18
A6810	Electrical work	23-Feb-18	01-Mar-18	29-Jun-18	05-Jul-18
A6820	Testing & Commissoning	02-Mar-18	08-Mar-18	06-Jul-18	12-Jul-18
A6829	Material order and delivery	28-Mar-18	06-Apr-18	28-Mar-18	06-Apr-18
A6830	Finishing in staircase & lobby area	07-Apr-18	16-Apr-18	07-Apr-18	16-Apr-18
A6850	Lift lobby finishes	17-Apr-18	26-Apr-18	17-Apr-18	26-Apr-18
A6860	Doors and Windows Fixing	17-Apr-18	26-Apr-18	17-Apr-18	26-Apr-18
A6890	Material order and delivery	11-Mar-16	30-Mar-16	11-Mar-16	30-Mar-16

Fig 5.4 Logic Report

Chapter 6

Conclusion

Primavera serves as an effective tool for generating Gantt chart for the schedule of a High Rise construction. With the help of Primavera a scheduler can:

- Effectively link all the activities involved in the construction of the project.
- Determine the total duration required for the construction of the different phases involved.
- Determine the Critical Path of the schedule of the project.
- Determine the total float generated due to interdependence of activities.
- Keep a track of the scheduled and the on-site construction.
- Assign the resources in a manner that expenses and time duration and shortened and the project proves economical.

Chapter 7

Scope of Future Study

- Estimation of quantities of material like concrete, steel, bricks, paints, tiling, and sanitary fixtures can be determined according to the given plan.
- Estimation of the required manpower and machinery can be carried out for further ease in scheduling.
- Keeping the resource as time as a constraint, manpower, machinery, and money can be optimized so as to achieve a quality product that is also economical.
- Through Primavera, Resource Allocation and Resource leveling techniques can be applied for calculating the total budget of the project.

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