This is to certify that the thesis titled

ESTIMATION AND SCEDULING OF NEW SECRETARIAT BLOCK AT CONSTITUTION AVENUE, ISLAMABAD, PAKISTAN

Submitted
By

Fatima Nayyar (Group Leader)	**2009-NUST-BE-CE-159**
Syeda Zainab Azam	**2009-NUST-BE-CE-158**
Syed Ali Miqdad Shah	**2009-NUST-BE-CE-127**
Arslan Taj	**2009-NUST-BE-CE-017**
Ahsan Pervaiz	**2009-NUST-BE-CE-007**

Has been accepted towards the partial fulfillment
of the requirements for the degree
of

Bachelors of Civil Engineering

Supervisor_____

(Assistant professor Zia Ud Din)

Professor of Construction Engineering and Management,
NUST Institute of Transportation,
School of Civil and Environmental Engineering,
National Institute of Science and Technology (NUST).

Dedicated to our parents and teachers

ACKNOWLEDGEMENTS

First of all, we thank to Almighty Allah who gave us ability and courage to complete this challenging task. Our heartiest gratitude to Assistant professor Zia Ud Din (Project supervisor) for guidance, encouragement and criticism that is responsible for successful completion of our Final year project. We are also thankful to Dr. Rafiq Muhammad Choudhry (Head of Deapartment) and Engineer Khuwaja Mateen for providing us encouragement and all possible assistance during the studies. We are extremely thankful too all senior members of the staff for sharing their intellectual ideas with us which proved very helpful during our studies. Never the less the cooperation of lower staff is worth mentioning as they provided their full support at every stage of our thesis.

We will eternity be appreciative to the Resident Engineer of New Secretariat Block senior Engineer Syed Shuja Safdar Gardezi, Site Engineer of new Secretariat Block senior Engineer Mohammad Akeel Rabbani, and site officer Mr. Syed Nakmoalfarh not just for furnishing us information needed for finishing our undertaking and also assisting in comprehension it. We acknowledge their backing and we are obligated to them for their assistance.

Table of Contents

TABLE OF FIGURES

LIST OF TABLES

ABSTRACT

Construction project are required to be completed within allocated budget and time. Therefore exact estimation is required. In any construction project time, cost and quality are considered as main objectives. If a project is delayed then more financing will be required hence time and cost are interrelated.

Estimation is done through engineering and architectural drawings. Building construction estimating is the determination of practical development expenses of any given task. It is finished with the assistance of working drawings.
Whereas scheduling is part of project planning. It is the most critical go in arranging procedure of the development undertaking.

This project is on the scheduling of a construction building. The project building site is New Secretariat Block which is being under construction since 2007 and it is expected that this building will complete in 2013.

The basic purpose behind the construction of new secretariat block is to accommodate all the scattered ministries which were early accommodated in rented offices. When this building will come in functional mode, this will surely save the finance of the government which now a days is being utilized in rents of ministries offices. The New Secretariat Block located on Constitution Avenue, Islamabad, is a 9 storied building with two basements. The total cost of the project was **Rs.127,020,3220** according to the estimate and schedule we made**,** and it also includes the cost of electrical work and plumbing work along with 15% overhead charges and 10% contractor's bonus.

Chapter 1

INTRODUCTION

In this present reality we, as task managers, are given the completion date of the undertaking before we even have an opportunity to get ready for it. This is a sufficient excuse for why we have to improve at booking our activities and leveling our limited assets. New secretariat building is being developed on state of art design, based on modern architectural concepts and carefully selected materials. It is not only a prestigious building and priceless addition to the national assets but is also a source of uplift to the cityscape of Federal capital. The building and its completion will house the offices of the top most authorities of the Government including the Ministries and Secretaries. Furthermore, it will frequently be visited by important National and International personalities and other delegates. Keeping in view such high profile of the project, best effort has been made to equip the building with the most updated and durable architectural features, engineering practices, efficient equipment and reliable technology. In the quest to achieve the highest level of satisfaction of the end users, the architectural finishes have been accommodated to be most durable, reliable and aesthetically excellent.

VIEW 1

VIEW 2

Figure 1.1 Main Hall of the 2nd Floor

1.1 PROJECT OBJECTIVES

Project is remarkable and unique in nature which can either be an administration or item. The result of an undertaking can either be a product or good. It is a solitary time action (Conway, Maxwell et al. 2003).

The target of the project is to create an approach that over the enduring will decrease reactive support, to minimize the disorder and productivity misfortunes coming about because of

detaches with the preparation agenda, necessity updates, crisis function, and unanticipated part blackouts and to get more work finished with fewer individuals (Woolf 2007).

Although time is often considered as the dominant scheduling objective, objectives of our project are

i. To estimate the quantities of work.
ii. To estimate the cost of work.
iii. To calculate duration of activities.
iv. To estimate the total project duration using Critical Path Method (CPM).

1.2 AREA OF APPLICATION

Planning issues are discovered in a great deal of requisition areas. As a rule, booking arrangements with the temporal duty of exercises to constrained assets where a constructed to uphold the clients in performing their planning undertakings. The frameworks incorporate booking learning and also presentation and database parts (Conway, Maxwell et al. 2003).

It prompts free asset limits for future ventures. It likewise lessens danger of abusing a due date by and large high punishment cost happens if an activity is not finished by the due date. Additionally acknowledging particularly assembling and development ventures an early undertaking close is attractive on the grounds that an impressive divide of installment is normally made on the finishing of activity.

Later years have seen a huge expand in exploration on asset compelled activity planning this lead to advancement of numerous new displaying ideas and additionally booking calculations (Conway, Maxwell et al. 2003).
Schedules underpin project managers in arranging and planning the undertakings well as regulating it throughout its acknowledgement. The main area of application behind this project of construction building scheduling is to show the project manager

i. Precisely where the work stands and where it should stand.
ii. When delays occur what must be done to offset them.
iii. The cost of correcting delays, compared to the cost of drag out that will otherwise accrue.
iv. The effect of delays and difficulties which occur on project completion, start up, production and owner’s return on investment (Conway, Maxwell et al. 2003).

Figure 1.2(a) Laborer working at site

1.2 ADVANTAGES OF THE PROJECT

Project has numerous points of interest like it satisfies your reason in the type of product or service. It safeguards cash. One an opportunity execution cost and flat operational expense. Undertaking will return its worth throughout payback period. It gives more vocation. It serves the country (Callahan, Quackenbush et al. 1992; Kerzner 2009).

Scheduling of the new Secretariat Block is a compelling and glorious medium for catching information. This Project expedites consistence with conglomeration strategies and methodology. The Project which is booking of New Secretariat Block gives an essential enter into danger distinguishing proof whatsoever phases of the task lifecycle. It lessens the enterprise needed to examine change sways. It expedites venture and vast asset arranging. The point antiquated of new secretariat piece was to suit all services which were long ago utilizing leased places to suit under a solitary top.

Around then we look at the tracks to lessen the general length of an assignment the modest view is to hurl more stakes at it. Without an exact timetable it is testing to assess the timetable, stake and require suggestions of a basic undertaking change. Not simply can a docket improve the way of impact dismemberment; it furthermore outfits a system for reproducing the impacts of notable philosophies to a proposed change (Willis 1986).

This project will serve in many ways. As mentioned earlier this project will accommodate all the scattered ministries under one roof. So by this project government will save finance which currently government is spending on the rents of offices of various ministries. Currently this project is providing jobs vacancy for many people including labor, contractor and engineers. This project will be a successful project on completion.

Figure 1.3(a) The central view of the building from lobby

1.3.1 Educational Outcomes

Following are the educational outcomes of this project.

i. It will help learning real construction project environment.
ii. It will serve as real life project example for the application of the scheduling.
iii. It will enable us in learning estimation, which is an essential part of scheduling.
iv. It helps us in finding cost of resources.

Following picture was taken at site during our site visit

Figure 1.3(b**)** The central view of the building

Chapter 2

REVIEW OF LITERATURE

2.1 DEFINITION

Scheduling is part of project planning. It is the most critical go in arranging procedure of the development undertaking. Scheduling could be outlined as the methodology of changing over a general or layout get ready for an activity into a period based realistic presentation given informative data on accessible assets and time demands. The individual who does the booking is reputed to be scheduler or an activity supervisor. The undertaking calendar gives a graphical representation of expected errands, turning points, conditions, asset necessities, undertaking span and due dates**.**(Mubarak 2010),**(**Conway, Maxwell et al. 2003)

2.2 STEPS REQUIRED TO SCHEDULE A PROJECT

For the planning, execution and completion of the project by using CPM following steps are required which are discussed as under.

2.2.1 Determine Work Activities

Any project regardless of how extensive or minor must be partitioned into littler elements called exercises or errands. There is no categorical break down of exercises. We can do it by two routes, either by limiting the amount of exercises for the straightforwardness of the activity or by separating the undertaking into little activities.

2.2.2 Determining Activities Duration

Techniques for estimating activity duration vary from one situation to another situation depending upon type of work, estimators and other factors. Most activity duration can be estimated as follows.

Duration = total quantity/crew productivity

The scheduler must be aware of nonworking days and working days also he should think as of them in the schedule. In spite of the fact that the work day is the regularly utilized schedule unit as a part of development project, different units of time, for example hour, week or month are not unimaginable.

2.2.3 Determine Logical Relationships

This step is a specialized matter. Scheduler might as well get this qualified information from venture bosses and specialized colleagues. Also these relationships must not be befuddled with stipulations.

A sensible relationship exists between two exercises when the begin of one action physically relies on the completion of other movement, though an asset demand is one when you hypothetically do two undertakings in the meantime in view of constrained assets.

2.2.4 Draw Logical Network and Perform CPM Calculations

Assuming that you are utilizing a computer software it will perform all capacities for you, gave that you have information the right information. In this step you will acquire ascertained fulfill date of activity, the basic way and the accessible buoy for all noncritical exercises. It is vital to check enter and yield and not to depend totally on programming.

2.2.5 Review and Analyze the Schedule

In this step we review the logic and make sure that every activity has correct predecessors and no redundant relationships are present. Moreover we look for any missing relationship and wrong relationship.

2.2.6 Implement the Schedule

Implementing the schedule implies taking the docket from paper to execution. This step is vital for the satisfaction of calendar. The scheduler must pick begin and fulfill dates inside extent of computed dates.

2.2.7 Monitor and Control the Schedule

Project control means comparing the baseline with what has really done, investigating any deviation from standard, and initiating remedial movement whenever and where ever needed. Following incorporates watching and reporting and maybe examining. Control adds remedial activity to following. Just the gathering who is executing has the ability to control.

2.3 NEED OF SCHEDULING

Schedule is prepared by the contractor for their own particular straightforwardness. The agenda aides the builder in auspicious culmination of their activity. Lineup is a mixture of exercises, breakthroughs and dates. The point when the customer outlines his/her date of fruition of activity, and the plan of the activity, the foreman plans the calendar for the opportune finish of the undertaking and refraining for any postponement cases.
Arranging and booking of a task serves as an adequate route of forestalling the issues. It can recover the postponements in the work which is a major explanation for questions in the

undertaking finish and additionally take overwhelm, these prompts numerous legitimate questions. The point when a task is opportune done, it might not make the decrease in gainfulness and laborer's assurance (Plotnick, O'Brien et al. 2009).

Here and there if the activity is of a modest scale, it may not require a schedule. Be that as it may if the undertaking chief is taking care of numerous little scale ventures at a same time, then there is a propensity for the activity director for some defer in any venture if he/she doesn't operates everything on time. At that point booking of the aforementioned minor projects comes to be exceptionally vital.

To administer various minor ventures, the activity boss must improve plan and plan that incorporates all ventures for which he/she is allotted to. In major ventures, the venture administrator or project manager is normally appointed to single undertaking. The task supervisor is instructed to plan the docket and generally essentially it includes far reaching conveyances with allies to guarantee that work is advancing in enduring and uninterrupted way (Conway, Maxwell et al. 2003).

Despite the extent of the activity, planning is an imperative venture in arranging. Yet before planning there is a different noteworthy step which is amount take-off. This is finished under the estimation of material utilized as a part of the constructing.

2.4 ESTIMATION OF THE CONSTRUCTION PROJECT

2.4.1 Introduction

Building construction estimating is the determination of practical development expenses of any given task. It is finished with the assistance of working drawings. The working drawings hold the qualified information observing the configuration, area, measurements and development of venture. Plus working drawings, there is a different paramount archive called activity manual. Venture manual is the composed upgrade to drawings and hold informative content concerning the materials and workmanship.

The amounts of the material evaluated are utilized to request and buy them. So the appraisal must hold the much qualified data to stay away from any issue in future.

There are numerous sorts of evaluations which are ready consistent with the prerequisites.

2.4.2 Types of estimates

The level of accuracy required in estimation decides the type of estimate to be used. The different estimating techniques are as follows.

2.4.2.1 Detailed Estimate

The detailed estimate comprises determination of amounts and cost of everything that is crucial to finish the activity. This incorporates materials, gear, protections, work, securities and overhead, and additionally the assessment for benefit. The detailed assessment must build the assessed amounts and expenses of materials, the time needed for and expenses of work, the gear needed and its cost, the rate of benefit sought, acknowledging the venture, the time to finish and the multifaceted nature of venture.

2.4.2.2 Assembly Estimate

In assembly estimating, the distinct segments are gathered reputed to be get-togethers. Hence entire activity is isolated into assemblies. This strategy is less exact and dependent upon expansive presumptions. It is normally completed at preparatory phase of venture simply to have harsh thought for the expense of the undertaking.

2.4.2.3 Square-Foot Estimates

Square-foot estimates are ready by multiplying the square footage of the constructing by an expense for every square-foot then after that modifying the cost to remunerate for distinctions in the manufacturing statures, length of raising border, and other raising segments.

2.4.2.4 Parametric Estimates

Parametric estimates use equations that express that factual relationship between constructing parameters and the expense of the manufacturing. The constructing parameters utilized as a part of comparisons incorporate terrible square footage, number of floors, length of edge, rate of the fabricating that is regular space.

2.4.2.5 Model Estimating

Model estimating uses computer models to prepare an estimate based on number of questions answered by the estimator. It is similar to assembly estimating but requires less input.

2.5 A BRIEF HISTORY OF PROJECT SCHEDULING

2.5.1 Introduction

The present day project administration was advanced as an immediate concern of the requirement to make adequate utilization of the information processed by the activity organizers and schedulers to make an endeavor to maintain and control the basic way and costs which are included in an activity of projects (Hinze 2004).

2.5.2 In The Beginning

In late 1956 Kelly and Walker started chipping away at and advancing the calculations that turned into the 'activity-on-Arrow' booking methodology. The system they advanced was utilized within trials on plant conclusions in 1957 and their first paper on Critical Path Scheduling (Cps)

was distributed in March 1959. The Pert (Project Evaluation and Review Technique) framework was created at around the same time however slacked Cps by 6 to 12 months (despite the fact that the term 'critical path' was created by the Pert group). Later Dr. John Fondahl advanced the Precedence approach in 1961 as a 'non-computer' which is a substitute to Cps. The advancement of present day venture administration is an immediate consequence of the requirement to make viable utilization of the information which is being produced by the schedulers keeping in mind the end goal to make an endeavor to maintain and control the discriminating way (Pinedo 2012).

The development of booking nearly followed the change of machines. The introductory frameworks were perplexing mainframe, ordinarily taking another scheduler numerous months to figure out how to utilize. These frameworks moved to the 'mini workstations' of the 1970s and 80s yet remained unreasonable, supporting the boundless utilization of manual planning practices, with just the bigger (or more complex) conglomerations having the capacity to bear the cost of a centermost planning office and the supporting machine frameworks.

The coming of the "microcomputer" have altered the booking unendingly. The development of microcomputer based booking had moved the undertaking controls from an environment where a talented scheduler can work exorbitant frameworks to verify the booking was "correct" (and the conglomeration "possessed" the information) to a scenario where anybody could figure out how to guide a planning programming bundle (Wickwire2003).

2.5.3 The History of Scheduling Tools

2.5.3.1 Program Evaluation and Review Technique and Associated Systems

Program Evaluation and Review Technique (PERT) was established by the US Navy Special Projects Office, Bureau of Ordnance (SPO). Kelly and Walker utilized the name 'main chain' for the longest way through their agenda which is reputed to be basic way on which the span of undertaking rests on. Principle chain or discriminating way chooses the sum length of time of the undertaking (Pinedo 2012).

2.5.3.3 The Precedence Diagramming Method (PDM)

PDM is priority graphing system. It could be finished by either movement on bolt or action on junction. This depicted the PDM arrangement of booking and it is almost always offered as an adequate manual methodology to evade the unreasonable workstation based CPM (Critical Path Method) framework (Nyman and Levitt 2001).

2.5.4 The Impact of the Tools on Professional Schedulers

2.5.4.1 Mainframe days

Through to the early 1980s, to make an activity agenda the procedures utilize either of these.

i. A smaller than usual or mainframe machine framework like particular workstations.

ii. Drew and figured agendas physically that is doing it with hands and performing all the estimations on a paper.

Schedulers were prepared through a methodology of coaching; it require an excess of and took excessively long to alter issues initiated by naiveté of schedulers as planning is the spine of any activity. The aftereffect of this coaching was the advancement of an aggregation of activity schedulers who are gifted in both the symbolization and exploration of planning (Neeraj and Jha).

Inside an organization, the planning branches guarantees that the booking techniques were institutionalized and the timetable information was vastly "possessed" by the conglomeration itself. Furthermore, the yearning of expert schedulers to trade qualified data and improve their abilities might seem to have been the establishment for the advancement of 'modern venture management'. Also trading of qualified data can expand schedulers information in the vicinity of a venture, he can see it from a broader outlook simultaneously (Hinze 2004).

2.5.5 Personal Computer Systems

2.5.5.1 Micro Planning International Ltd

Microcomputers like desktops and particular PCs were raised in the late 1970s, machines such as the Commodore and Atari were at first pointed at the devotee schedulers. Nonetheless, toward the conclusion of the 1970s microcomputers were beginning to make their vicinity felt in the business. One of the guides in the business market around then was Apple Computer. Micro Planning Services in the UK improved the first business planning programming for this class of machine. Running on the Apple II Micro Planner v1.0 was discharged in 1980 14 months later advancement

2.5.5.2 Primavera

Primavera was founded in May 1983 by: Dick Faris, Joel Koppelman and Les Seskin. Who kept tabs on the then "standard" Dos working framework, Primavera shot to unmistakable quality with the arrival of a 10,000 action fit framework in the late 1980s and has since then offered an unfaltering stream of inventive advancements in it with the entry of time. Primavera is a client neighborly programming and can perform the CPM counts quite effectively and viably in a shorter time. Scheduler just enters the exercises in it and includes all the needed qualified

information incorporating logic, requirements and assets. It can make the agenda inside no time demonstrating all work breaks down structure and capable supervisors behind every movement.

2.6 TECHNIQUES FOR SCHEDULING

The procedure utilized for project scheduling is reliant upon the activity's size, multifaceted nature, span, and work force and holder prerequisites. The system picked by the venture supervisor to be utilized must be modest to utilize and is effortlessly deciphered by all activity members. As a rule there are two systems that are utilized: the bar chart (Gantt chart) and the critical path method (CPM/ Network Analysis System)(James Jerome and Plotnick 2006).

In the bar chart (Gantt chart), the activities are plotted on time scale diagram. It is not difficult to decipher and the staff will comprehend it effortlessly. Anyway the disservice of this system is that it is extremely troublesome to upgrade as it doesn't indicate relationships of exercises, and doesn't join costs or assets with the calendar. It is a successful method for the general task booking, however has restricted requisition for the portion development function (Popescu and Charoenngam 1995).

The critical path method requires more enterprise than the Gantt outline. For a successful task arranging, it is obliged to have detailed informative content which is given by the basic way system. In CPM, the exercises are graphically stood for in system structure with the beginning and finishing date of the movement on the action box.

There are two methods of drawing CPM diagrams: the arrow diagram (sometimes called activity on arrow) and the precedence diagram (sometimes called activity on node)(Hajdu 1996).

2.6.1 The Difference between Construction Project Scheduling and Daily Scheduling

Construction project scheduling could more aptly be called Construction Schedule Planning as this is where the arrangement is made. It essentially indicates the arrangement of fabricating exercises (which action accompanies which action) and which ones could be going ahead in the meantime.

Outfitted with this informative data (your Construction Project Schedule), you can complete the Daily Scheduling -a day-to-day movement that runs all through the development methodology. The everyday planning includes getting subs and materials to the occupation site when they are wanted [www.homebuilding answers.com].

2.6.2 Construction Scheduling Techniques

1. Bar Charts

2. CPM(Critical Path Method)
3. Line of Balance
4. PERT

2.6.2.1 Bar charts

Bar Charts are the most modest and most straightforward route to prepare a schedule shape in the development business. It is extensively utilized because of its straightforwardness and different accommodations to various occasions. A bar outlines is structured with a record of exercises, detailing the begin date, length of time of the movement and culmination date of every movement, and afterward plotted into a project time scale. The itemized level of the bar diagram will rely on upon your activity unpredictability and the planned utilization of the lineup(James Jerome and Plotnick 2006).
A variety of the bar diagram lineup is the joined bar graph. Utilizing a connected bar outline, the exercises and ensuing things are connected with shafts and lines, determining the arrangement and request of going before exercises. The past exercises are joined one to an additional to show that one movement must be finished after the other action can begin (Conway, Maxwell et al. 2003).

Bar charts are helpful and normally used to catch the measure of assets required for one specific activity. Including the assets vertically will transform what is known as the asset accumulation. The reason for this accumulation is to gauge the work processing and securing gauges for man-hour and supplies required (Hajdu 1996).

Bar charts can additionally be utilized for additional complex examinations of information with aggregated bar graphs and stacked bar graphs. In an aggregated bar graph, for every clear cut aggregation there are two or more bars. These bars are shade coded to speak for a specific gathering. For instance, a business manager with two stores may make an aggregated bar graph with diverse colored bars to speak for every store: the flat pivot might demonstrate the months of the year and the vertical pivot might indicate the income. On the other hand, a stacked bar diagram could be utilized. The stacked bar graph stacks bars that stand for distinctive aggregations on top of one another. The stature of the coming about bar indicates the joined together consequence of the gatherings (Callahan, Quackenbush et al. 1992).

There is also another type called Gantt Charts.

Gantt chart: it is a type of bar graph that was created by Henry Gantt which represents the undertaking agenda. Gantt outlines show begins and finalize dates of the terminal components and synopsis components of an undertaking. Terminal components and summation components contain the work breakdown structure of the undertaking. Some Gantt graphs likewise show the reliance (i.e., priority organize) relationships between exercises. Gantt graphs could be utilized to show current plan status utilizing percent-complete shadings and a vertical "Today" line as appeared. Gantt outlines have turned into a normal strategy for standing for the stages and

exercises of a venture work breakdown structure (WBS), so they could be grasped by a wide crowd everywhere on the planet (James Jerome and Plotnick 2006).

2.6.2.2 Critical Path Method:

This procedure is more expounded and nitty gritty than the past one. With a great record of exercises, every action is then joined to past and resulting exercises, tagging that every movement has at any rate an additional one that must be finished preceding beginning the previous one. With the Critical Path Method, datebook days are made and exercises are doled out with an early date, first date that an action can begin; late begin, pointing out the final conceivable date that this movement must be begun to dodge defers in the general development process; early fulfill, the prior date that the proposed action will be finished; and the late completion, that is the final date the action must be finished without influencing the begin of the following one, and consequently influencing the whole development plan. The steps in processing a system are as accompanies:

i. Listing of exercises
ii. Producing a system demonstrating the intelligent relationship between exercises.
iii. Assessing the term of every movement, transforming a lineup, and confirming the begin and complete times of every action and the accessible buoy
iv. Assessing the needed assets (Hajdu 1996).

There are two ways to represent predecessor relationships in network form.

AON (Activity on Node) network easy to draw and Activity on Arc (AOA) diagram or Arrow diagram here, occupations relate to bends. Every junction corresponds to an Event, "jobs comparing to all circular segments episode into it, and all their forerunners, have been finished". To depict ancestor relationships accurately in shaft graph, at times fundamental to acquaint Dummy curves comparing with counterfeit employments which dependably have zero term (Plotnick, O'Brien et al. 2009).

2.6.2.2.1 Activity on Node (AON) Technique

Activity on node is a diagram where each junction (ring) speaks for an action. Priority charting strategy is likewise called activity on node.

2.6.2.2.2 Activity on Arrow (ADM) Technique

The arrow diagramming method (ADM) refers to a schedule network diagramming method in which the activities to be scheduled are placed on arrows.

2.6.2.2.3 Dummy Activities

Invented action with zero movement time used to act for priority or utilized whenever two or more exercises have the same beginning and completion junctions.

2.6.2.3 Line of balance

This method is also known as Linear Scheduling Method (**LSM**).This procedure is an arranging procedure for dull function. The fundamental methodology for this booking system is to dispense the assets required for every step or operation, so the accompanying exercises are not postponed and the outcome might be acquired. This procedure is ordinarily connected in the development work and more particular in street development(Hajdu 1996).

Line of Balance (LOB) is an administration control handle for gathering, measuring and showing actualities identifying with time, cost and achievement -all measured against a particular arrangement. It demonstrates the methodology, status, foundation, timing and staging of the venture exercises, in this manner furnishing administration with measuring instruments that offer assistance:

1. Contrasting true advancement and a formal goal arrangement.

2. Analyzing just the deviations from built plans, and checking their level of intensity as for the leftover of the task.

3. Getting auspicious qualified data concerning inconvenience zones and showing ranges where proper restorative activity is needed.

4. Guaging future exhibition.

The "Line of Balance" itself is a realistic apparatus that empowers an administrator to see at a solitary look which of numerous exercises including a mind boggling operation is "in parity" - i.e., if those which might as well have been finished around then of the audit really are finished and if any exercises booked for future finishing are falling behind agenda. The Line of Balance diagram involves one and only characteristic of the entire rationality which incorporates various peril indicator controls for all the different levels of administration concerned(Plotnick, O'Brien et al. 2009).

2.6.2.4 Program Evaluation and Review Technique (PERT):

The **Program** (or **Project**) **Evaluation and Review Technique**, commonly abbreviated **PERT**, is a measurable device, utilized within project administration, that is intended to investigate and speak for the errands included in finishing a given activity. Initially advanced by the United States Navy in the 1950s, it is usually utilized within conjunction with the discriminating way technique (CPM).

PERT and CPM were surprisingly comparative, both utilized the shaft outlining method (with shafts acting for exercises). The crucial distinction was that Du Pont's business was essentially known (development and upkeep of concoction plants) and movement lengths of time could be

evaluated with some level of exactly dependent upon known amounts and preparation rates. Subsequently, CPM was kept tabs on advancing expenses by equalizing assets. The Navy's take a shot at Polaris was substantially with expense an optional issue; lengths of time could just be surveyed and Pert was concentrated on figuring out the likelihood of an occasion event by some destiny date

Discovering the term of the activity includes the accompanying steps.

2.6.3 Determining Different Activities involve in a construction project

2.6.3.1 Determining Different Activities

Determining different activities in the scheduling project is one of the main steps. A project is usually comprised of various activities. These activities are interred related to each other by various logics (Willis 1986).

2.6.3.2 Splitting of Work into Work Activities

We break our work into various activities to facilitate the scheduling.

2.6.3.3 Determining the Quantities

Determining the quantities of each activity is the very important step. The whole procedure of scheduling is based upon it (Demeulemeester and Herroelen 2002). In this semester we work out on the quantities and we calculated all the quantities involved in the project. We made frequent site visits and gathered much information about the quantities.

2.6.3.4 Making Networks and Logics

After calculating the quantities we will make networks and find logics between different activities. By this the project will become more detailed, disciplined and it makes each project unique.

2.6.3.5 Assigning Duration and Resources to Each Activity

We assign duration to each activity. It assists in comprehension the potential impacts of utilizing remotely reported item takes for choice making (Conway, Maxwell et al. 2003). Direct or linear development projects ordinarily have redundant exercises, and have the same operations rehashed at every unit.

2.6.3.6 Finding Critical Path and Doing CPM Calculations

Critical path is the longest duration path in the through the network. The noteworthiness of it is that exercises on the basic way can't be postponed without postponing the task(Morton and Pentico 1993).

METHODOLOGY

3.1METHODOLOGY ADOPTED FOR THE PROJECT

Methodology which is adopted for this project involves the following steps

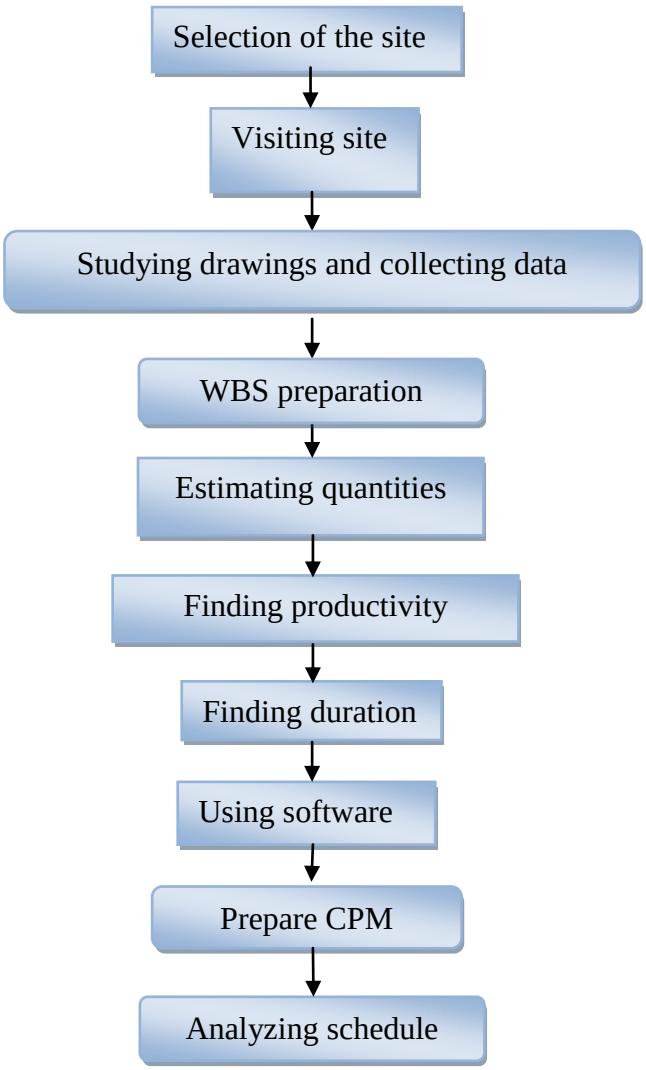

Figure 3.1 Flow chart of methodology

3.1.1 Selection of the Site

The first step in the construction project scheduling is the selection of a suitable site. Various factors are considered while selecting a construction site. Availability of data is one of the most important steps which govern the site selection. Co-ordination of site staff plays an important role in it. In our project construction site is New Secretariat Block which is located at Constitution Avenue, Islamabad.

3.1.2 Visiting Site

In order to obtain the knowledge about the construction project site, various site visits were made. These site visits helps in better understanding of the construction project. Drawings were much better understood by visiting the site.

3.1.3 Studying Drawings and Collecting Data

In order to perform scheduling, understanding of drawings is a crucial step. If a scheduler does not know how to read drawings then he is unable to perform scheduling. Building drawings include various parts which include

i. Master plan
ii. Structural drawings
iii. Architectural drawings
iv. HVAC drawings
v. Plumbing Drawings
vi. Electrical Drawings
vii. Site plan

3.1.4 Work Breakdown Structure (WBS) Preparation

WBS is a various leveled decay of the undertaking into stages, deliverables and work bundles. It is a tree structure, which shows a subdivision of step would have done well to understand a focus; case in point a task, step, and contract. In an undertaking or contract, the WBS is prepared by starting with the completion end of the line and successively subdividing it into sensible sections observing size, term, and diversion which incorporate all steps indispensible to realize the target (Hinze 2004).

3.1.5 Estimating Quantities

Estimation is the procedure of discovering an evaluation, or close estimation, which is a quality that is usable for some reason regardless of the possibility that enter information may be deficient, questionable, or flimsy. In making an evaluation, the objective is regularly generally handy to create a reach of conceivable conclusions that is exact enough to be handy, however not so exact that it is prone to be off base **(**Demeulemeester and Herroelen 2002**).**

3.1.6 Finding Productivity

Productivity is a measure of the efficiency of production. Productivity is a degree of creation yield to what is obliged to prepare it. By finding profit of a movement we can discover the sum span of that specific action by separating the work yield to the profit it gives us term of the action (Mubarak 2010).

3.1.7 Finding Duration

Duration is the measure of duration of any item or occasion inside time. All the more decisively term is the amount of logbook periods it sits down the execution of component begins to the minute it is finished (Hinze 2004). Duration can be found out after finding the productivity of an activity.

3.1.8 Using Software

We will use Primavera software in our project scheduling. The focus of Primavera software is to allow organizations to successfully operate their systems and ventures -paying little respect to unpredictability. The programming furnishes end-to-end, constant perceive ability of all corporate qualified information to educate portfolio administration choices, confirm the right assets, and guarantee single undertaking groups have the proper aptitudes to finish any given venture (Lewis 2004).

3.1.9 Preparing Critical Path Method and Performing Calculations

The critical path method (CPM) is a calculation for scheduling a set of task exercises. It is a paramount device for successful activity administration(Wickwire 2003). CPM is one of the easiest possible ways for making a schedule. There are two ways of representing the networks. One is Activity on node and one is activity on arrow.

3.1.10 Analyzing the Schedule

Last step is the analyzing of the project schedule. It is essential for the proper understanding of the project.

Chapter 4

ESTIMATION OF THE NEW SECRETARIART BLOCK

4.1 NEW SECRETARIAT BLOCK

At present a lot of government offices are housed in private rented buildings. Construction of New Secretariat Block will not only provide accommodation to different offices but also save huge amount incurred on rent. Moreover efficiency, effectiveness and productivity of Federal Government Employees will be enhanced.

This new Secretariat Block which is in fact combination of three secretariat blocks i-e T, U and V will be one of the most prestigious buildings of Government of Pakistan. Most modern facilities will be provided in the building with latest equipment. The Capital Development Authority has allotted a 4.844 acres plot measuring 872'x 242' for the construction of New Secretariat Block.

The building comprises of two basements and a ground plus nine similar floors having total covered area of 769,200 Sft has been designed by M/s NESPAK by ensuring most economical use of space the comparison of covered areas in the approved and revised PC-1 is given as under.

Table 1: Covered areas

Description	**Covered area as per approved PC-1 (Sft)**	**Covered area as per revised PC-1 (Sft)**
Basement-II	-	38,900
Basement- I	58,080	73,300
Ground Floor	58,080	64,965
First Floor	58,080	64,965
Second Floor	58,080	64,965
Third Floor	58,080	64,965
Fourth Floor	58,080	64,965
Fifth Floor	58,080	64,965
Sixth Floor	58,080	64,965
Seventh Floor	3954	64,965
Eighth Floor	-	64,965
Ninth Floor	-	64,965
Roof Floor	-	7,350
Total	**468,594**	**769,200**

In addition to above enough space will be available for the construction of underground water tank and for the provision of parking space and other infrastructure facilities. The project is in consonance with the master plan of the Federal Capital. The Capital Development Authority has already earmarked provision of new secretariat block in the master plan of Islamabad.

4.2 SPECIFICATIONS

4.2.1 RCC Structure

The reinforced cement concrete foundation is a raft type and the super structure consists of Reinforced cement concrete frame structure designed as per revised code of practice for **seismic zone 2b.** The building consists of two basements and ground plus two upper stories.

4.2.2 Finishes

Figure 4.1 Main Passage to offices

4.2.2.1 Façade

The façade of building consist of power coated aluminium glazed curtain walls with 12 mm thick coloured tempered glass and graffito textured coating on exterior surfaces.

Fig 4.2 12 mm Thick Tempered Glass

4.2.2.2 Flooring

The floor finish mainly consists of porcelain textured tiles (Spanish/ Italian) and pre polished marble tiles of approved colour and shade. The skirting and dado will be of matching material and colour. In Data Centre areas, flooring will be of antistatic tiles.

4.2.2.3 Walls

The partition walls will be of block masonry plastered with cement sand mortar and finally finished with plastic emulsion paint and pre polished granite cladding etc.

4.2.2.4 Toilets

Local ceramic tiles in floors and walls will be used with best quality fittings and fixtures.

4.2.2.5 Ceilings

Cement plastered surfaces will be finished with paint. Dampa type gypsum board and Lasani board false ceiling will be provided in specified area.

4.2.2.6 Doors and windows

Deodar wooden paneled doors powder coated aluminium doors, windows, ventilators and curtain walls etc will be provided as specified.

4.2.2.7 Plumbing works

Best quality of locally made PPR, GI and CI pipes work with local fixtures and fittings will be used.

4.2.2.8 Electrical works

Best quality locally made wiring; distribution boards, Phillips type light fixtures, telephone system, local area network, fire alarms, CCTV and CATV systems will be provided. In addition to these walk through gates, scanners and metal detectors will be provided to provide an efficient security system in the building. Four Nos. 1250 KVA diesel generating sets will be installed for providing back up power.

4.2.2.9 Lift works

The building will be equipped with best quality imported 12 passenger and 2 cargo lifts.

4.2.2.10 HVAC works

The building will be provided with a centrally air conditioning systems with imported chillers, air handling units, Fan coil units with HVAC building management and control systems.

Chapter 5

RESULTS

5.1 ESTIMATION OF NEW SECRETARIAT BLOCK ON CONSTITUTION AVENUE, ISLAMABAD

The planning of a project starts with the designing of the building and then after that the building is to be quantifying the materials to be use in the project.

The New Secretariat Block located on Constitution Avenue, Islamabad, is a 9 storied building with two basements. The materials like reinforcements, tiles, aluminium composite panels, etc. are to be calculated. The different items are to be measured in different units. The plaster of wall is measured in square-foot. Similarly, reinforcements in tones, reinforced cement concrete in cubic-foot.

The quantities are taken out by the dimensions of the drawings of the building. Structural drawings are used to identify the reinforcements and calculation of the weights. The architectural drawings are used to take off the quantities of other items like paints, plasters, tiles, etc.

The quantities of different items are taken out are shown in the appendix. These quantities are used to find the duration of the activities by using the productivity rates. The cost of the project is based on the quantities and the material used in the building.

5.2 SCHEDULING OF NEW SECRETARIAT BLOCK ON CONSTITUTION AVENUE, ISLAMABAD

The quantities that are calculated in the estimation first, those are used to find out the durations of the activities involved in construction phase. The schedule of the block is prepared in the software called Primavera P6 Professional. In this software, we first define the activities. Then we assign these activities with the durations and relationships.

The calendar is set according to Pakistani environment. The activities have relationship mostly start-to-start provided with lag. The activities are divided using Work breakdown structure for the ease. Then the resources are assigned. Each activity has its own resource. The project is to be completed in 2 years' time span.

The schedule can be used as a baseline schedule for the project, and it can be updated as the project progresses. The activities of the New Secretariat Block is divided under different headings, such as plumbing works, electrical works, site clearance, etc.

Chapter 6

RECOMMENDATIONS AND CONCLUSIONS

According to our objective of our project, detailed estimate was carried out and it was found the total cost of the project was **Rs.127,020,3220** (1 billion). It includes the cost of civil work, electrical work and plumbing work along with 15% overhead charges and 10% contractor's bonus. Price per square foot comes out to be **Rs 1650**. The detailed working of the estimate and scheduling is shown in Appendix A, B and C. the estimate does not reflect the overhead cost of project. Scheduling of the New Secretariat Block was carried out on the basis of quantities extracted in detailed estimate from which durations of different activities were calculated. The duration of the project was found to be 2 year. This schedule could not be compared with the schedule prepared by the contractor because contractor was not following the practices of scheduling.

Future studies of estimation should include over head cost of the project also. Moreover detailed contingency of time should be added to reflect any delay due to unforeseen weather conditions and delay due to strikes of labor.

REFERENCES

1. Callahan, M. T., D. G. Quackenbush, et al. (1992). Construction project scheduling.

2. Conway, R. W., W. L. Maxwell, et al. (2003). Theory of scheduling, Dover Publications.

3. Demeulemeester, E. L. and W. S. Herroelen (2002). Project scheduling: a research handbook, Springer.

4. Hajdu, M. (1996). Network scheduling techniques for construction project management, Springer.

5. Hinze, J. (2004). Construction planning and scheduling, Pearson/Prentice Hall.

6. James Jerome, O. B. and F. L. Plotnick (2006). CPM in construction management, Recording for the Blind & Dyslexic.

7. Kerzner, H. (2009). Project management: a systems approach to planning, scheduling, and controlling, Wiley.

8. Lewis, J. P. (2004). Team-based project management, Beard Books Incorporated.

9. Marchman, D. A. and T. A. Sulbaran (2000). Construction Scheduling with SureTrak, Delmar Thomson Learning.

10. Morton, T. E. and D. W. Pentico (1993). Heuristic scheduling systems: with applications to production systems and project management, Wiley New York.

11. Mubarak, S. (2010). Construction project scheduling and control, Wiley.

12. Neeraj, J. K. and K. N. Jha Construction Project Management, Pearson Education India.

13. Nyman, D. and J. Levitt (2001). Maintenance planning, scheduling, and coordination, Industrial Press Inc.

14. Pinedo, M. L. (2012). Scheduling: theory, algorithms, and systems, Springer.

15. Plotnick, F., J. J. O'Brien, et al. (2009). CPM in Construction Management, McGraw-Hill Professional.

16. Popescu, C. M. and C. Charoenngam (1995). Project planning, scheduling, and control in construction: An encyclopedia of terms and applications, Wiley-Interscience.

17. Wickwire, J. M. (2003). Construction scheduling: preparation, liability, and claims, Aspen Law & Business.

18. Willis, E. M. (1986). "Scheduling construction projects." Construction Management and Economics**4**: 261-263.

19. Woolf, M. B. (2007). Faster construction projects with CPM scheduling, McGraw Hill.

20. [www.homebuilding answers.com]

Appendix A

Appendix B

Appendix C