Planning and Scheduling of Kuran Power House and 4-Laning of Rewa-Jabalpur Road using MS Project and Primavera Softwares

Submitted in partial fulfillment of the Degree of Bachelor of Technology

Department of Civil Engineering,

Jaypee University of Information Technology

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Date : 26/5/2015

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CERTIFICATE

This is to certify that the work entitled **"Planning & Scheduling of Power House of Kuran and Rewa-Jabalpur Road using MS Project and Primavera Softwares"** submitted by **Rachit Garg (111052), Jappanjit Singh (111690)** in partial fulfilment for the award of degree of Bachelor of Technology in Civil Engineering of Jaypee University of Information Technology has been carried out under my supervision. This work has not been submitted partially or wholly to any other University or Institute for the award of this or any other degree or diploma.

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1.INTRODUCTION

1.1 POWER HOUSE

Hydroelectricity is the term referring to electricity generated by hydropower; the production of electrical power through the use of the gravitational force of falling or flowing water. It is the most widely used form of renewable energy, accounting for 16 percent of global electricity generation – 3,427 terawatt-hours of electricity production in 2010, and is expected to increase about 3.1% each year for the next 25 years.

Hydropower is produced in 150 countries, with the Asia-Pacific region generating 32 percent of global hydropower in 2010. China is the largest hydroelectricity producer, with 721 terawatt-hours of production in 2010, representing around 17 percent of domestic electricity use. There are now four hydroelectricity stations larger than 10 GW: the Three Gorges Dam and Xiluodu Dam in China, Itaipu Dam across the Brazil/Paraguay border, and Guri Dam in Venezuela.

The cost of hydroelectricity is relatively low, making it a competitive source of renewable electricity. The average cost of electricity from a hydro station larger than 10 megawatts is 3 to 5 U.S. cents per kilowatt-hour.[1]It is also a flexible source of electricity since the amount produced by the station can be changed up or down very quickly to adapt to changing energy demands. However, damming interrupts the flow of rivers and can harm local ecosystems, and building large dams and reservoirs often involves displacing people and wildlife.[1] Once a hydroelectric complex is constructed, the project produces no direct waste, and has a considerably lower output level of the greenhouse gas carbon dioxide (CO 2) than fossil fuel powered energy plants.

Although no official definition exists for the capacity range of large hydroelectric power stations, facilities from over a few hundred megawatts to more than 10 GW are generally considered large hydroelectric facilities. Currently, only three facilities over 10 GW(10,000 MW) are in operation worldwide; Three Gorges Dam at 22.5 GW, Itaipu Dam at 14 GW, and Guri Dam at 10.2 GW. Large-scale hydroelectric power stations are more commonly seen as the largest power producing facilities in the world, with some hydroelectric facilities capable of generating more than double the installed capacities of the current largest nuclear power stations.
Power plant whose Power House's scheduling is our project is of 2 x 2.5 MW.

1.1.1 Salient Features about Hydro Power Plant

1)	Location	
	State	Himachal Pradesh
	District	Kullu
	Access Distance From	
	State Capital	160 km from Shimla
	District Head Quarter	200 km from Kullu
	Nearest Road Head	35km from NH-22
2)	Geographical Coordinates	
	Longitude	77”30’
	Latitude	30”32’

Table 1.1

1.1.2 LITERATURE

POWER HOUSE-

Power house is an industrial facility for the generation of electric power. At the center of nearly all power stations is a generator, a rotating machine that converts mechanical power into electrical power by creating relative motion between a magnetic field and a conductor. The energy source harnessed to turn the generator varies widely. It depends chiefly on which fuels are easily available, cheap enough and on the types of technology to which the power company has access. Most power stations in the world burn fossil fuels such as coal, oil, and natural gas to generate electricity, and some use nuclear power, but there is an increasing use of cleaner renewable sources such as solar, wind, wave and hydroelectric.

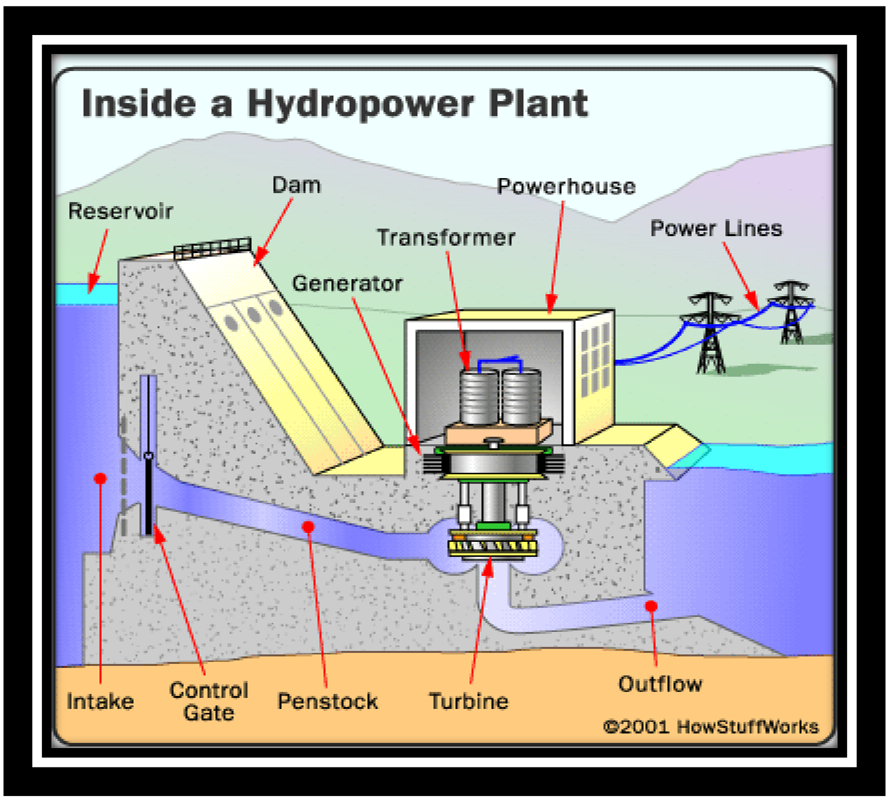

Fig 1.1 Power Plant

1.2.2 OTHER COMPONENTS OF HYDRO POWER PLANT

- **Dam** - Most hydropower plants rely on a dam that holds back water, creating a large reservoir. Often, this reservoir is used as a recreational lake, such as Lake Roosevelt at the Grand Coulee Damin Washington State.
- **Intake** - Gates on the dam open and gravity pulls the water through the **penstock**, a pipeline that leads to the turbine. Water builds up pressure as it flows through this pipe.
- **Turbine** - The water strikes and turns the large blades of a turbine, which is attached to a generator above it by way of a shaft. The most common type of turbine for hydropower plants is the Francis Turbine, which looks like a big disc with curved blades. A turbine can weigh as much as 172 tons and turn at a rate of 90 revolutions per minute (rpm), according to the Foundation for Water & Energy Education(FWEE).
- **Generators** - As the turbine blades turn, so do a series of magnets inside the generator. Giant magnets rotate past copper coils, producing alternating current (AC) by moving electrons. (You'll learn more about how the generator works later.)
- **Transformer** - The transformer inside the powerhouse takes the AC and converts it to higher-voltage current.
- **Power lines** - Out of every power plant come four wires: the three phases of power being produced simultaneously plus a neutral or ground common to all three. (Read How Power Distribution Grids Work to learn more about power line transmission.)

- **Outflow -** Used water is carried through pipelines, called tailraces, and re-enters the river downstream.

The water in the reservoir is considered stored energy. When the gates open, the water flowing through the penstock becomes kinetic energy because it's in motion. The amount of electricity that is generated is determined by several factors. Two of those factors are the volume of water flow and the amount of hydraulic head. The head refers to the distance between the water surface and the turbines. As the head and flow increase, so does the electricity generated. The head is usually dependent upon the amount of water in the reservoir.

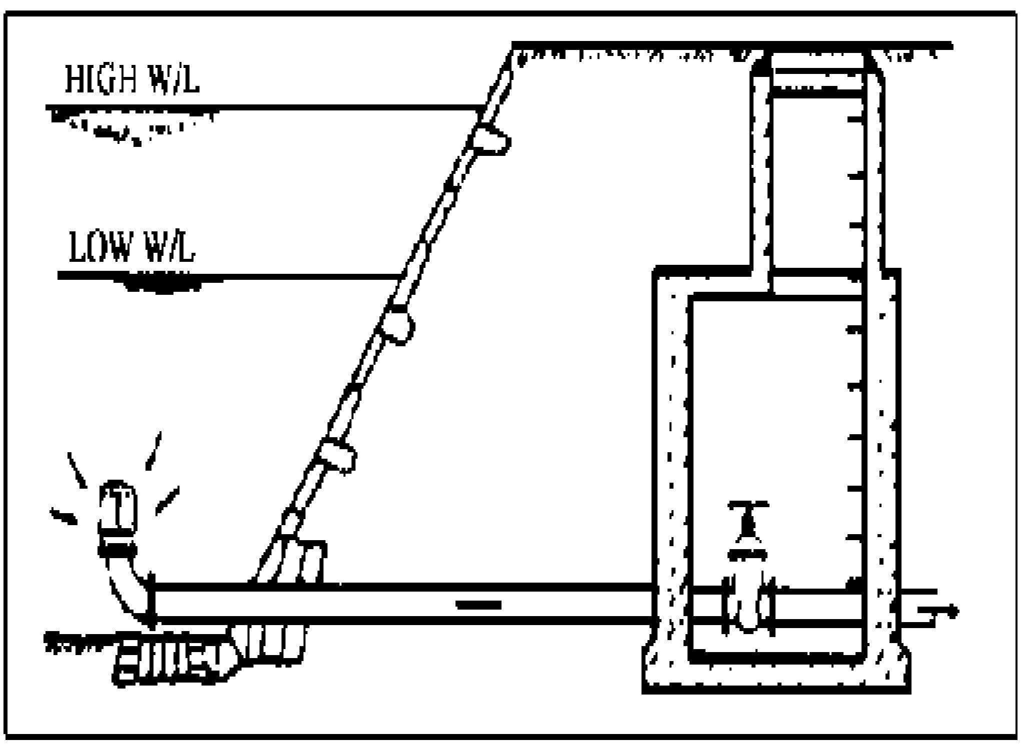

FIG 1.2 INTAKE STRUCTURE

1.2.1 NHAI

Road transport is one of the most common and oldest modes of transport. Roads in the form of trackways, human pathways etc. were used even from the pre-historic times. Since then many experiments were done to make the riding safe and comfort. Thus road construction became an inseparable part of many civilizations and empires. Road is essential to provide link between two areas. There has been vast development in the study of highway engineering during 18th century.

Many engineers provided their own ways of construction of highway roads. The one most accepted was of the John macadam, who was the surveyor general of roads in England, whose method was entirely different with respect to older methods. He presented a theory taking into consideration the sub-grade drainage, lower thickness by removing the heavy, big foundation stones with broken stones and realized the process of load transfer through layers.

In India, maximum development in road network was done in the Mughal period. In 1927 the chamber of Indian legislature appointed a committee to enquire and look into the development of roads in India. The jayakaar committee submitted its report in 1928, with its main recommendations being i) introduction of central road fund (CRF) to collect the tax and use it for development ii) formation of IRC for questions relating to engineering, organisationsal and administrative problems iii) formation of an organization for looking into the research and new techniques in road development, central road research institute.

Road development in India took place in three stages, the first one was the Nagpur plan from 1943 to 1963, and the second plan being Bombay road plan from 1961 to 1981, the third plan was Lucknow road plan from 1981 to 2001 where the road network was stretched upto 82 Kmper 100 sq.km.

The National Highways Authority of India was constituted by an act of Parliament, NHAI , 1988. It is responsible for the development, maintenance and management of National Highways entrusted to it and for matters connected or incidental there. The Authority came into operation on Feb, 1995.

Roads are classified according to traffic volume, load transported, location and function as NH, SH, MDR, ODR and VR. The various road patterns used in India are rectangular or block pattern, radial or star and block pattern, radial or star and circular pattern, hexagonal pattern, star and grid pattern.

1.2.2 LAYERS IN HIGHWAY

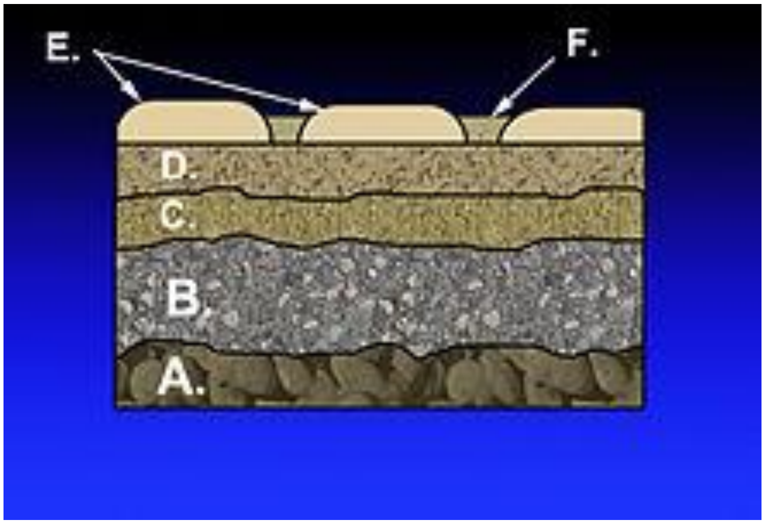

Fig 1.3 Layers in Highway

(A) Subgrade
(B) Sub-base
(C) Base
(D) Paver
(E) Surface
(F) Fine sand

1.2.3 DESIGN OF LAYERS

SUBGRADE- it is the formation level underneath the road on which the pavement is constructed Sub-grades are commonly compacted before the construction of a road, pavement or railway track that are sometimes stabilized by the addition of asphalt, lime, Portland cement and other modifiers. The subgrade is the foundation of the pavement structure, on which the sub-base is laid.

GRANULAR SUB-BASE: It is the drainage layer.Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, Construction of granular sub-base by providing close graded material, spreading in uniform layers with motor grader on prepared surface, mixing by mix in place method with rotavator at OMC, and compacting with vibratory roller to achieve the desired density.

WET-MIX MACADAM (WMM) : Aggregates used are of the smaller sizes, varies between the 4.75 mm to 20 mm sizes and the binders(stone dust or quarry dust having PI(Plasticity Index) not less than 6%) are premixed in a batching plant or in a mixing machine. Then they are brought to the site for overlaying and compaction.

The PI(plasticity Index) of the binding material is kept low because it should be a sound and non- plastic material. If the plasticity index is more then there are the chances of the swelling and more water retention properties. So this value should be kept in mind.

Providing and applying primer coat with bitumen emulsion on prepared surface of granular Base including clearing of road surface and spraying primer at the rate of 0.60 kg/sqm using mechanical means.

DENSE BITUMINOUS MACADAM (DBM)-Bitumen macadam in which the aggregates and filler are so graded as to form a close textured mixture, of low permeability, when spread and compacted.Providing and laying dense graded bituminous macadam producing an average output of 75 tons per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 4.0 to 4.5 per cent by weight of total mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction.

BASE COURSE - The base course or base course in pavements is a layer of material in an asphalt roadway that is located directly under the surface layer. If there is a subbase course,the base course is constructed directly above this layer. Otherwise, it is built directly on top of the subgrade. Typical base course thickness ranges from 4 to 6 inches and is governed by underlying layer properties.

Providing, laying and rolling sand-asphalt base course composed of sand, mineral filler and bituminous binder on a prepared sub-grade or sub-base to the lines, levels, grades and cross sections as per the drawings including mixing in a plant of suitable type and capacity, transporting, laying, compacting and finishing.

SURFACE COURSE – The surface course of a flexible pavement protects the underlying base course from traffic and water while also providing adequate tire friction, generating minimal noise in urban areas, and giving suitable light reflectance for night-time driving.

2. OBJECTIVE OF THE PROJECT

The objective of our project is to do planning and scheduling of Powerhouse of 2 x 2.5 MW Kurpan Hydro-Electric project located in tahsil Nirmand, district Kullu , Himachal Pradesh using MS Project software, completing the project in stipulated time, with optimal use and scheduling of resources, leveling of resources and optimizing the cost of project and various activities.

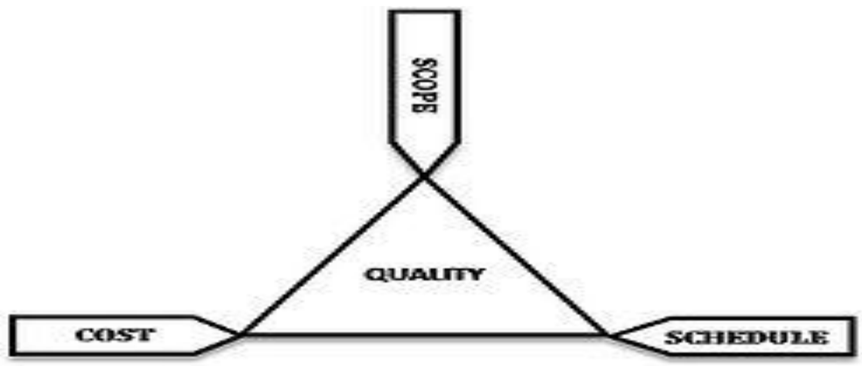

Fig 2.1 Objective

Time is money for owners, users and constructors.

From the perspective of owners they may lose revenue by not receiving return on investment on time, cash flow may be stopped, loss of clients, considerations of tax, extended interest payment.

From users perspective it may have high cost, delays in construction or rehabilitation may have negative impact on the business, public and on other financial aspects.

From contractor's perspective, it may have negative or positive impact as by liquidating the assets and damages or receiving bonus through incentives.

Delays result in extended overhead costs and other liabilities. And inefficient time management results in high labor cost as well as the equipment cost. Therefore, to achieve the objective of the project, it is necessary to foresee the project prior starting the work and provide a structural approach to planning, to identify the problems and their solutions before they arise.

In construction planning, we firstly determine the task, then the sequence of work, then checking out the possible adequate construction methods, and finally assign the respective responsibilities to the various members of the team.

Resource leveling is needed in construction to avoid the difficulties associated with the large variations in resource usage.It is a technique used to examine unbalanced use of resources over time and to resolve conflicts.

3. ABOUT

3.1 MS Project Software –

Microsoft Project is a Windows-based project management software package. It provides the flexibility to help manage your project, provides assistance in every phase of the project, and calculates schedules and other project information. It helps to build the project plan and also helps in tracking it to its completion. Microsoft project supports calendar controls, allocation of resources, production of PERT, GANTT charts, resource charts, calendar charts and dozens of reports. It is easy to navigate & similar to other MS packages. MICROSOFT PROJECT can be of substantial assistance in the management of projects. It does not produce or print a delineated work breakdown structure, although it does generate work breakdown structure numbers. Its primary advantage is its widespread use as it is simple to use, learn and work upon.

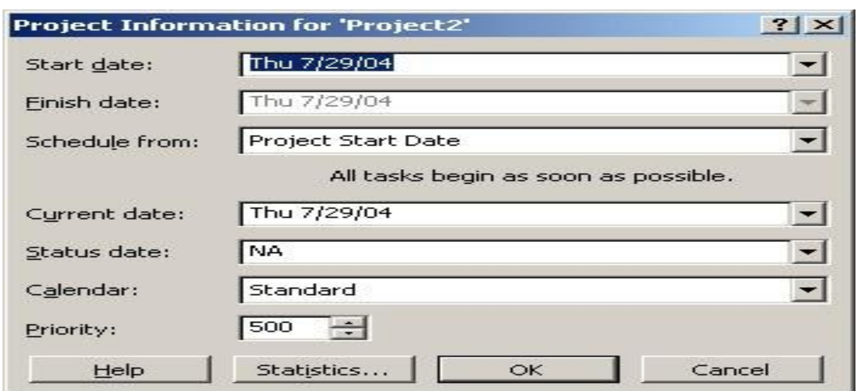

FIG 3.1 MS Project

This is the GANTT view of the project, on the left side is the table in which we can change the values, on the right side is the Gantt chart produced.

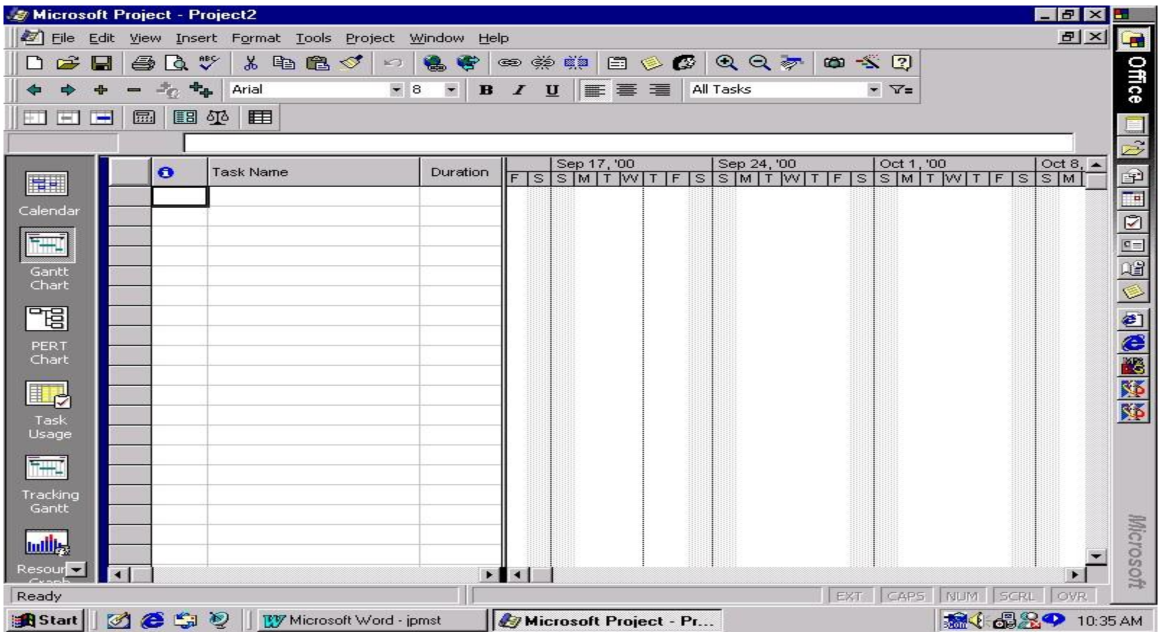

FIG 3.2 Gantt Chart

Then we determine the total time, resources for each activity with the dependencies. For the walk throughs, all resources get assigned. MS project cuts out the duration to something less than a day. We have to re-set the duration to one day for the walk throughs once all resources have been assigned. The end result of all these tasks and assignment entries is the following.

3.2 Primavera Software

Primavera Systems Inc. provides project and program management software for the Architecture, Engineering and Construction industry. Focused on project portfolio management, or PPM, Primavera's solutions let users measure progress, assure governance, improve team collaboration and prioritize project investments and resources.

Primavera's software packages include P6, Prosight, Contract Manager, Cost Manager, Pertmaster, SureTrak, Evolve and Inspire. The newest addition to the suite of project management solutions is Primavera P6, which is an integrated PPM (project portfolio management) solution that provides a real-time view of portfolio performance. P6 also offers what-if scenario modeling, tabular scorecards and capacity analysis.

3.3 SCHEDULING

Project scheduling is one of the most important topics in construction management. Many scheduling techniques have been developed and are widely used for construction projects. A bar chart is one of the simplest scheduling techniques but it does not clearly show the dependency among activities. The Critical Path Method (CPM) is another popular scheduling technique used in project scheduling due to its network presentation capability and ease of usage.

But many construction projects of highway typically contain activities repeated continuously at different locations. Research has shown that CPM lacks efficiency in scheduling linear construction projects with repetitive activities. CPM is unable to provide work continuity for crews or resources to plan the large number of activities necessary to represent a repetitive or linear project, to indicate rate of progress, to accommodate changes in the sequence of work between units, and to accurately reflect actual conditions. Therefore, we take into consideration MS project for scheduling our project work.

CPM (Critical Path Method) is a project management technique that focuses on methods of categorizing the work performed in a project. The traditional method of diagramming a CPM network of tasks is often referred to as the "Activity on Arrow" or "Arrow Diagram Method." The CPM method of project management features a single time estimate for each activity and an associated cost of that activity.

Microsoft Project uses the CPM internally to calculate the duration of projects. Microsoft Project defines the critical path as a set of those tasks that if delayed or started early will affect the finish date of the entire project. Therefore, those tasks that constitute the critical path are the "critical" tasks.

With time there has been major improvement in efficiency of scheduling, with the development of new techniques and softwares like MS project, primavera. Scheduling is the primary activity of any project and is effectively called time management, the schedule is not a one-time activity during a project. Scheduling using MS project is like learning how to use proper saw for a carpenter.

Earlier it used to take time and there was not proper record for making schedules and planning work and time required for activities and there was a huge problem in leveling of resources but with the development of MS project and other softwares it is easy to use and do the resource leveling, activity scheduling, management of time and resource, knowing the schedule in hand before starting the work.

4. METHODOLOGY

The procedure of work, is, starting from listing the activities and the respective quantities and then we list out the resources required for each activity, then depending upon the constraints we find out the predecessors.

Delays in pre-construction activities causes a lot of problems from high cost to quality shrinkage Delays in land acquisition and construction activities may increase the cost of the project by many fold. The delays in construction of ‘the world’ in Dubai increased its initial cost by more than five times. There are some other constraints in highway construction such as before cutting and cleaning the next activity cannot be done, similarly, subgrade construction cannot be done before embankment construction. And the construction cannot possibly be done by stopping the flow of traffic, so there has to be an alternate route for the traffic to continue its movement unaffectedly before any construction work.

What MS project does is

- Creates a schedule
- Communicate the scope of the project
- Communicate roles for the team members
- Find out the expectations of resources and time
- Find the status of activities
- Any changes in the project

Schedule in MS project:

1. The first step is setting up of project
2. Then we enter the tasks in the project
3. Then the duration for each task
4. Then the task dependencies.
5. Then the deadlines, other related constraints and task calendar
6. Then we enter the resources
7. Then assign the resources
8. And finally, optimize the schedule.

What primavera does is

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

Schedule in Primavera project:

1. The first step is setting up of project
2. Then we enter the tasks in the project
3. Then the duration for each task
4. Then the task dependencies.
5. Then the deadlines, other related constraints and task calendar
6. Then we enter the resources
7. Then assign the resources
8. And finally, optimize the schedule.

4.1 LIST OF ACTIVITIES

4.1.1 POWER HOUSE

DESIGN BRIEF

- preparation of sanction plans
- draft project brief of the project by consultant
- submission of sanction plans
- approval of sanction plans
- Preconstruction Management
- Civil Structure Works
- "Electrical, plumbing and Sanitary works"
- Fire Protection works
- IT Telecom

PROCUREMENT & DELIEVERIES

- Main Civil Works
- Out of tender
- Submission of tender/ Bid opening
- Pre award period/ Negotiation
- Award
- "Electrical, plumbing and Sanitary works"
- Out of tender
- Submission of tender/ Bid opening
- Pre award period/ Negotiation
- Award
- Fire fighting system
- Out of tender
- Submission of tender/ Bid opening
- Pre award period/ Negotiation
- Award
- DG sets

- Out of tender
- Submission of tender/ Bid opening
- Pre award period/ Negotiation
- Award
- IT & Telecom
- Out of tender
- Submission of tender/ Bid opening
- Pre award period/ Negotiation
- Award

CONSTRUCTION MANAGEMENT

- Power House
- Civil structure works
- Foundation
- Excavation
- PCC of Footing
- Rack Footings
- "Layout of columns, walls"
- Casting of columns
- "casting of beams,"
- construction of walls
- shuttering of slab
- slab completion
- Cement plastering
- Non Civil works
- painting inside walls
- painting outside wails
- embedded pipes
- sanitary fixture
- Ceramic floor and wall tiles
- "door window fixing, hand rails, safety chains"

4.1.2 REWA-JABALPUR ROAD

CUTTING OF TREES

- Using Google Map we first calculate number of trees in every 100 square meters about our original pavement.
- Average value came out to be 3.
- Then using MS Excel we calculated the quantity of trees for every chainage with a designated cross section.

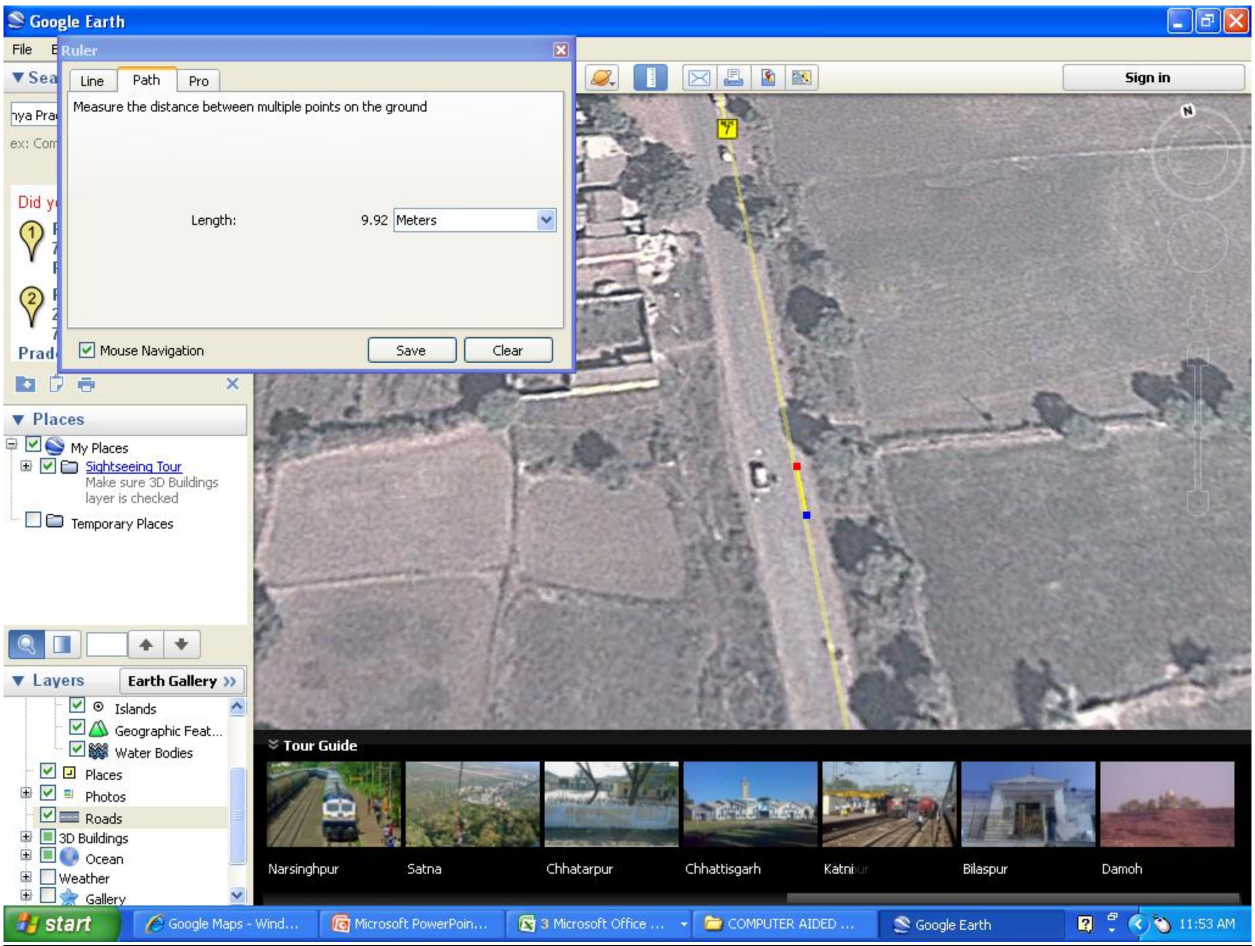

Fig. 4.1 Google Map View
(Annexure A)

CLEANING AND GRUBBING

- Cleaning and Grubbing is evaluated over the surface area of chainage and for every chainage with a cross sectional width we calculate the Area.
- Using the Detailed Project Report.
- From the standard data book we have the rate for each activity, from which we can find out the resources required for the given amount of work.

(Annexure B)

EXCAVATION AND EMBANKMENT

- Using DPR we find out the value of width and height for every chainage with some designated length.
- Then we find the value of amount of excavation and embankment required.
- Using the standard data book, we calculate the work rate and resources for the given quantity.

(Annexure C, D)

SUBGRADE FOR NEW PAVEMENT

- Using DPR we see the thickness of sub-grade needed for construction.
- Then, multiplying the height with width and length of every particular chainage and cross section we find out the quantity of work in cubic meters.
- Using standard data book, we find out the work rate and resources for the calculated quantity.

(Annexure E)

GRANULAR SUB-BASE

- Using DPR we see the thickness of granular sub-base needed for construction.
- Then, multiplying the height with width and length of every particular chainage and cross section we find out the quantity of work in cubic meters.
- Using standard data book, we find out the work rate and resources for the calculated quantity

(Annexure F)

WET MIX MACADAM (WMM)

- Using DPR we see the thickness of WMM needed for construction.
- Then, multiplying the height with width and length of every particular chainage and cross section we find out the quantity of work in cubic meters.
- Using standard data book, we find out the work rate and resources for the calculated quantity

(Annexure G)

DENSE BITUMINOUS MACADAM

- Using DPR we see the thickness of DBM needed for construction.
- Then, multiplying the height with width and length of every particular chainage and cross section we find out the quantity of work in cubic meters.
- Using standard data book, we find out the work rate and resources for the calculated quantity.

(Annexure H)

BASE COURSE

- Using DPR we see the thickness of base course needed for construction.
- Then, multiplying the height with width and length of every particular chainage and cross section we find out the quantity of work in cubic meters.
- Using standard data book, we find out the work rate and resources for the calculated quantity

(Annexure I)

SCARIFICATION

- Scarification quantity is found by taking width of existing pavement i.e 7meters
- Then for different chainage lengths the quantity is estimated in square meter by multiplying chainage length with the width of existing pavement.
- Using standard data book, we find out the resources and work rate for the calculated quantity.

SUBGRADE FOR EXISTING PAVEMENT

- Using DPR we see the thickness of sub-grade needed for construction.
- Then, multiplying the height with width and length of every particular chainage and cross section we find out the quantity of work in cubic meters.
- Using standard data book, we find out the work rate and resources for the calculated quantity.

GRANULAR SUB-BASE FOR EXISTING PAVEMENT

- Using DPR we see the thickness of granular sub-base needed for construction.
- Then, multiplying the height with width and length of every particular chainage and cross section we find out the quantity of work in cubic meters.

- Using standard data book, we find out the work rate and resources for the calculated quantity.

WET MIX MACADAM (WMM) FOR EXISTING PAVEMENT

- Using DPR we see the thickness of WMM needed for construction.
- Then, multiplying the height with width and length of every particular chainage and cross section we find out the quantity of work in cubic meters.
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DENSE BITUMINOUS MACADAM FOR EXISTING PAVEMENT

- Using DPR we see the thickness of DBM needed for construction.
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BASE COURSE FOR EXISTING PAVEMENT

- Using DPR we see the thickness of base course needed for construction.
- Then, multiplying the height with width and length of every particular chainage and cross section we find out the quantity of work in cubic meters.
- Using standard data book, we find out the work rate and resources for the calculated quantity

4.2 RESOURCES

- Mate
- Mazdoor
- Skilled labour
- Pneumatic roller
- Vibratory roller
- Water tanker
- Wet mix plant
- Hydraulic excavator
- Paver finisher
- Tractor trolley
- Tipper
- Dozers
- Mortar grader
- Water tanker
- Front end loader
- Mechanical broom

4.3 WORK RATE

The work rate for all the activities is found out using standard data book.

In standard data book resources required for each activity is given for one day for a given quantity, knowing the quantity and resources required we can find out the work rate for each activity.

Sino	Activity	Pred.	Work Rate
1	Cutting of Trees	-	1 mate 22 labour and 7.5 hour tractor-trolley will do 25 trees cutting per day
2	Embankment Construction	FF2+1 DAY	1 Mate 25 labour 2 Dozers will do 10^4 cubic meters of embankment
4	Excavation	FF2+1 DAY	1 Mate 25 labour 5 Dozers will do 2250 cubic meters of excavation
5	Shuttering	FF3+1DAY,FF4+1 DAY	1 Carpenter, 1 Helper will do 4-6 sq.meters of shuttering in 8 hrs
6	Barbinding	FF5+1 DAY	1 barbinder and 1 helper will bing 200-300 kg of steel
7	Brickwork	FF6+1 DAY	1 mason and 2 helpers will do about 1-2 cubic cm in about 8 hours

9	Masonry	FF8+1 DAY	1 mason and 2 helpers will do work of about 2sq meters in 8 hours

TABLE 4.1

5. SCHEDULING USING SOFTWARE

Now all this data is required for the MS project software

It requires the specific activity, its time and the different resources as the input and the software uses this data to prepare a gaant chart which shows the scheduling of the various activities according to the data.

It requires the summary and details of the tasks to be carried out, for what are these tasks used, and their dependency on overall schedule. Then the estimates required are found using experience or standard data book. The types of tasks and their relation to estimating is necessary like some are fixed duration, some are fixed work while some are fixed unit. The dependency used is Finish-to-Finish (FF), and we have marked the constraints on the calendar and the resources required and their assignment for fixed duration, fixed unit or fixed work. Fixed duration is used here.

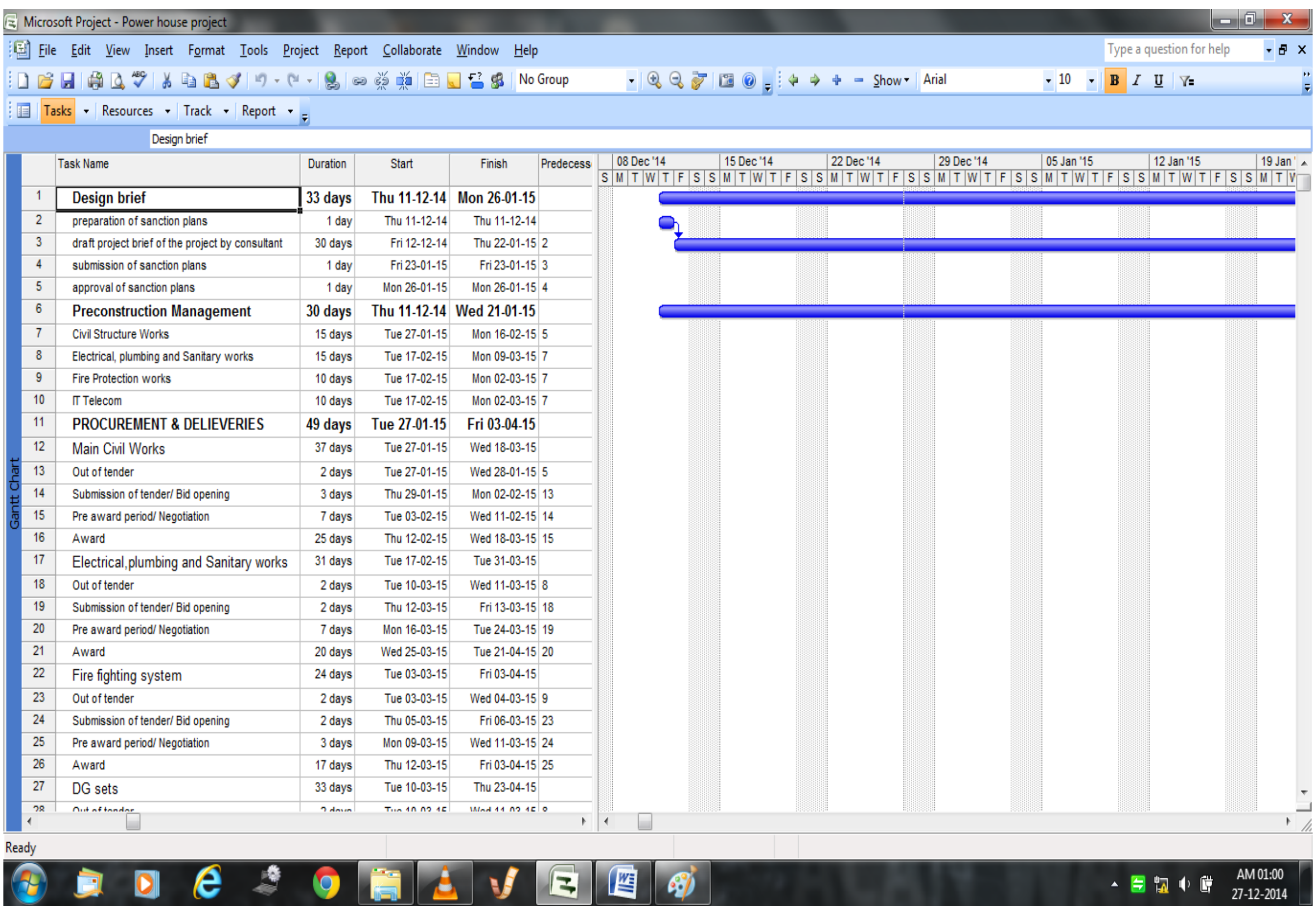
6. RESULTS

Till now we have

- listed out the activities
- resources required for each activity
- work rate for each activity
- time for each activity

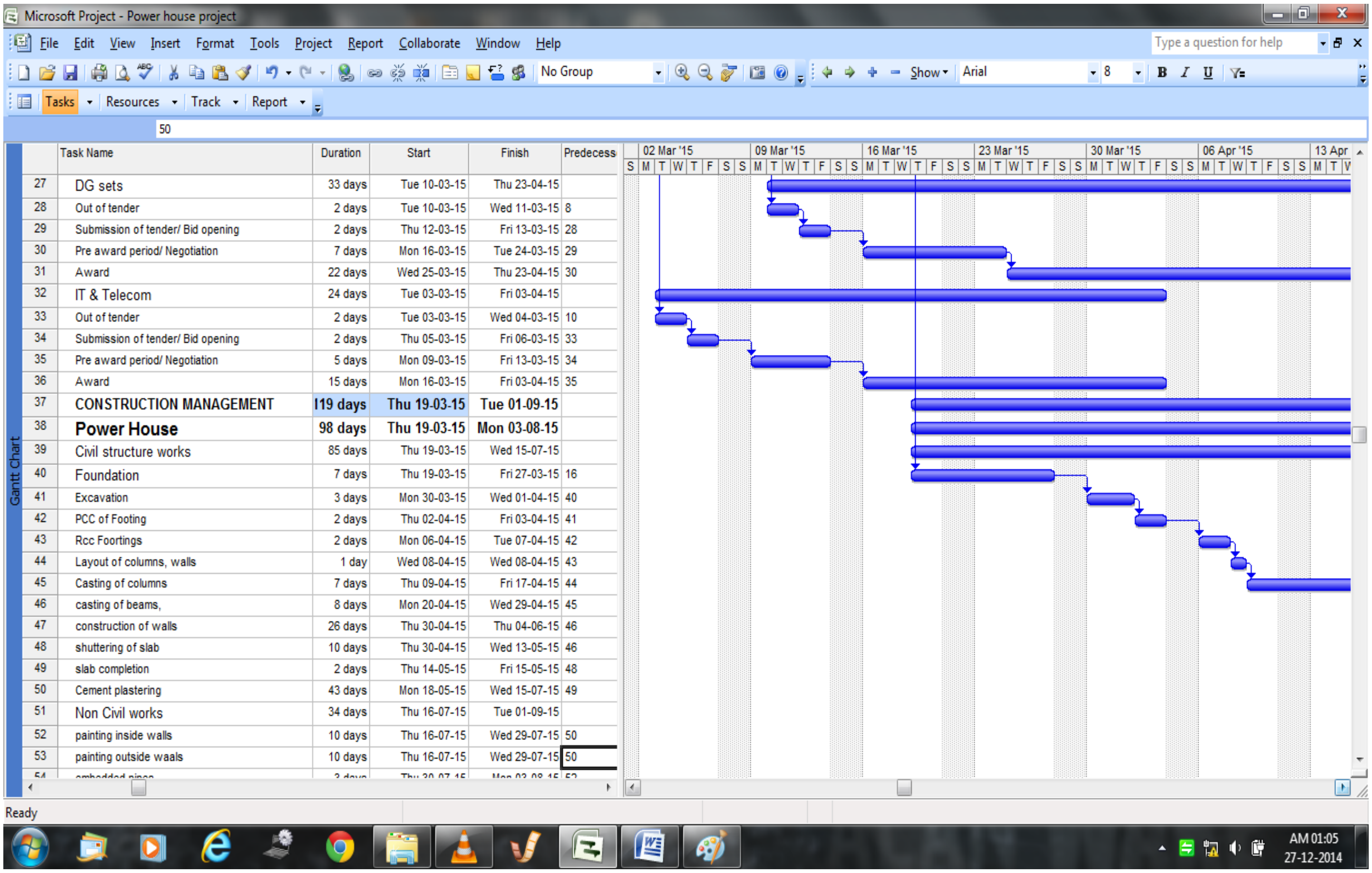
In MS project we input these activities and their respective resources with duration, taking into consideration the constraints and predecessors for each activity. The MS project will automatically give the output in form of Gantt chart graphically.

6.1 Power House



	Task Name	Duration	Start	Finish	Predecess
1	**Design brief**	**33 days**	**Thu 11-12-14**	**Mon 26-01-15**	
2	preparation of sanction plans	1 day	Thu 11-12-14	Thu 11-12-14	
3	draft project brief of the project by consultant	30 days	Fri 12-12-14	Thu 22-01-15	2
4	submission of sanction plans	1 day	Fri 23-01-15	Fri 23-01-15	3
5	approval of sanction plans	1 day	Mon 26-01-15	Mon 26-01-15	4
6	**Preconstruction Management**	**30 days**	**Thu 11-12-14**	**Wed 21-01-15**	
7	Civil Structure Works	15 days	Tue 27-01-15	Mon 16-02-15	5
8	Electrical, plumbing and Sanitary works	15 days	Tue 17-02-15	Mon 09-03-15	7
9	Fire Protection works	10 days	Tue 17-02-15	Mon 02-03-15	7
10	IT Telecom	10 days	Tue 17-02-15	Mon 02-03-15	7
11	**PROCUREMENT & DELIEVERIES**	**49 days**	**Tue 27-01-15**	**Fri 03-04-15**	
12	Main Civil Works	37 days	Tue 27-01-15	Wed 18-03-15	
13	Out of tender	2 days	Tue 27-01-15	Wed 28-01-15	5
14	Submission of tender/ Bid opening	3 days	Thu 29-01-15	Mon 02-02-15	13
15	Pre award period/ Negotiation	7 days	Tue 03-02-15	Wed 11-02-15	14
16	Award	25 days	Thu 12-02-15	Wed 18-03-15	15
17	Electrical,plumbing and Sanitary works	31 days	Tue 17-02-15	Tue 31-03-15	
18	Out of tender	2 days	Tue 10-03-15	Wed 11-03-15	8
19	Submission of tender/ Bid opening	2 days	Thu 12-03-15	Fri 13-03-15	18
20	Pre award period/ Negotiation	7 days	Mon 16-03-15	Tue 24-03-15	19
21	Award	20 days	Wed 25-03-15	Tue 21-04-15	20
22	Fire fighting system	24 days	Tue 03-03-15	Fri 03-04-15	
23	Out of tender	2 days	Tue 03-03-15	Wed 04-03-15	9
24	Submission of tender/ Bid opening	2 days	Thu 05-03-15	Fri 06-03-15	23
25	Pre award period/ Negotiation	3 days	Mon 09-03-15	Wed 11-03-15	24
26	Award	17 days	Thu 12-03-15	Fri 03-04-15	25
27	DG sets	33 days	Tue 10-03-15	Thu 23-04-15	
28	Out of tender	2 days	Tue 10-03-15	Wed 11-03-15	8

FIG 6.1 **MS Project Result (part 1)**



	Task Name	Duration	Start	Finish	Predecess
27	DG sets	33 days	Tue 10-03-15	Thu 23-04-15	
28	Out of tender	2 days	Tue 10-03-15	Wed 11-03-15	8
29	Submission of tender/ Bid opening	2 days	Thu 12-03-15	Fri 13-03-15	28
30	Pre award period/ Negotiation	7 days	Mon 16-03-15	Tue 24-03-15	29
31	Award	22 days	Wed 25-03-15	Thu 23-04-15	30
32	IT & Telecom	24 days	Tue 03-03-15	Fri 03-04-15	
33	Out of tender	2 days	Tue 03-03-15	Wed 04-03-15	10
34	Submission of tender/ Bid opening	2 days	Thu 05-03-15	Fri 06-03-15	33
35	Pre award period/ Negotiation	5 days	Mon 09-03-15	Fri 13-03-15	34
36	Award	15 days	Mon 16-03-15	Fri 03-04-15	35
37	**CONSTRUCTION MANAGEMENT**	**119 days**	**Thu 19-03-15**	**Tue 01-09-15**	
38	**Power House**	**98 days**	**Thu 19-03-15**	**Mon 03-08-15**	
39	Civil structure works	85 days	Thu 19-03-15	Wed 15-07-15	
40	Foundation	7 days	Thu 19-03-15	Fri 27-03-15	16
41	Excavation	3 days	Mon 30-03-15	Wed 01-04-15	40
42	PCC of Footing	2 days	Thu 02-04-15	Fri 03-04-15	41
43	Rcc Foortings	2 days	Mon 06-04-15	Tue 07-04-15	42
44	Layout of columns, walls	1 day	Wed 08-04-15	Wed 08-04-15	43
45	Casting of columns	7 days	Thu 09-04-15	Fri 17-04-15	44
46	casting of beams,	8 days	Mon 20-04-15	Wed 29-04-15	45
47	construction of walls	26 days	Thu 30-04-15	Thu 04-06-15	46
48	shuttering of slab	10 days	Thu 30-04-15	Wed 13-05-15	46
49	slab completion	2 days	Thu 14-05-15	Fri 15-05-15	48
50	Cement plastering	43 days	Mon 18-05-15	Wed 15-07-15	49
51	Non Civil works	34 days	Thu 16-07-15	Tue 01-09-15	
52	painting inside walls	10 days	Thu 16-07-15	Wed 29-07-15	50
53	painting outside waals	10 days	Thu 16-07-15	Wed 29-07-15	50

FIG 6.2 MS Project Result (part 2)

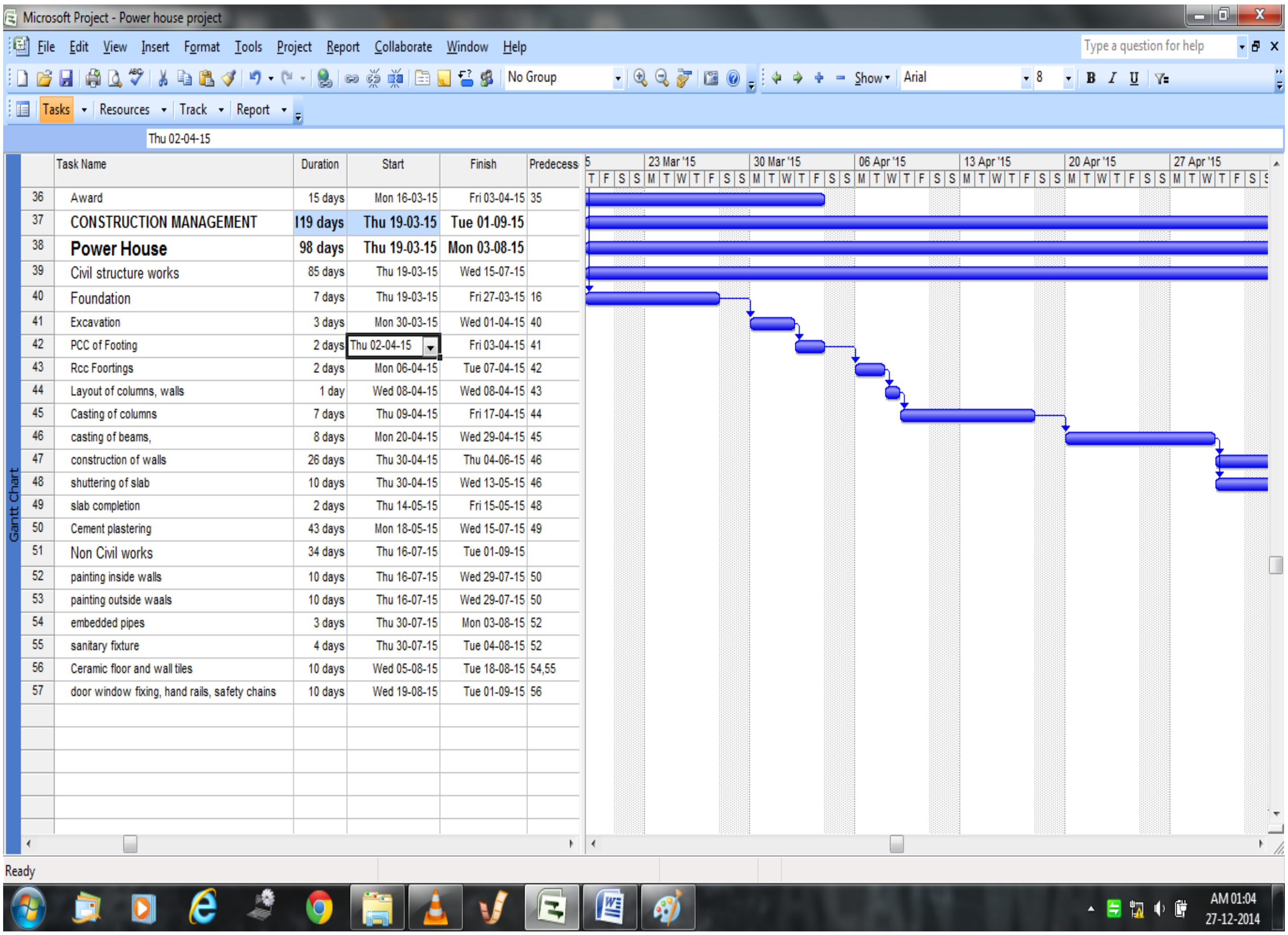


FIG 6.3 MS Project Result (part 3)

Then at last we will find out the optimized scheduled time required for the project

6.2 Rewa-Jabalpur Road Project

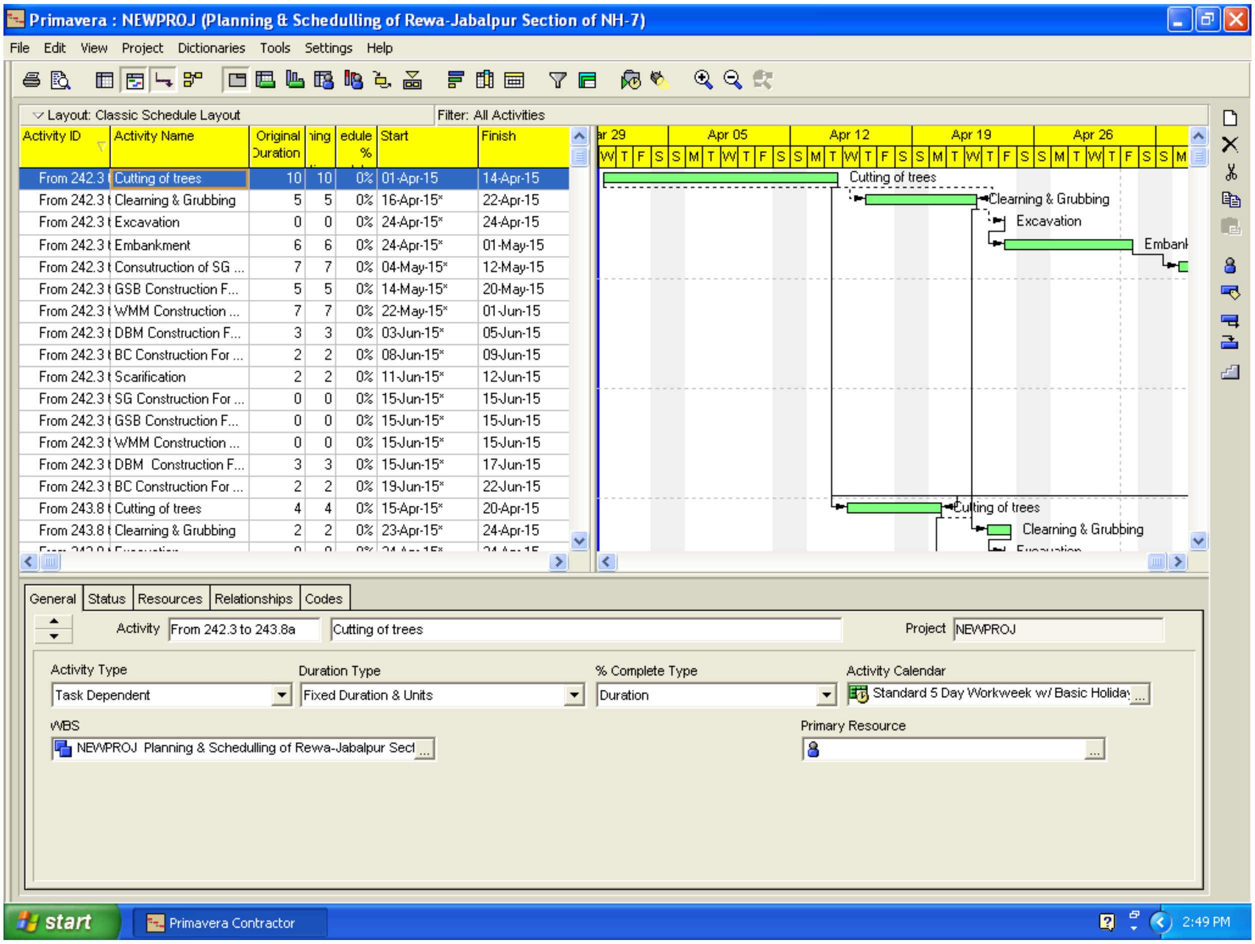


Fig. 6.4 Primavera Result (part 1)

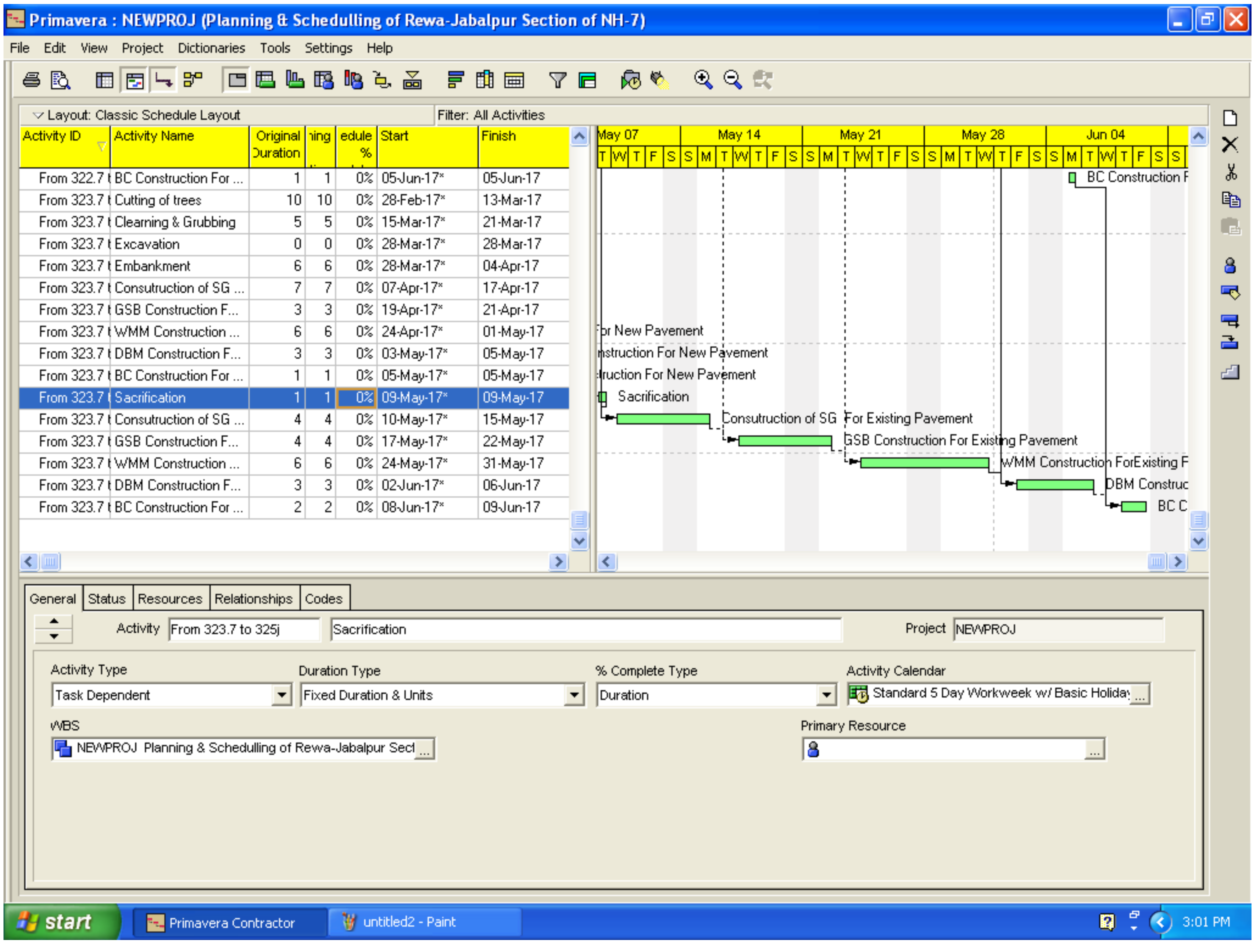


Fig. 6.5 Primavera Result (part 2)

Then at last we will find out the optimized scheduled time required for the Rewa-Jabalpur Road Project is 803 days ie 4 years 6 months and 9 days.

7. SCOPE FOR FUTURE PROJECTS

Project scheduling is one of the most important topics in construction management. Many scheduling techniques have been developed and are widely used for construction projects.

Time is money for owners, users and constructors. From the perspective of owners they may lose revenue by not receiving return on investment on time, cash flow may be stopped, loss of clients, considerations of tax, extended interest payment

In this semester we have done scheduling for only Power House in the hydro power plant structure . For the next semester we will do scheduling of other structures such as like intake structures, penstocks etc

8. References

1. http://cpwd.gov.in/Publication/DAR14-Vol11 & 2.pdf

for rate requirement for brickwork, concrete work, sanitary work

2. Standard Data Book

for excavation work and cutting of trees resource requirement

3. Colliersinternational/resource.info/casapicaso

for all preconstruction management activities

4.THEPL-2014/CW & HM/01

for structure specifications and quantity estimation

Annexure-A

S. No.	Design Chainage		Length (km)		
	From	To		Quantity	Time estimation
1	242.3	243.8	1.5	164	7
2	243.8	244.4	0.6	108	5
3	244.4	244.9	0.5	55	3
4	244.9	245.9	1.0	105	5
5	245.9	246.5	0.6	112	5
6	246.5	247.5	1.0	195	8
7	247.5	248.3	0.8	81	4
8	248.3	249.6	1.3	160	7
9	249.6	251.0	1.4	153	7
10	251.0	253.0	2.0	360	15
11	253.0	253.6	0.6	61	3
12	253.6	254.5	1.0	105	5

13	254.5	255.8	1.3	138	6
14	255.8	256.8	1.0	181	8
15	256.8	261.7	4.9	522	21
16	261.7	262.7	0.9	N/A	N/A
17	262.7	263.5	0.8	88	4
18	263.5	266.1	2.6	280	12
19	266.1	267.3	1.2	123	5
20	267.3	268.0	0.7	133	6
21	268.0	268.7	0.6	68	3
22	268.7	269.6	0.9	99	4
23	269.6	270.056	0.5	51	3
24	270.1	270.698	0.6	69	3
25	270.7	271.8	1.1	121	5
26	271.8	272.4	0.6	108	5
27	272.4	273.6	1.1	122	5

28	273.6	274.018	0.5	48	2
29	274.0	275.2	1.2	124	5
30	275.2	275.8	0.6	122	5
31	275.8	276.8	1.0	109	5
32	276.8	277.9	1.1	207	9
33	277.9	278.7	0.9	91	4
34	278.7	279.4	0.6	122	5
35	279.4	280.745	1.4	148	6
36	280.7	282.1	1.4	145	6
37	282.1	282.556	0.5	48	2
38	282.6	283.158	0.6	108	5
39	283.2	284.1	1.0	103	5
40	284.1	285.1	1.0	106	5
41	285.1	286.1	0.9	169	7

42	286.1	287.2	1.1	118	5
43	287.2	287.771	0.6	65	3
44	287.8	288.377	0.6	109	5
45	288.4	289.2	0.8	83	4
46	289.2	291.994	2.8	303	13
47	292.0	292.376	0.4	41	2
48	292.4	294.880	2.5	267	11
49	294.9	295.770	0.9	95	4
50	295.8	299.4	3.7	391	16
51	299.4	300.5	1.0	127	6
52	300.5	301.6	1.1	220	9
53	301.6	301.997	0.4	48	2
54	302.0	303.6	1.6	309	13
55	303.6	306.158	2.6	275	11
56	306.2	306.5	0.3	36	2

57	306.5	307.253	0.8	136	6
58	307.3	307.7	0.4	48	2
59	307.7	308.848	1.1	122	5
60	308.8	311.081	2.2	238	10
61	311.1	314.8	3.7	393	16
62	314.8	315.4	0.7	70	3
63	315.4	316.3	0.9	165	7
64	318.6	319.969	1.4	146	6
65	320.0	320.311	0.3	37	2
66	320.3	321.5	1.1	122	5
67	321.5	322.1	0.6	125	5
68	322.1	322.711	0.6	66	3
69	322.7	323.685	1.0	104	5
70	323.7	324.9	1.3	134	6

Annexure-B

S. No.	Design Chainage		Length (km)	Quantity	Time estimation
	From	To			
1	242.3	243.8	1.5	5	6
2	243.8	244.4	0.6	4	4
3	244.4	244.9	0.5	2	2
4	244.9	245.9	1.0	3	4
5	245.9	246.5	0.6	4	4
6	246.5	247.5	1.0	7	7
7	247.5	248.3	0.8	3	3
8	248.3	249.6	1.3	5	6
9	249.6	251.0	1.4	5	6
10	251.0	253.0	2.0	12	12
11	253.0	253.6	0.6	2	3
12	253.6	254.5	1.0	3	4

13	254.5	255.8	1.3	5	5
14	255.8	256.8	1.0	6	7
15	256.8	261.7	4.9	17	18
16	261.7	262.7	0.9	#N/A	#N/A
17	262.7	263.5	0.8	2.94768	3
18	263.5	266.1	2.6	9.33966	10
19	266.1	267.3	1.2	4.10824	5
20	267.3	268.0	0.7	4.428	5
21	268.0	268.7	0.6	2.2695	3
22	268.7	269.6	0.9	3.29122	4
23	269.6	270.056	0.5	1.69456	2
24	270.1	270.698	0.6	2.28552	3
25	270.7	271.8	1.1	4.01924	5
26	271.8	+	0.6	3.6	4
27	272.4	273.6	1.1	4.0584	5

28	273.6	274.018	0.5	1.60556	2
29	274.0	275.2	1.2	4.14562	5
30	275.2	275.8	0.6	4.056	5
31	275.8	276.8	1.0	3.61874	4
32	276.8	277.9	1.1	6.89	7
33	277.9	278.7	0.9	3.02778	4
34	278.7	279.4	0.6	4.0625	5
35	279.4	280.745	1.4	4.93594	5
36	280.7	282.1	1.4	4.8416	5
37	282.1	282.556	0.5	1.60556	2
38	282.6	283.158	0.6	3.612	4
39	283.2	284.1	1.0	3.43184	4
40	284.1	285.1	1.0	3.5422	4
41	285.1	286.1	0.9	5.637	6

42	286.1	287.2	1.1	3.94982	4
43	287.2	287.771	0.6	2.1538	3
44	287.8	288.377	0.6	3.636	4
45	288.4	289.2	0.8	2.77858	3
46	289.2	291.994	2.8	10.09794	11
47	292.0	292.376	0.4	1.35992	2
48	292.4	294.880	2.5	8.91424	9
49	294.9	295.770	0.9	3.1684	4
50	295.8	299.4	3.7	13.03316	14
51	299.4	300.5	1.0	4.23864	5
52	300.5	301.6	1.1	7.34825	8
53	301.6	301.997	0.4	1.58949	2
54	302.0	303.6	1.6	10.296	11
55	303.6	306.158	2.6	9.17412	10
56	306.2	306.5	0.3	1.20862	2

57	306.5	307.253	0.8	4.533	5
58	307.3	307.7	0.4	1.59844	2
59	307.7	308.848	1.1	4.07976	5
60	308.8	311.081	2.2	7.94948	8
61	311.1	314.8	3.7	13.1008	14
62	314.8	315.4	0.7	2.33002	3
63	315.4	316.3	0.9	5.499	6
64	318.6	319.969	1.4	4.86652	5
65	320.0	320.311	0.3	1.21752	2
66	320.3	321.5	1.1	4.06374	5
67	321.5	322.1	0.6	4.173	5
68	322.1	322.711	0.6	2.19474	3
69	322.7	323.685	1.0	3.46744	4
70	323.7	324.9	1.3	4.47492	5

Annexure-C

S. No.	Design Chainage		Length (km)	Quantity	Time estimation
	From	To			
1	242.3	243.8	1.5	0	0
2	243.8	244.4	0.6	0	0
3	244.4	244.9	0.5	0	0
4	244.9	245.9	1.0	0	0
5	245.9	246.5	0.6	0	0
6	246.5	247.5	1.0	0	0
7	247.5	248.3	0.8	0	0
8	248.3	249.6	1.3	798	2
9	249.6	251.0	1.4	3308	7
10	251.0	253.0	2.0	0	0
11	253.0	253.6	0.6	0	0

12	253.6	254.5	1.0	0	0
13	254.5	255.8	1.3	0	0
14	255.8	256.8	1.0	0	0
15	256.8	261.7	4.9	0	0
16	261.7	262.7	0.9	0	0
17	262.7	263.5	0.8	0	0
18	263.5	266.1	2.6	0	0
19	266.1	267.3	1.2	0	0
20	267.3	268.0	0.7	1328.4	3
21	268.0	268.7	0.6	0	0
22	268.7	269.6	0.9	0	0
23	269.6	270.056	0.5	0	0
24	270.1	270.698	0.6	0	0
25	270.7	271.8	1.1	0	0

26	271.8	+	0.6	0	0
27	272.4	273.6	1.1	0	0
28	273.6	274.018	0.5	0	0
29	274.0	275.2	1.2	0	0
30	275.2	275.8	0.6	0	0
31	275.8	276.8	1.0	0	0
32	276.8	277.9	1.1	0	0
33	277.9	278.7	0.9	0	0
34	278.7	279.4	0.6	0	0
35	279.4	280.745	1.4	0	0
36	280.7	282.1	1.4	0	0
37	282.1	282.556	0.5	0	0
38	282.6	283.158	0.6	0	0
39	283.2	284.1	1.0	0	0
40	284.1	285.1	1.0	1771.1	4

41	285.1	286.1	0.9	281.85	1
42	286.1	287.2	1.1	197.491	1
43	287.2	287.771	0.6	0	0
44	287.8	288.377	0.6	0	0
45	288.4	289.2	0.8	0	0
46	289.2	291.994	2.8	0	0
47	292.0	292.376	0.4	0	0
48	292.4	294.880	2.5	0	0
49	294.9	295.770	0.9	0	0
50	295.8	299.4	3.7	0	0
51	299.4	300.5	1.0	0	0
52	300.5	301.6	1.1	0	0
53	301.6	301.997	0.4	0	0
54	302.0	303.6	1.6	0	0

55	303.6	306.158	2.6	0	0
56	306.2	306.5	0.3	0	0
57	306.5	307.253	0.8	0	0
58	307.3	307.7	0.4	0	0
59	307.7	308.848	1.1	0	0
60	308.8	311.081	2.2	0	0
61	311.1	314.8	3.7	0	0
62	314.8	315.4	0.7	0	0
63	315.4	316.3	0.9	0	0
64	318.6	319.969	1.4	0	0
65	320.0	320.311	0.3	0	0
66	320.3	321.5	1.1	0	0
67	321.5	322.1	0.6	0	0
68	322.1	322.711	0.6	0	0
69	322.7	323.685	1.0	0	0
70	323.7	324.9	1.3	0	0

Annexure –D

S. No.	Design Chainage		Length (km)	Quantity	Time estimation
	From	To			
1	242.3	243.8	1.5	25617	9
2	243.8	244.4	0.6	19620	7
3	244.4	244.9	0.5	24056	9
4	244.9	245.9	1.0	13418	5
5	245.9	246.5	0.6	19926	7
6	246.5	247.5	1.0	38025	13
7	247.5	248.3	0.8	17169	6
8	248.3	249.6	1.3	0	0
9	249.6	251.0	1.4	0	0
10	251.0	253.0	2.0	42600	15
11	253.0	253.6	0.6	6151	3
12	253.6	254.5	1.0	1924	1

13	254.5	255.8	1.3	8489	3
14	255.8	256.8	1.0	11150	4
15	256.8	261.7	4.9	32209	11
16	261.7	262.7	0.9	#N/A	#N/A
17	262.7	263.5	0.8	5453.208	2
18	263.5	266.1	2.6	17278.371	6
19	266.1	267.3	1.2	9038.128	4
20	267.3	268.0	0.7	0	0
21	268.0	268.7	0.6	2723.4	1
22	268.7	269.6	0.9	15304.173	6
23	269.6	270.056	0.5	6185.144	3
24	270.1	270.698	0.6	8342.148	3
25	270.7	271.8	1.1	19292.352	7
26	271.8	+	0.6	17280	6
27	272.4	273.6	1.1	19480.32	7

28	273.6	274.018	0.5	7706.688	3
29	274.0	275.2	1.2	19898.976	7
30	275.2	275.8	0.6	19468.8	7
31	275.8	276.8	1.0	17369.952	6
32	276.8	277.9	1.1	63043.5	12
33	277.9	278.7	0.9	27704.187	10
34	278.7	279.4	0.6	37171.875	13
35	279.4	280.745	1.4	45163.851	16
36	280.7	282.1	1.4	60762.08	21
37	282.1	282.556	0.5	20149.778	7
38	282.6	283.158	0.6	45330.6	16
39	283.2	284.1	1.0	12011.44	5
40	284.1	285.1	1.0	0	0
41	285.1	286.1	0.9	0	0

42	286.1	287.2	1.1	0	0
43	287.2	287.771	0.6	6138.33	3
44	287.8	288.377	0.6	10362.6	4
45	288.4	289.2	0.8	12086.823	5
46	289.2	291.994	2.8	14137.116	5
47	292.0	292.376	0.4	1903.888	1
48	292.4	294.880	2.5	57051.136	20
49	294.9	295.770	0.9	20277.76	7
50	295.8	299.4	3.7	83412.224	28
51	299.4	300.5	1.0	27127.296	9
52	300.5	301.6	1.1	47028.8	16
53	301.6	301.997	0.4	10172.736	4
54	302.0	303.6	1.6	65894.4	12
55	303.6	306.158	2.6	90823.788	30
56	306.2	306.5	0.3	11965.338	4

57	306.5	307.253	0.8	35810.7	12
58	307.3	307.7	0.4	12627.676	5
59	307.7	308.848	1.1	32230.104	11
60	308.8	311.081	2.2	31797.92	11
61	311.1	314.8	3.7	52403.2	18
62	314.8	315.4	0.7	9320.08	4
63	315.4	316.3	0.9	8248.5	3
64	318.6	319.969	1.4	17032.82	6
65	320.0	320.311	0.3	4261.32	2
66	320.3	321.5	1.1	14223.09	5
67	321.5	322.1	0.6	16274.7	6
68	322.1	322.711	0.6	8559.486	3
69	322.7	323.685	1.0	13523.016	5
70	323.7	324.9	1.3	19689.648	7

Annexure-E

S. No.	Design Chainage		Length (km)	Quantity	Time estimation
	From	To			
1	242.3	243.8	1.5	8497	9
2	243.8	244.4	0.6	3330	4
3	244.4	244.9	0.5	2869	3
4	244.9	245.9	1.0	5433	6
5	245.9	246.5	0.6	3180	4
6	246.5	247.5	1.0	5550	6
7	247.5	248.3	0.8	4215	5
8	248.3	249.6	1.3	7276	8
9	249.6	251.0	1.4	7934	8
10	251.0	253.0	2.0	11100	12
11	253.0	253.6	0.6	3144	4
12	253.6	254.5	1.0	5453	6

13	254.5	255.8	1.3	7154	8
14	255.8	256.8	1.0	5575	6
15	256.8	261.7	4.9	27142	28
16	261.7	262.7	0.9	#N/A	#N/A
17	262.7	263.5	0.8	4595.4	5
18	263.5	266.1	2.6	14560.425	15
19	266.1	267.3	1.2	6404.7	7
20	267.3	268.0	0.7	4095.9	5
21	268.0	268.7	0.6	3538.125	4
22	268.7	269.6	0.9	5130.975	6
23	269.6	270.056	0.5	2641.8	3
24	270.1	270.698	0.6	3563.1	4
25	270.7	271.8	1.1	6265.95	7
26	271.8	+	0.6	3330	4
27	272.4	273.6	1.1	6327	7

28	273.6	274.018	0.5	2503.05	3
29	274.0	275.2	1.2	6462.975	7
30	275.2	275.8	0.6	3463.2	4
31	275.8	276.8	1.0	5641.575	6
32	276.8	277.9	1.1	5883	6
33	277.9	278.7	0.9	4720.275	5
34	278.7	279.4	0.6	3468.75	4
35	279.4	280.745	1.4	7695.075	8
36	280.7	282.1	1.4	7548	8
37	282.1	282.556	0.5	2503.05	3
38	282.6	283.158	0.6	3341.1	4
39	283.2	284.1	1.0	5350.2	6
40	284.1	285.1	1.0	5522.25	6
41	285.1	286.1	0.9	5214.225	6

42	286.1	287.2	1.1	6157.725	7
43	287.2	287.771	0.6	3357.75	4
44	287.8	288.377	0.6	3363.3	4
45	288.4	289.2	0.8	4331.775	5
46	289.2	291.994	2.8	15742.575	16
47	292.0	292.376	0.4	2120.1	3
48	292.4	294.880	2.5	13897.2	14
49	294.9	295.770	0.9	4939.5	5
50	295.8	299.4	3.7	20318.55	21
51	299.4	300.5	1.0	5794.2	6
52	300.5	301.6	1.1	6274.275	7
53	301.6	301.997	0.4	2172.825	3
54	302.0	303.6	1.6	8791.2	9
55	303.6	306.158	2.6	14302.35	15
56	306.2	306.5	0.3	1884.225	2

57	306.5	307.253	0.8	4193.025	5
58	307.3	307.7	0.4	2491.95	3
59	307.7	308.848	1.1	6360.3	7
60	308.8	311.081	2.2	12393.15	13
61	311.1	314.8	3.7	20424	21
62	314.8	315.4	0.7	3632.475	4
63	315.4	316.3	0.9	5086.575	6
64	318.6	319.969	1.4	7586.85	8
65	320.0	320.311	0.3	1898.1	2
66	320.3	321.5	1.1	6335.325	7
67	321.5	322.1	0.6	3563.1	4
68	322.1	322.711	0.6	3421.575	4
69	322.7	323.685	1.0	5405.7	6
70	323.7	324.9	1.3	6976.35	7

Annexure-F

S. No.	Design Chainage		Length (km)	Quantity	Time estimation
	From	To			
1	242.3	243.8	1.5	3399	5
2	243.8	244.4	0.6	1332	2
3	244.4	244.9	0.5	1148	2
4	244.9	245.9	1.0	2173	3
5	245.9	246.5	0.6	1272	2
6	246.5	247.5	1.0	2220	4
7	247.5	248.3	0.8	1686	3
8	248.3	249.6	1.3	2910	4
9	249.6	251.0	1.4	3173	5
10	251.0	253.0	2.0	4440	7
11	253.0	253.6	0.6	1258	2
12	253.6	254.5	1.0	2181	3

13	254.5	255.8	1.3	2862	4
14	255.8	256.8	1.0	2230	4
15	256.8	261.7	4.9	10857	15
16	261.7	262.7	0.9	#N/A	#N/A
17	262.7	263.5	0.8	1838.16	3
18	263.5	266.1	2.6	5824.17	8
19	266.1	267.3	1.2	2561.88	4
20	267.3	268.0	0.7	1638.36	3
21	268.0	268.7	0.6	1415.25	2
22	268.7	269.6	0.9	2052.39	3
23	269.6	270.056	0.5	1056.72	2
24	270.1	270.698	0.6	1425.24	2
25	270.7	271.8	1.1	2506.38	4
26	271.8	+	0.6	1332	2
27	272.4	273.6	1.1	2530.8	4

28	273.6	274.018	0.5	1001.22	2
29	274.0	275.2	1.2	2585.19	4
30	275.2	275.8	0.6	1385.28	2
31	275.8	276.8	1.0	2256.63	4
32	276.8	277.9	1.1	2353.2	4
33	277.9	278.7	0.9	1888.11	3
34	278.7	279.4	0.6	1387.5	2
35	279.4	280.745	1.4	3078.03	5
36	280.7	282.1	1.4	3019.2	5
37	282.1	282.556	0.5	1001.22	2
38	282.6	283.158	0.6	1336.44	2
39	283.2	284.1	1.0	2140.08	3
40	284.1	285.1	1.0	2208.9	4
41	285.1	286.1	0.9	2085.69	3

42	286.1	287.2	1.1	2463.09	4
43	287.2	287.771	0.6	1343.1	2
44	287.8	288.377	0.6	1345.32	2
45	288.4	289.2	0.8	1732.71	3
46	289.2	291.994	2.8	6297.03	9
47	292.0	292.376	0.4	848.04	2
48	292.4	294.880	2.5	5558.88	8
49	294.9	295.770	0.9	1975.8	3
50	295.8	299.4	3.7	8127.42	12
51	299.4	300.5	1.0	2317.68	4
52	300.5	301.6	1.1	2509.71	4
53	301.6	301.997	0.4	869.13	2
54	302.0	303.6	1.6	3516.48	5
55	303.6	306.158	2.6	5720.94	8
56	306.2	306.5	0.3	753.69	2

57	306.5	307.253	0.8	1677.21	3
58	307.3	307.7	0.4	996.78	2
59	307.7	308.848	1.1	2544.12	4
60	308.8	311.081	2.2	4957.26	7
61	311.1	314.8	3.7	8169.6	12
62	314.8	315.4	0.7	1452.99	2
63	315.4	316.3	0.9	2034.63	3
64	318.6	319.969	1.4	3034.74	5
65	320.0	320.311	0.3	759.24	2
66	320.3	321.5	1.1	2534.13	4
67	321.5	322.1	0.6	1425.24	2
68	322.1	322.711	0.6	1368.63	2
69	322.7	323.685	1.0	2162.28	3
70	323.7	324.9	1.3	2790.54	4

Annexure-G

S. No.	Design Chainage		Length (km)		
	From	To		Quantity	Time estimation
1	242.3	243.8	1.5	3866	7
2	243.8	244.4	0.6	1515	3
3	244.4	244.9	0.5	1305	3
4	244.9	245.9	1.0	2472	5
5	245.9	246.5	0.6	1447	3
6	246.5	247.5	1.0	2525	5
7	247.5	248.3	0.8	1918	4
8	248.3	249.6	1.3	3310	6
9	249.6	251.0	1.4	3609	7
10	251.0	253.0	2.0	5050	9
11	253.0	253.6	0.6	1430	3
12	253.6	254.5	1.0	2481	5

13	254.5	255.8	1.3	3255	6
14	255.8	256.8	1.0	2536	5
15	256.8	261.7	4.9	12349	21
16	261.7	262.7	0.9	#N/A	#N/A
17	262.7	263.5	0.8	2090.7	4
18	263.5	266.1	2.6	6624.337	12
19	266.1	267.3	1.2	2913.85	5
20	267.3	268.0	0.7	1863.45	4
21	268.0	268.7	0.6	1609.687	3
22	268.7	269.6	0.9	2334.363	4
23	269.6	270.056	0.5	1201.9	3
24	270.1	270.698	0.6	1621.05	3
25	270.7	271.8	1.1	2850.725	5
26	271.8	+	0.6	1515	3
27	272.4	273.6	1.1	2878.5	5

28	273.6	274.018	0.5	1138.775	2
29	274.0	275.2	1.2	2940.363	5
30	275.2	275.8	0.6	1575.6	3
31	275.8	276.8	1.0	2566.663	5
32	276.8	277.9	1.1	2676.5	5
33	277.9	278.7	0.9	2147.513	4
34	278.7	279.4	0.6	1578.125	3
35	279.4	280.745	1.4	3500.913	6
36	280.7	282.1	1.4	3434	6
37	282.1	282.556	0.5	1138.775	2
38	282.6	283.158	0.6	1520.05	3
39	283.2	284.1	1.0	2434.1	5
40	284.1	285.1	1.0	2512.375	5
41	285.1	286.1	0.9	2372.238	4

42	286.1	287.2	1.1	2801.487	5
43	287.2	287.771	0.6	1527.625	3
44	287.8	288.377	0.6	1530.15	3
45	288.4	289.2	0.8	1970.763	4
46	289.2	291.994	2.8	7162.163	12
47	292.0	292.376	0.4	964.55	2
48	292.4	294.880	2.5	6322.6	11
49	294.9	295.770	0.9	2247.25	4
50	295.8	299.4	3.7	9244.025	16
51	299.4	300.5	1.0	2636.1	5
52	300.5	301.6	1.1	2854.512	5
53	301.6	301.997	0.4	988.5375	2
54	302.0	303.6	1.6	3999.6	7
55	303.6	306.158	2.6	6506.925	11
56	306.2	306.5	0.3	857.2375	2

57	306.5	307.253	0.8	1907.637	4
58	307.3	307.7	0.4	1133.725	2
59	307.7	308.848	1.1	2893.65	5
60	308.8	311.081	2.2	5638.325	10
61	311.1	314.8	3.7	9292	16
62	314.8	315.4	0.7	1652.612	3
63	315.4	316.3	0.9	2314.162	4
64	318.6	319.969	1.4	3451.675	6
65	320.0	320.311	0.3	863.55	2
66	320.3	321.5	1.1	2882.288	5
67	321.5	322.1	0.6	1621.05	3
68	322.1	322.711	0.6	1556.663	3
69	322.7	323.685	1.0	2459.35	5
70	323.7	324.9	1.3	3173.925	6

Annexure-H

S. No.	Design Chainage		Length (km)	Quantity	Time estimation
	From	To			
1	242.3	243.8	1.5	1393	3
2	243.8	244.4	0.6	546	1
3	244.4	244.9	0.5	470	1
4	244.9	245.9	1.0	891	2
5	245.9	246.5	0.6	521	1
6	246.5	247.5	1.0	910	2
7	247.5	248.3	0.8	691	2
8	248.3	249.6	1.3	1193	2
9	249.6	251.0	1.4	1301	3
10	251.0	253.0	2.0	1820	4
11	253.0	253.6	0.6	516	1
12	253.6	254.5	1.0	894	2

13	254.5	255.8	1.3	1173	2
14	255.8	256.8	1.0	914	2
15	256.8	261.7	4.9	4450	8
16	261.7	262.7	0.9	#N/A	#N/A
17	262.7	263.5	0.8	753.48	2
18	263.5	266.1	2.6	2387.385	4
19	266.1	267.3	1.2	1050.14	2
20	267.3	268.0	0.7	671.58	2
21	268.0	268.7	0.6	580.125	1
22	268.7	269.6	0.9	841.295	2
23	269.6	270.056	0.5	433.16	1
24	270.1	270.698	0.6	584.22	1
25	270.7	271.8	1.1	1027.39	2
26	271.8	+	0.6	546	1
27	272.4	273.6	1.1	1037.4	2

28	273.6	274.018	0.5	410.41	1
29	274.0	275.2	1.2	1059.695	2
30	275.2	275.8	0.6	567.84	1
31	275.8	276.8	1.0	925.015	2
32	276.8	277.9	1.1	964.6	2
33	277.9	278.7	0.9	773.955	2
34	278.7	279.4	0.6	568.75	1
35	279.4	280.745	1.4	1261.715	3
36	280.7	282.1	1.4	1237.6	3
37	282.1	282.556	0.5	410.41	1
38	282.6	283.158	0.6	547.82	1
39	283.2	284.1	1.0	877.24	2
40	284.1	285.1	1.0	905.45	2
41	285.1	286.1	0.9	854.945	2

42	286.1	287.2	1.1	1009.645	2
43	287.2	287.771	0.6	550.55	1
44	287.8	288.377	0.6	551.46	1
45	288.4	289.2	0.8	710.255	2
46	289.2	291.994	2.8	2581.215	5
47	292.0	292.376	0.4	347.62	1
48	292.4	294.880	2.5	2278.64	4
49	294.9	295.770	0.9	809.9	2
50	295.8	299.4	3.7	3331.51	6
51	299.4	300.5	1.0	950.04	2
52	300.5	301.6	1.1	1028.755	2
53	301.6	301.997	0.4	356.265	1
54	302.0	303.6	1.6	1441.44	3
55	303.6	306.158	2.6	2345.07	4
56	306.2	306.5	0.3	339.8395	1

57	306.5	307.253	0.8	756.2555	2
58	307.3	307.7	0.4	449.449	1
59	307.7	308.848	1.1	1147.146	2
60	308.8	311.081	2.2	2235.233	4
61	311.1	314.8	3.7	3683.68	7
62	314.8	315.4	0.7	655.1545	2
63	315.4	316.3	0.9	917.4165	2
64	318.6	319.969	1.4	1368.367	3
65	320.0	320.311	0.3	342.342	1
66	320.3	321.5	1.1	1142.642	2
67	321.5	322.1	0.6	642.642	2
68	322.1	322.711	0.6	617.1165	2
69	322.7	323.685	1.0	974.974	2
70	323.7	324.9	1.3	1258.257	3

Annexure-I

S. No.	Design Chainage		Length (km)	Quantity	Time estimation
	From	To			
1	242.3	243.8	1.5	697	2
2	243.8	244.4	0.6	273	1
3	244.4	244.9	0.5	235	1
4	244.9	245.9	1.0	445	1
5	245.9	246.5	0.6	261	1
6	246.5	247.5	1.0	455	1
7	247.5	248.3	0.8	346	1
8	248.3	249.6	1.3	597	1
9	249.6	251.0	1.4	520	1
10	251.0	253.0	2.0	728	2
11	253.0	253.6	0.6	206	1
12	253.6	254.5	1.0	358	1

13	254.5	255.8	1.3	469	1
14	255.8	256.8	1.0	366	1
15	256.8	261.7	4.9	1780	3
16	261.7	262.7	0.9	#N/A	#N/A
17	262.7	263.5	0.8	301.392	1
18	263.5	266.1	2.6	954.954	2
19	266.1	267.3	1.2	420.056	1
20	267.3	268.0	0.7	268.632	1
21	268.0	268.7	0.6	232.05	1
22	268.7	269.6	0.9	336.518	1
23	269.6	270.056	0.5	173.264	1
24	270.1	270.698	0.6	233.688	1
25	270.7	271.8	1.1	410.956	1
26	271.8	+	0.6	218.4	1
27	272.4	273.6	1.1	414.96	1

28	273.6	274.018	0.5	164.164	1
29	274.0	275.2	1.2	423.878	1
30	275.2	275.8	0.6	227.136	1
31	275.8	276.8	1.0	370.006	1
32	276.8	277.9	1.1	385.84	1
33	277.9	278.7	0.9	309.582	1
34	278.7	279.4	0.6	227.5	1
35	279.4	280.745	1.4	504.686	1
36	280.7	282.1	1.4	495.04	1
37	282.1	282.556	0.5	164.164	1
38	282.6	283.158	0.6	219.128	1
39	283.2	284.1	1.0	350.896	1
40	284.1	285.1	1.0	362.18	1
41	285.1	286.1	0.9	341.978	1

42	286.1	287.2	1.1	403.858	1
43	287.2	287.771	0.6	220.22	1
44	287.8	288.377	0.6	220.584	1
45	288.4	289.2	0.8	284.102	1
46	289.2	291.994	2.8	1032.486	2
47	292.0	292.376	0.4	139.048	1
48	292.4	294.880	2.5	911.456	2
49	294.9	295.770	0.9	323.96	1
50	295.8	299.4	3.7	1332.604	3
51	299.4	300.5	1.0	380.016	1
52	300.5	301.6	1.1	411.502	1
53	301.6	301.997	0.4	142.506	1
54	302.0	303.6	1.6	576.576	1
55	303.6	306.158	2.6	938.028	2
56	306.2	306.5	0.3	154.4725	1

57	306.5	307.253	0.8	343.7525	1
58	307.3	307.7	0.4	204.295	1
59	307.7	308.848	1.1	521.43	1
60	308.8	311.081	2.2	1016.015	2
61	311.1	314.8	3.7	1674.4	3
62	314.8	315.4	0.7	297.7975	1
63	315.4	316.3	0.9	417.0075	1
64	318.6	319.969	1.4	621.985	2
65	320.0	320.311	0.3	155.61	1
66	320.3	321.5	1.1	519.3825	1
67	321.5	322.1	0.6	292.11	1
68	322.1	322.711	0.6	280.5075	1
69	322.7	323.685	1.0	443.17	1
70	323.7	324.9	1.3	571.935	1