"COSTING ESTIMATION AND SCHEDULING OF 60m RCC BOX GIRDER BRIDGE OVER MAN KHAD, BARSAR (H.P)"

A

PROJECT

Submitted in partial fulfilment of the requirements for the award of the degree

of

BACHELOR OF TECHNOLOGY

IN

CIVIL ENGINEERING

Under the supervision of

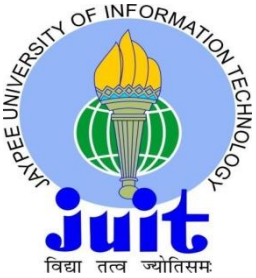
Mr. Lav Singh

(Assistant Professor)

By

Priya Singh (121640)

to



JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY

WAKNAGHAT SOLAN – 173 234

HIMACHAL PRADESH INDIA

June, 2016

CERTIFICATE

This is to certify that the work which is being presented in the project title **"Costing, Estimation and Scheduling of 60.837m long (2 spans) Box Girder Bridge over Man Khad Barsar"** in partial fulfilment of the requirements for the award of the degree of Bachelor of technology and submitted in Civil Engineering Department, Jaypee University of Information Technology, Waknaghat is an authentic record of work carried by **Priya Singh (121640) (**from July 2015 to June 2016) under the supervision of **Mr. Lav Singh (Assistant Professor)**, Civil Engineering Department, Jaypee University of Information Technology, Waknaghat.

The above statement made is correct to the best of my knowledge.

Date: - ……

Prof. Dr. Ashok Kumar Gupta	**Mr. Lav Singh**	**External Examiner**
Professor & Head of Department	**Assistant Professor**	
Civil Engineering Department	**Civil Engineering Department**	
JUIT Waknaghat	**JUIT Waknaghat**	

ACKNOWLEDGEMENT

I wish to express my sincere gratitude to Mr Lav Singh for his excellent guidance and encouragement and support during the course of my work. I truly appreciate and value his profound knowledge, esteemed supervision and encouragement from beginning to the end of this project report.

My special thanks to Dr. Ashok Kumar Gupta, Professor and the Head of department of Civil Engineering, Jaypee University of Information Technology, Waknaghat for all the facilities provided to successfully complete this project.

I would also like to show my gratitude towards the HPPWD Hamirpur, Barsar Division for providing me with the necessary data. As well as Er. Ashok Kumar Verma (Govt. Cont.) for his expert guidance and vast knowledge.

Without the guidance of all of them this project would not have been completed.

Priya Singh

(121640)

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF FIGURES

`

LIST OF TABLES & GRAPHS

ABBREVIATION AND SYMBOLS

S.No	Symbol	Abbreviations
1	Cu m	Cubic metre
2	BOQ	Bill of Quantities
3	MoRTH	Ministry of Road Transportation and highway
4	HPPWD	Himachal Pradesh Public Works Department
5	IRC	Indian Road Congress
6	IS	Indian Standard
7	Dia	Diameter
8	Agg.	Aggregates
9	Sec	Section
10	W	Wall
11	R.F	Reinforcement
12	C.F	Counterfort
13	Ft.	Feet
14	PCC	Plain Cement Concrete
15	RCC	Reinforced Cement Concrete
13	LVL	Level
14	T	Torr Steel
15	E.F	Each Face
16	PERT	Programme Evaluation and Review Technique
17	CPM	Critical path Method

ABSTRACT

In this project the Estimation and Costing of a 60 M span box Girder Bridge over Man khad on jeoli devi , Saheli, Bhebar Karsai, Joure Amb Road has been done. The bridge consists of two spans of 30M each. And in the Project Part I the estimation of the foundation as well as the sub structure has been done. The purpose of this project is to basically learn the technique of estimating the quantity of concrete as well as the steel used in the structure. Along with the costing and estimation, rate analysis for the entire bridge has been done as per the items state in the BOQ for the respective bridge work. The rate analysis is extremely helpful to know the expected cost of a project which is further helpful for the construction firms at the time of bidding for a particular tender. The entire project has been summed up by comparing the estimated quantity of the concrete and the steel used with the quantities given in the BOQ of the work.

The project has been complete using software's like MS Excel 2010 using the format for the Rate Analysis, Estimation of concrete and the Estimation of the quantity of steel has been done. The drawing to show the cross sectional and the dimensional details of the have been prepared using AutoCAD.

In the analysis of the Rates the entire cost has been divided into four parts i.e. cost for labour, cost of material, cost of machinery and in some cases cost of carriage has also been taken into consideration. Whereas in the estimation. The estimation has been done in two parts the estimation of the quantity of steel and the estimation of quantity of concrete has been done separately. And in the end the abstract has been prepared to summarise the total rate of the project, total amount of concrete used and the total amount of steel used. In addition to this the amount of backfill and the amount of filter media used has also been calculated.

In the end the project is being scheduled using MS Project 2003 software. The scheduling done is based on the actual details and actual duration of the project based on the information gathered from the site. The number of duration has been calculated in days.

Key Words: *Estimation, Costing, BOQ, Schedule, Rate Analysis*

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

A bridge is a structure providing passage over an obstacle without closing the way beneath. The required passage may be for road, a railway, pedestrian, a canal or a pipeline. The obstacle to be crossed may be a river, a road, a valley.

There are six basic forms of bridge structures:

1. Beam bridges: The beam Bridge carry the loads by flexure
2. Truss bridges: The truss bridge of simple span behaves like a beam because it carries vertical loads by flexure. In which the top chords are in compression, and the bottom chords are in tension, while the vertical and diagonal members are in tension or compression depending upon their orientation.
3. Arch bridges: Loads are carried primarily in compression by the arch bridges, with the reaction at the supports being both vertical and horizontal forces.
4. Cantilever bridges: A cantilever bridge consists of three spans, of which the outer spans, known as anchor spans are anchored down to the shore, and these cantilever over channel.

The type of bridge that the project is being done on is a Beam bridge. A RCC box girder bridge supported by two abutments i.e. Jeoli Devi Side Abutment and the Saheli Side Abutment both the spans are of 30m length and is being supported by one single pier.

1.1.1 Components of bridges

The main parts of a bridge structure are:

1. Decking, consisting of the deck slab, girders, trusses, etc.
2. Bearing for the decking
3. Abutments and piers
4. Foundation for the abutments and the piers
5. Approaches to the bridge to connect the bridge proper to the roads on either side
6. Handrails, parapets and guard stones

The components above the level of bearing are grouped as superstructure, while the parts below the bearing level are classified as substructure. The portion below the bed level of a river bridge is called the foundation. The components below the bearing and above the foundation are often referred as substructure.

1.1.2 Reinforced Concrete Bridges

Concrete was used in 1840 for a 12m span bridge across the Garonne canal at Grisoles in France. The first reinforced concrete bridge was built by Adair in 1871 as a 15m span bridge across the Waveney at homers field, England. The adaptability of reinforced concrete to any architectural form and the increased efficiency in concrete construction resulted in its widespread use in bridge building. The use of reinforced concrete bridges has become popular in India since the beginning of the twentieth century. The bridge types adopted include

1. Simply supported
2. Simply supported T beams
3. Balanced cantilever with suspended spans
4. Arch and bow string girder
5. Continuous or framed structure

The solid slab simply supported bridges were common in 1920s. T-beam bridges have been used widely in the span range of 10-25m. Elegant arch bridges were built during 1920-50.

Since the length of the bridge is 60 m it is designed as Simply Supported Box Girder Bridge. The box girder bridges are constructed for a span more than 30m and less than or equal to 60m where if the span is of length more than 60m the Pre-stressed bridges are used.

1.2 OBJECTIVE OF THE PROJECT

The aim of the project has been categorised into three parts which can be stated as following:

1. To prepare the Analysis of Rates for the entire bridge as per the items stated in the BOQ attached with the tender document. The rate Analysis only for the items that are estimated i.e. Quantity of Steel, Backfill, and Quantity of Concrete has been done. Rate analysis is an extremely important in the process of tendering. The rate analysis is done by both the contractor and by the Department so that the rough estimate of the cost can be prepared. The determination of rate per unit of a particular item of work,

from the cost of quantities of materials, the cost of labourers and other miscellaneous petty expenses required for the completion

2. To estimate the quantity of concrete used or required in the structure. In the project only the quantity of the concrete for the sub structure has been estimated as per the technical specifications and plan stated in the drawing provided by HPPWD Barsar.
3. To estimate the quantity of steel used or required in the structure. Again here the estimation has been done for the substructure only and has been done separately for the abutments and pier.
4. To schedule the project using MS Project 2003. The start date of the project is taken as 11th march and keeping the completion time of 1 year in mind the scheduling of the project has been done by dividing the project into various activities.

1.3 SCOPE OF THE PROJECT

For all engineering works it is required to know beforehand the probable cost of construction known as the estimated cost and the estimated time of the project. The scope of the project is vast and has been noted as under:

1. In the process of tendering. For the process of tendering it is required to prepare the estimates of the project so that the Estimated Cost can be prepared.
2. Bidding for a particular contract also requires preparing the rate analysis as well as the estimates.
3. In providing the justification of rates
4. It also gives an idea about the amount of material that will be required for a particular activity of the project.
5. Scheduling of the project beforehand is very important as it helps in the better management of the project.
6. The project cost can be effectively decreased if the project is completed before the time as for that the scheduling of the project is very necessary. It can also help in increasing the profits for a particular Project.

1.4 DETAILS OF BRIDGE

a) **Name of the work:** c/o 60.837m span RCC Box Girder Bridge over Man Khad on Jeoli Devi, Saheli, Bhebar Karsai, Joure Amb road
b) **Type**: R.C.C Box Girder Bridge
c) **Loading**: Single Lane of IRC Class 'A'
d) **Tender Issued By**: HPPWD Hamirpur, Barsar Division
e) Grade of Cement shall confirm to IS: 269(GRADE 33)/ IS: 8112(GRADE 43)
f) The construction of the bridge is being done by Er. Ashok Verma(Govt. Contractor)
g) The time of completion of the work is 1 years and the work started on 11th March 2015.

1.4.1 Site of the Bridge

The Bridge is to be constructed over Mahn Khad which falls in Village Barsar in Hamirpur Himachal Pradesh. The main motive of the bridge is to provide passage over the khad which turns out to be destructive at the time of Monsoon. The bridge joins the two villages named as Jeoli devi and Saheli and hence the name of the two abutments has been finalised depending on which side of the Mahn Khad it falls. The construction of the bridge falls under the Himachal Pradesh Public Works Department (HPPWD) Barsar Sub divion. And the work is being done by Govt. Contractor Er. Ashok Verma. The work started on 11th March 2015 and is at its completion. The estimated cost of the project is Rs.1,25,00,000.

Fig. No 1.1 Saheli side span of bridge over Man Khad

1.5 DETAILS OF THE STRUCTURE OF THE BRIDGE

The bridge is an RCC Box girder type bridge consisting of a hollow box shaped slab in the superstructure and RCC abutments. The bridge is 60M long and consists of two spans of 30M each. The span from Jeoli Devi to Pier and the other span from Saheli side to the Pier. It consists of two abutments and one single circular Pier.

1.5.1 Foundation of the Bridge

The type of foundation used in this bridge is Raft foundation which is a large slab supporting a number of columns and walls under the entire structure or a large part of the structure to lower the contact pressure compared to spread footing. After the raft the construction of the counterforts will take place. The counterforts will rise up to only a specific height after that only the walls of the abutment will be built.

Fig.No 1.2 Raft foundation of Pier

1.5.2 Pier of the Bridge

A pier, in architecture, is an upright support for a structure or superstructure such as an arch or bridge. Sections of structural walls between openings (bays) can function as piers.

The pier divides the length of the bridge into spans and supports the slab at the center. This bridge has one pier dividing the bridge into two small spans of 30m each. The pier is circular in shape.

Fig No 1.3 Pier of the Bridge

1.5.3 Abutments

Fig No 1.4 Saheli Side Abutment

The bridge consists of two abutments named as Jeoli devi side abutment and Saheli side abutment the abutments falls on the sides of two villages named as Jeoli devi And saheli and hence the name of the abutment.

The saheli side abutment has a raft foundation and after the Raft the counterforts and the walls start. The walls are respectively named as w1, w2, w3, w4 and w5. The chambers surrounded by the walls are to be kept hollow. After the walls are constructed up to the required height the bed block is constructed and above the bed block bearings are installed. The bearings used are Rocker& Roller Bearing.

Similarly the Jeoli devi side Abutment also has Raft foundation but instead of 5 walls it has only 3 w1, w2 and w3.

1.5.4 Slab of the Superstructure

The slab of the super structure is divided into 2 spans of 30m each. In the project the calculation for only the Saheli Side span is done. The slab is RCC box girder. And consists of Soffit slab and Deck Slab separated by a hollow space. The hollow space is left in order to decrease the dead weight of the structure. The slab is joined to the road by an approach slab of length 4m.

Fig. No 1.5 Slab of bridge

CHAPTER 2

LITERATURE REVIEW

2.1 BILL OF QUANTITY

The Bill of quantity is basically a document giving the quantities and rates of each item of work and cost of each item of work and total cost of the whole work. Quantity surveying emerged as a separate profession in Britain in the 19th century. It is simply a task of measuring construction work required to implement the architects' design for new or renovated buildings. The purpose of the work is to produce quantified specifications of works known as Bills of Quantities. [1][4]

2.1.1 Objectives:

The objectives of the Bill of Quantities are:

1. To provide sufficient information on the quantities of Works to be performed to enable bids to be prepared efficiently and accurately; and when a contract has been entered into,
2. To provide a priced Bill of Quantities for use in the periodic valuation of works executed. In order to attain these objectives, works are itemized in the Bill of Quantities in sufficient detail to distinguish between the different classes of works, or between works of the same nature carried out in different locations or in other circumstances which may give rise to different considerations of cost. [1]

2.1.2 An Overview of Bills of Quantities

The Bills of Quantities are usually indicated by items of work, units of measurement, quantities of work, rate for doing the work, and total value of the work. Usually the contractor goes through the Bills of Quantities and would quote her/his rate as a percentage above or below the rates indicated. Even though the QS employed by the owner provides a detailed estimate for the project, sometimes the rates and total amount to do the works may not be shown in the Bills of Quantities. In that case, the bidder provides the rates of the items at which she/he is capable to do the works. Pricing of different items of work are done on the basis of the cost of materials, equipment, labor, and overheads and profit.[1]

Materials: The materials costs are calculated by examining the material quotations received from suppliers, applying appropriate wastage factors, and delivery charges.

Equipment: Cost of equipment is calculated usually as a percentage of the cost of materials. Depending on whether the equipment is owned or rented, this percentage will vary.

Labor: The most difficult element to price is the labor cost. Most of the times, it is not sufficient to rely on published standard rates. Allowances for absences due to sickness, loss of time due to inclement weather, overtime, etc. are required to be built in to arrive at a pragmatic all-inclusive labor rate. Rate of productivity is another factor that plays an important role in fixing labor prices. [1]

Overheads and profit: Once the cost of materials, equipment, and labor has been added up, a percentage for overhead and profit is added to the item rate. This percentage may vary from project to project depending on how well the document has been prepared by the QS and also on market conditions. It may range from 2.5 to over 25 per cent. [1]

Once the pricing of all individual items for all trades is completed, the amounts are carried to a summary page to indicate the total bid price.

The most important document in the process of tendering is the BOQ of the work which is attached to the Tender Inviting Notice.
A tender inviting notice consists of:

a) Tender Inviting Authority
b) Nature of the Work
c) Contract No.
d) Bidder Name
e) Schedule of the work
f) Signature of the tenderer with the seal

The BOQ of the bridge as released by the HPPWD for the Purpose of tendering has been attached at the end. [4]

2.2 ESTIMATION AND COSTING OF THE BRIDGE

For all engineering works it is required to know beforehand the probable cost of construction known as the estimated cost. If the estimated cost is greater than the money available, then attempts are made to reduce the cost by reducing the work or by changing the specification. In preparing the estimate, the quantities of different items of work are calculated by simple mensuration method and from these quantities the cost is calculated. Estimating is the most important of the practical aspects of construction management, and the subject deserves the closest attention of one aspiring to a career in the profession. It is a comparatively simple subject to understand; however, as it brings one up against practical work, methods and procedure, knowledge of it cannot be acquired without close application.[1][6]

2.2.1 Purpose of Estimating:

To give a reasonably accurate idea of the cost**:** An estimate is necessary to give the owner a reasonably accurate idea of the cost to help him decide whether the works can be undertaken as proposed or needs to be curtailed or abandoned, depending upon the availability of funds and prospective direct and indirect benefits. For government works proper sanction has to be obtained for allocating the required amount. Works are often let on a lump sum basis, in which case the Estimator must be in a position to know exactly how much expenditure he is going to incur on them. [1]

1. Estimating Materials: From the estimate of a work it is possible to determine what materials and in what quantities will be required for the works so that the arrangements to procure them can be made.
2. Estimating Labor: The number and kind of workers of different categories who will have to be employed to complete the work in the specified time can be found from the estimate.
3. Estimating Plant: An estimate will help in determining amount and kind of equipment needed to complete the work.
4. Estimating Time: The estimate of a work and the past experience enable one to estimate quite closely the length of time required to complete an item of work or the work as a whole.

2.2.2 Types of construction estimates

There are several kinds of estimating techniques; these can be grouped into two main categories

1. Approximate Estimates: An approximate estimate is an approximate or rough estimate prepared to obtain an approximate cost in a short time. For certain purposes the use of such methods is justified.
2. Detailed Estimate: A detailed estimate of the cost of a project is prepared by determining the quantities and costs of everything that a contractor is required to provide and do for the satisfactory completion of the work. It is the best and most

The detailed estimates are of two types:

a) Unit Quantity Method: In the unit quantity method, the work is divided into as many operations or items as are required. A unit of measurement is decided. The total quantity of work under each item is taken out in the proper unit of measurement. The total cost per unit quantity of each item is analysed and worked out. Then the total cost for the item is found by multiplying the cost per unit quantity by the number of units. This method has the advantage that the unit costs on various jobs can be readily compared and that the total estimate can easily be corrected for variations in quantities.
b) Total Quantity Method: In the total quantity method, an item of work is divided into the following five subdivisions:

    1. Materials
    2. Labor
    3. Plant
    4. Overheads
    5. Profit.

The total quantities of each kind or class of material or labor are found and multiplied by their individual unit cost. Similarly, the cost of plant, overhead expenses and profit are determined. The costs of all the five sub-heads are summed up to give the estimated cost of the item of work. [1]

2.3 RCC WORK AND STRUCTURE ESTIMATION

Reinforced cement concrete work is usually estimated less than two items. The concrete work including centring and shuttering, and binding of steel bars in position is taken under one item in cu m (cu ft.) and steel reinforcement and its bending is taken under a separate item in tonnes. The quantity of steel being small no deduction is made for steel from in the volume of concrete. Binding wire is not taken separately but included in item of RCC work. [6]

Steel reinforcement is calculated as per the actual requirement as laid in position including over-laps, hooks, cranks, etc. and is determined from the detailed drawings. If the detailed drawings are not available the steel reinforcement may be calculated approx. on the percentage basis of concrete. The density of steel may be taken as 78.5 quintal per cu m. The percentage of steel reinforcement depends on the design of the structure. [2]

2.4 ANALYSIS OF RATES OF THE BRIDGE

The determination of rate per unit of a particular item of work, from the cost quantities of material, the cost of labourers and other miscellaneous petty expenses require for its completion is known as the analysis of the rate. As reasonable profit, usually 10% for the contractor is also included in the analysis of the rate. Rates of the materials are usually taken as the rates delivered at the site of work and include the first cost (cost at the origin), cost of transport, taxes etc. if the materials are to be carried out from a distant place, more than 8km, then the cost of transport are also added. The rates of material and labour vary from place to lace.[2][5]

The rates of a particular item of work depend on the following:-

1. Specification of work and materials, quality of materials, proportion of mortar method of constructional operation.
2. Quantities of material and their rates, number of different types of labourer and their rates.
3. Location of the site work and its distance from the source of material and the rates of transport and availability of water.
4. Profits and miscellaneous and overhead expenses of the contractor.

Overhead Costs: Overhead costs include general office expenses, rents, taxes, supervision and other costs which are indirect expenses and not productive expenses on the job.[2]

The overhead costs are under the following heads:

A General Overheads:

1. Establishment
2. Stationary, printing and postage etc.
3. Travelling
4. Telephone
5. Rent and taxes

B Job overheads

1. Supervision (Salary of Engineers, oversees, Supervision etc.)
2. Handling of material
3. Repairs, carriage and depreciation
4. Amenities of labour
5. Workmen compensation, insurance etc.
6. Investment interest
7. Losses on advances

The contractor may be allowed a net profit of 6 to 8 per cent, and the miscellaneous overhead expenses may come to about 5 to 10 per cent. For overhead expenses and contractors profit 15 per cent of the actual cost may be reasonable amount but it is a usual practice to add 10 per cent for all these under profit head. [5]

2.5 PROJECT SCHEDULING

Planning, scheduling is an important part of the construction project management. Planning and scheduling of construction activities helps engineers to complete the project in time and within the budget. The term ‘Construction’ does not only denotes physical activities involving men, materials and machinery but also covers the entire gamut of activities from conception to realization of a construction project. Thus, management of resources such as men, materials, machinery requires effective planning and scheduling of each activity.

Construction Management: Management is the science and art of planning, organizing, leading and controlling the work of organization members and of using all available organization resources to reach stated organizational goals.

Construction management deals with economical consumption of the resources available in the least possible time for successful completion of construction project. 'Men', 'materials', 'machinery' and 'money' are termed as resources in construction Management.[3]

Objectives of Construction Management: The main objectives of construction management are:

1. Completing the work with in estimated budget and specified time.
2. Maintaining a reputation for high quality workmanship
3. Taking sound decisions and delegation of authority
4. Developing an organization that works as a team.

Construction Project Scheduling: Scheduling is the fitting of the final work plan to a time scale. It shows the duration and order of various construction activities. It deals with the aspect of 'when to do it'.

Importance of scheduling:

1. Scheduling of the programming, planning and construction process is a vital tool in both the daily management and reporting of the project progress.
2. Proper management practices invariably lead to "maximum production at least cost". A good construction management, results in completion of a construction project with in the stipulated budget.
3. Construction management provides importance for optimum utilization of resources. In other words, it results in completion of a construction project with judicious use of available resources.
4. Construction management provides necessary leadership, motivates employees to complete the difficult tasks well in time and extracts potential talents of its employees

2.5.1 Activities

An activity is the actual performance of a task. It is the work required to complete a specific event. An activity is a recognizable part of a work project that requires time and resources for its completion.

A significant activity must be:

a) A positive, specific, tangible and meaningful effort
b) Such that the primary responsibility of effort can be determined.

c) Having a description understandable by all concerned with the project.

In order to Plan and manage the project the first and foremost thing is to identify the activities involved in the project. [3][4]

2.5.2 MS project

Microsoft Project is a project management software program, developed and sold by Microsoft, that is designed to assist a project in developing a plan, assigning resources to tasks, tracking progress, managing the budget, and analysing workloads.

Features:

Project creates budgets based on assignment work and resource rates. As resources are assigned to tasks and assignment work estimated, the program calculates the cost, equal to the work times the rate, which rolls up to the task level and then to any summary tasks and finally to the project level. Resource definitions (people, equipment and materials) can be shared between projects using a shared resource pool. Each resource can have its own calendar, which defines what days and shifts a resource is available. Resource rates are used to calculate resource assignment costs which are rolled up and summarized at the resource level. Each resource can be assigned to multiple tasks in multiple plans and each task can be assigned multiple resources, and the application schedules task work based on the resource availability as defined in the resource calendars. All resources can be defined in label without limit. Therefore, it cannot determine how many finished products can be produced with a given amount of raw materials. This makes Microsoft Project unsuitable for solving problems of available materials constrained production. Additional software is necessary to manage a complex facility that produces physical goods.

The application creates critical path schedules, and critical chain and event chain methodology third-party add-ons also are available. Schedules can be resource levelled, and chains are visualized in a Gantt chart. Additionally, Microsoft Project can recognize different classes of users. These different classes of users can have differing access levels to projects, views, and other data. Custom objects such as calendars, views, tables, filters, and fields are stored in an enterprise global which is shared by all users.[3]

CHAPTER 3

METHODOLOGY

3.1 METHODOLOGY ADOPTED

The Project has been basically divided into seven parts which are stated below:

1. Study of the BOQ of the Project [APPENDIX]
2. Estimating the Quantity of Concrete, backfill and filter Media Required in the Substructure and Foundation
3. Estimating the Quantity of Concrete in the Superstructure
4. Estimating the Quantity of Steel in Substructure
5. Estimating the Quantity of Steel in the Superstructure
6. Rate Analysis for the Quantities Estimated using Standard MoRTH Data book
7. Preparing the Project Schedule.

3.1.1 Study of the BOQ of the Project

Studying the BOQ of the Project gives a rough estimate of the quantities used in the different parts of the Bridge. The BOQ of the Project as issued by the HPPWD Barsar subdivision is attached in the Appendix section. The contract is an Item Rate Contract. And in case of an item rate every item of the bridge is specified in different section and the Quantity of various item to be used in the project are given. The bidders just have to quote the amount for that particular item. Studying the BOQ helps a lot while preparing our Rates. Moreover in the end the quantities stated in the BOQ and the quantities estimated are compared.

3.1.2 Estimating the Quantity of Concrete, Backfill and filter media required in the Substructure and foundation

A bridge Structure basically consists of three parts:

1. Foundation
2. Substructure
3. Superstructure

First of all the quantity of soil to be excavated is to be calculated and then the amount of concrete in the foundation, abutment, and bed block and pier is calculated.

3.1.3 Estimating the Quantity of Concrete in the Superstructure

The type of the bridge is determined by the type of slab of the bridge. And hence the bridge is RCC box girder. The quantity of concrete for the dirt wall and return wall has been estimated and then the Quantity of Concrete for the deck slab and soffit slab is calculated. The estimation has been carried out using MS Excel 2010.

3.1.4 Estimating the quantity of Steel in the Sub structure and foundation

In an RCC structure the main components are steel and concrete and hence after calculating the Quantity of concrete the quantity of another major component i.e. steel is to be calculated. In the calculation of the quantity of steel a bar bending schedule is prepared. Referring to the drawings provided by the HPPWD. The work is carried out using MS Excel 2010.

3.1.5 Estimating the quantity of steel in the Superstructure

Again the quantity of steel used in the Superstructure is calculated. The calculation is done for a single span from Saheli side abutment to the Pier i.e. for 30m is done. Using the bar bending schedule provided in the drawings issued by HPPWD. The work is carried out using MS Excel 2010.

3.1.6 Rate Analysis of the bridge

In order to determine the cost of the project the rate analysis is the first and foremost step. The rate analysis for bridge works is done referring to the Standard MoRTH Data book (Bridge and Road works). After studying the BOQ properly and then referring to the Standard Data Book we can easily calculate the Rates for the Respective items. The rates used as issued by the HPPWD. [5]

3.1.7 Project Scheduling

Finally in the end it is very important to Schedule the Project to know how to carry out the construction of the Project. Finally the scheduling of the bridge is carried out using the MS Project 2003. The starting date of the project is taken as 11th March 2015.

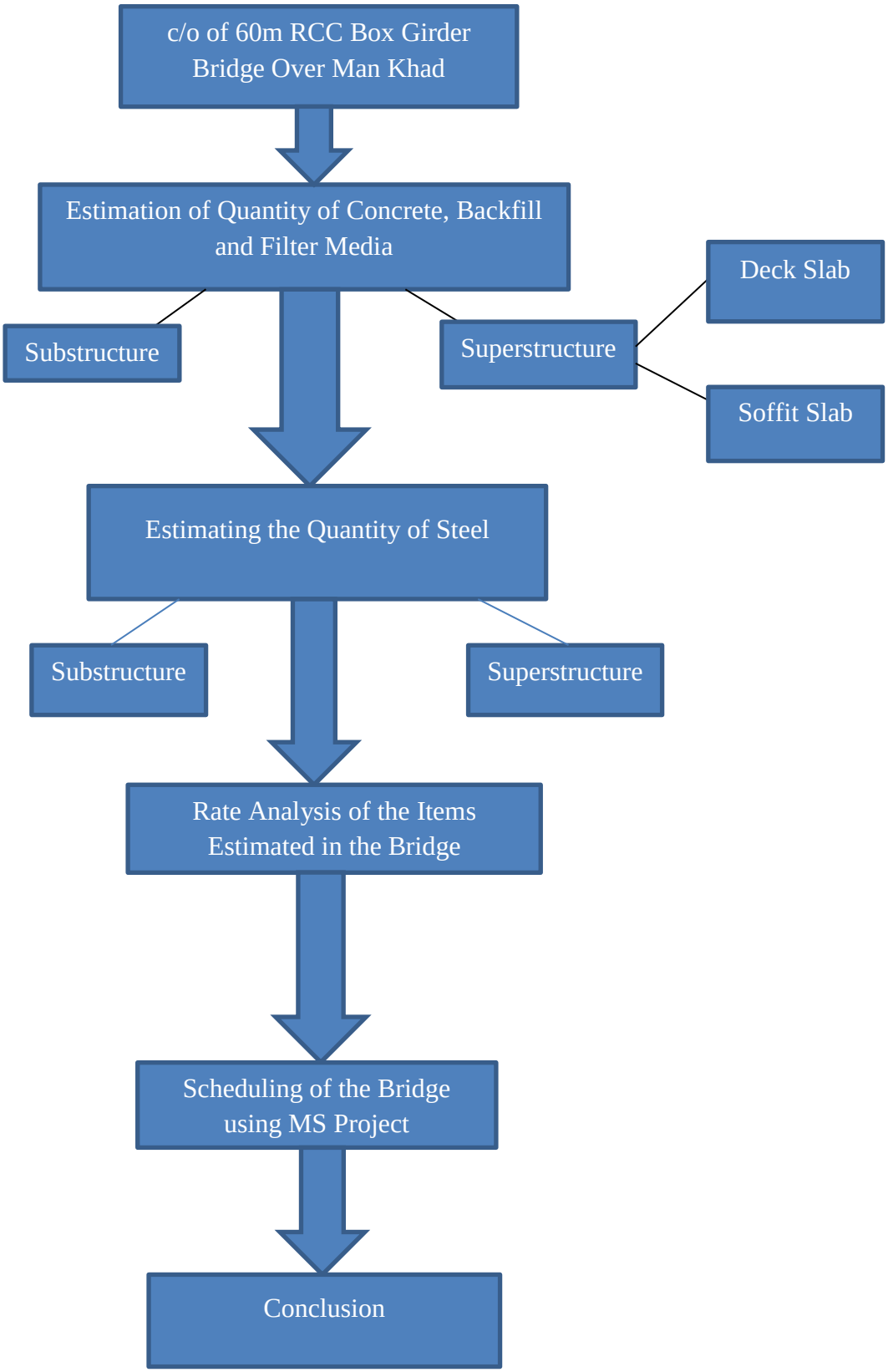


Fig. No 3.1 Methodology Adopted

CHAPTER 4

ESTIMATION OF BRIDGE

4.1 GENERAL

A bridge consists of three parts i.e. the foundation, the substructure and the Superstructure. The substructure basically consists of the part below the bearing level which constitutes of the foundation, the walls of the abutment and the Pier Column up to the level of the bearing. Whereas the part above the bearing level is called as the Superstructure. The superstructure consists of the dirt wall, return wall, soffit slab and the deck slab.

In this section the estimates for various quantities used in the Superstructure are estimated taking the reference of the BOQ attached in the Appendix. The quantities have been stated as Item 1, Item 2 etc. as mentioned in the BOQ.

As stated in section 2.2.2 the construction estimates are of two types:

1. Approximate Estimates
2. Detailed Estimates

The estimates of the BOQ are Approximates Estimates which may vary from the actual estimates. Whereas the estimates given by the contractor when the work has been completed is called as the detailed estimates. In this project work detailed estimates have been prepared by referring to the drawings as well as consulting the contractor.

The details estimates are again of two types:

1. Unit Quantity Method
2. Total Quantity Method

Since in the BOQ the estimates have been divided into many small items or operations hence the method followed is the Unit Quantity Method.

4.2 METHODOLOGY FOR ESTIMATION:

In this section the estimates for various items of the Substructure has been prepared. The items include:

1. Earthwork in Excavation
2. Laying PCC in the foundation
3. Laying M30 in the Substructure
4. Filter Media and granular Material
5. Backfilling with granular material
6. M25 in the superstructure (Single span)

4.2.1 Earthwork in Excavation

The quantity of excavation is calculated considering a working space of 35cm. The quantity of excavation has The type of foundation used in this bridge is Raft foundation which is a large slab supporting a number of columns and walls under the entire structure or a large part of the structure to lower the contact pressure compared to spread footing. The estimates for the Jeoli Devi side abutment, pier and Saheli side has been prepared using MS Excel.

4.2.2 Providing and laying PCC in the foundation

Before the structure is to be made it is very important that a PCC layer is laid at the foundation of the abutments and Pier. The PCC layer consists of plain Cement and 40mm aggregates. It is useful for the ground improvement.

4.2.3 Providing and laying M30 in the Substructure

The estimation of concrete in the substructure has been done for both the abutments and the pier. Dividing the estimates into three parts as:

1. Jeoli Devi consisting of Raft foundation, Counterforts, walls(w1,w2,w3,w4), bed block, and wing walls
2. Pier consisting of Raft foundation, Pier Column and Pier Cap
3. Saheli Side Abutment Consisting of Raft foundation, Counterforts, walls(w1,w2,w5,w4,w3), bed block and wing walls

4.2.4 Providing Filter media

The filter media is to be filled in the walls of the abutment which is useful in reducing the load on the structure by decreasing the dead weight of the concrete.

4.2.5 Backfilling with the granular material

The backfilling of the structure is to be done up to the ground level in case of pier and the abutment. The backfilling of the sides and the front is to be done in case of the abutments whereas around the circular column in case of the Pier.

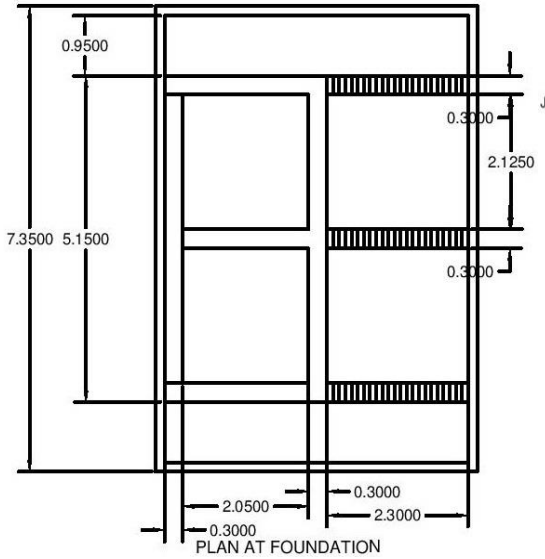
4.2.6 Laying M25 in the Superstructure

In the end the estimation for the quantity of concrete in the superstructure will be done. the estimates for only a single span has been prepared to avoid the repetition. The estimates has been divided into three parts:

1. Quantity of Concrete in the Dirt wall
2. Quantity of Concrete in the Return wall
3. Slab of the bridge subcategorized into Soffit slab, web, Cross beams, Deck Slab

4.3 DRAWINGS FOR THE ESTIMATION OF CONCRETE

4.3.1 Jeoli Devi Side



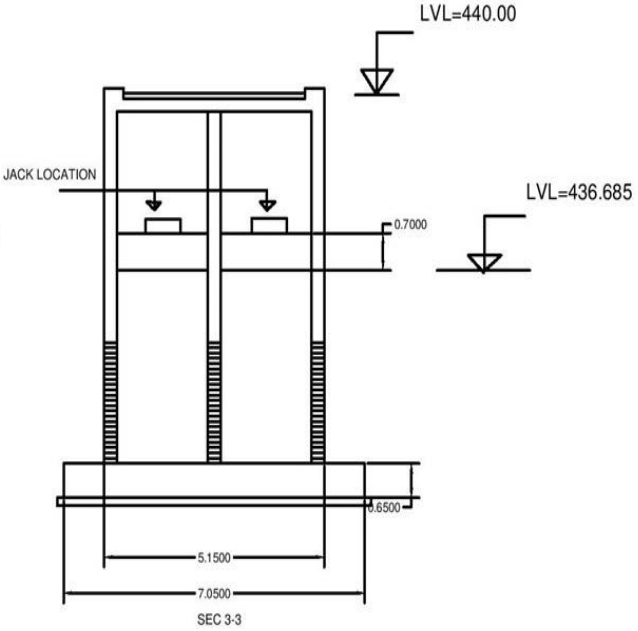
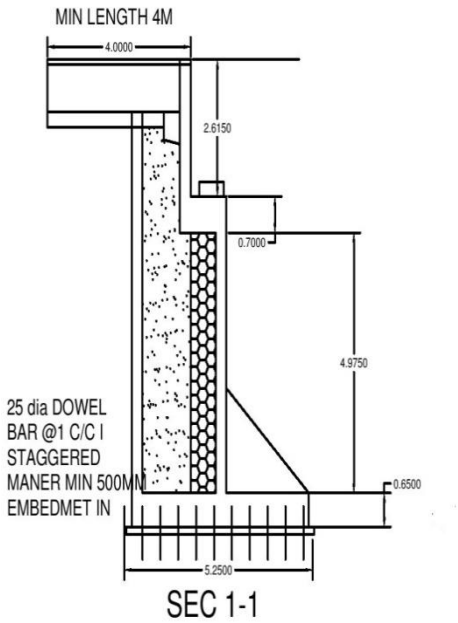


Fig. No 4.1: Jeoli Devi Sec 3-3

Fig. No 4.2 Sec3-3 for Jeoli Devi



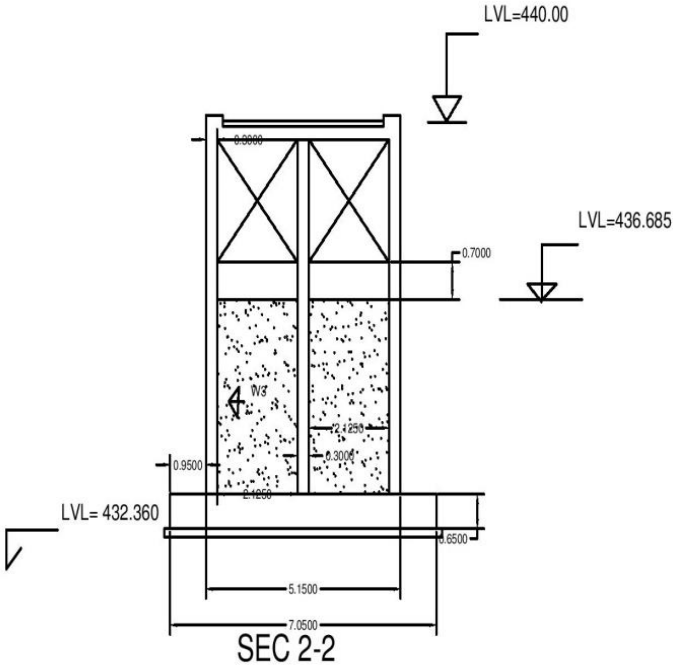


Fig. No. 4.3: Jeoli Devi Sec 1-1

Fig.No 4.4 :Jeoli Devi Sec 2-2

4.3.2 Saheli Side and Pier

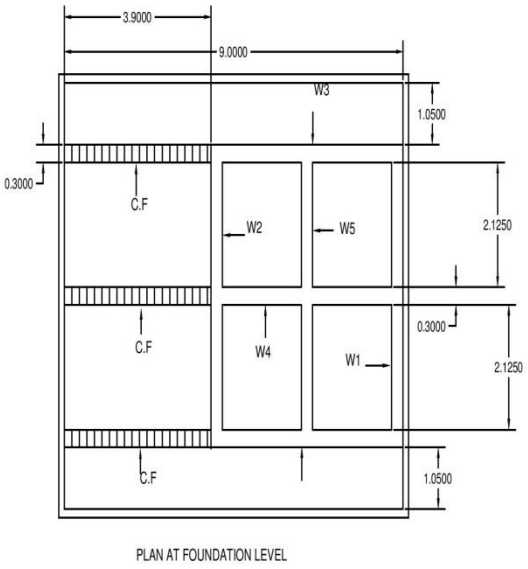


Fig. No 4.5: Plan at foundation Saheli Side

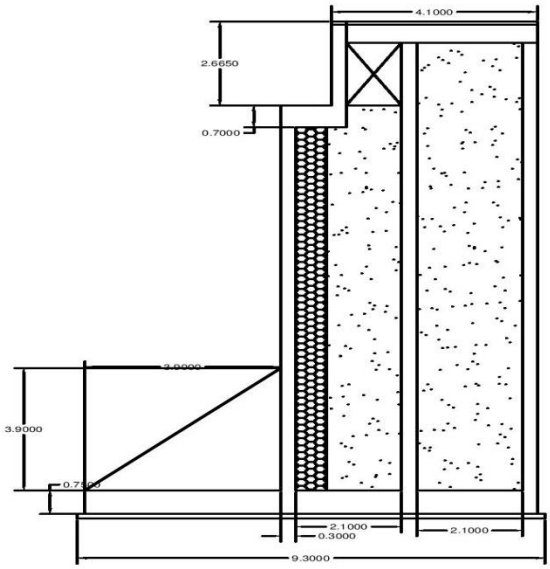


Fig.No 4.6: Sec 2'-2' Saheli Side

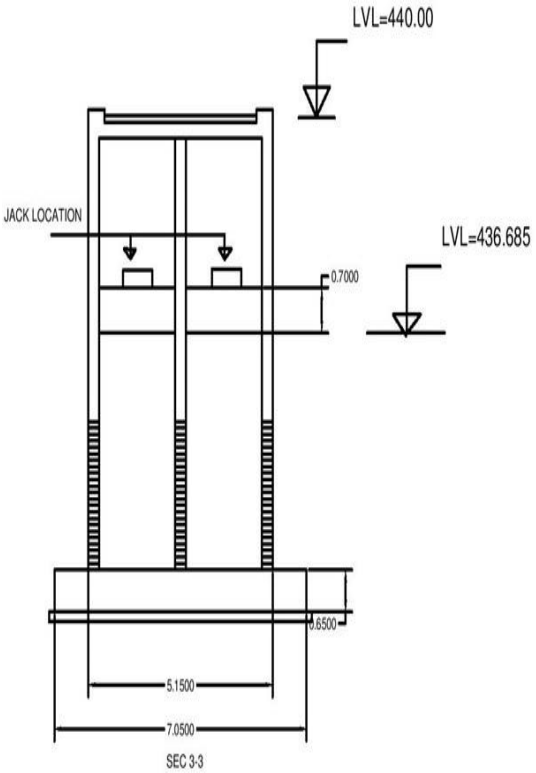


Fig.No 4.7: Sec 3-3 Saheli Side

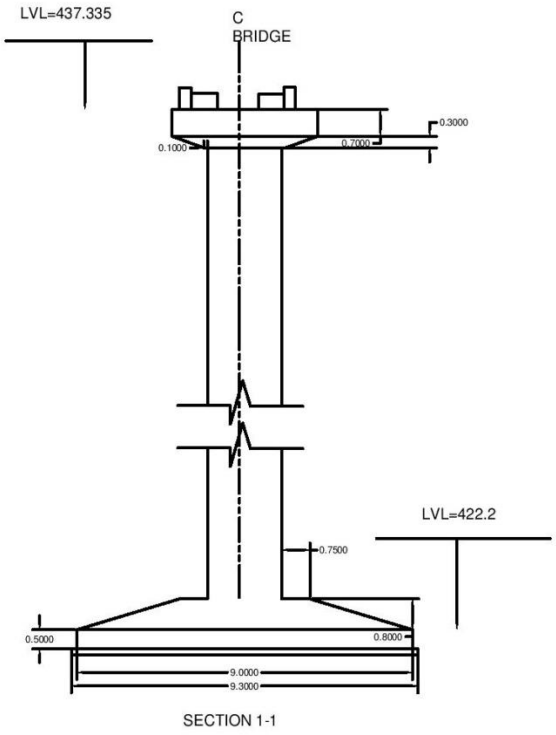


Fig.No 4.8: Sec 1-1 Pier

4.4 ESTIMATION OF THE BRIDGE FOR THE QUANTITY OF CONCRETE, STEEL AND FILTER MEDIA

TABLE-1 (a) Estimation of the Bridge

Item No.	Particulars of the item	No.	Dimension in meter Length	Breadth	Height	Quantity Cu m	Explanatory Notes
1	**Earthwork in excavation**						
	Jeoli Devi Side		5.95	8.05	5.17	247.63	(5.25+0.7)*(7.35+0.7)*(5.17)
	Pier		10	10	7.35	735.00	(9.30+0.7)*(9.30+0.7)*(7.35)
	Saheli Side		10	8.25	15.83	1305.98	(15.83)*(9.30+0.7)*(7.55+0.7)
	Total Quantity of Item 1					**2288.61**	Adding excavation for jeoli devi, pier, Saheli
2	**1:3:6**						
	Jeoli Devi Side		5.25	7.35	0.15	5.79	(2.05+0.9+2.3)*(7.35)*(0.15)
	Pier		9.3	9.3	0.15	12.97	(9.3)*(9.3)*(0.15)
	Saheli Side		9.3	7.55	0.15	10.53	(7.250+0.3)*(0.15)*(9.3)
`	**Total Quantity of Item 2**					**29.29**	Adding PCC for jeoli devi, pier, Saheli side
5	**Providing and laying Filter media**						
	Jeoli Devi	2	2.12	2.05	3.675	31.94	(2*2.12*2.05*3.95)
		2	2.05	1.05	0.7	3.01	(2*2.05*1.05*0.70)
					Total	**34.96**	Total Filter media of Jeoli Devi
	Saheli Side	4	2.12	2.1	11.91	212.09	
		2	2.12	2.1	0.7	6.23	
		2	2.12	1.1	0.7	3.26	
					Total	**221.59**	Total filter media of Saheli Side
A	**Total Quantity of Item 5**					**256.55**	Adding the filter media for jeoli&Saheli
3	**M-30 in Substructure**						
A.	Jeoli Devi						
	Raft		4.95	7.05	0.65	22.68	Refer Sec 4.3.1 for the Drawing
	Front Counterfort	3	2.3	0.3	1	2.07	height= (0+2)/2
	Quantity of concrete in walls(w	2	5.15	0.3	3.95	12.21	Refer Sec 4.3.1 for the Drawing
	w3, w4	3	2.05	0.3	3.95	7.29	Refer Sec 4.3.1 for the Drawing
	Bed Block		5.15	1.3	0.7	4.69	Refer Sec 4.3.1 for the Drawing
	Wing wall or return wall	2	5.15	0.3	0.615	1.90	Refer Sec 4.3.1 for the Drawing
		3	1.05	0.3	0.615	0.58	Refer Sec 4.3.1 for the Drawing

TABLE-1 (b) Estimation of the Bridge							
Item No.	**Particulars of the item**	**No.**	**Dimension in meter**			**Quantity Cu m**	**Explanatory Notes**
			Length	**Breadth**	**Height**		
B.	Pier						
	Raft Concrete		9	9	0.5	40.50	Refer Sec 4.3.2 for the Drawings
			9	9	0.8	64.80	Refer Sec 4.3.2 for the Drawings
			3.5	3.5	0.8	9.80	Refer Sec 4.3.2 for the Drawings
					Average	37.30	((9*9)+(3.5*3.5))/2
	Pier Column			Dia=2	13.16	41.32	Diameter of the pier colum
	Pier Cap	2	2.6		0.15	0.78	height=(0.3+0)/2
		2	3.9		0.15	1.17	height=(0.3+0)/2
		2	2.6		0.7	3.64	Refer Sec 4.3.2 for the Drawings
		2	3.9		0.7	5.46	Refer Sec 4.3.2 for the Drawings
C.	Saheli Side						
	Raft Concrete		9	7.25	0.75	48.94	Refer Sec 4.3.2 for the Drawings
	Front Counterfort	3	3.9	0.35	1.75	7.17	no of counterforts is 3
	Quantity of concrete in walls(w	3	5.15	0.3	11.91	55.20	Refer Sec 4.3.2 for the Drawings
	w4, w3	6	2.1	0.3	11.91	45.02	Refer Sec 4.3.2 for the Drawings
	Bed Block		5.15	1.3	0.7	4.69	Refer Sec 4.3.2 for the Drawings
	Wing wall or Return Wall	2	5.15	0.3	0.615	1.90	Refer Sec 4.3.2 for the Drawings
		3	1.1	0.3	0.615	0.61	Refer Sec 4.3.2 for the Drawings
		3	2.1	0.3	0.615	1.16	Refer Sec 4.3.2 for the Drawings
	Total Quantity of the item 3					**420.87**	Adding all the Quantities of A,B and C
20	**Backfilling with granular material**						
A.	Jeoli Devi						
	Front Side		7.35	2.45	2.65	47.72	(2.40)*(2.30+0.15)*(7.35)
					Net	45.65	deduct qty. of concrete in 3 no. c/f
	Sides	2	2.65	1.1	2.65	15.45	
					Total	**61.10**	Adding A

TABLE-1 (c) Estimation of the Bridge							
Item No.	**Particulars of the item**	**No.**	**Dimension in meter**			**Quantity Cu m**	**Explanatory Notes**
			Length	**Breadth**	**Height**		
B.	Pier		9.3	9.3	4.5	389.21	
					Net	375.00	Deduct qty. of concrete in Pier (14.13)
C.	Saheli Side						Refer Sec 4.3.2 for the Drawings
	Front Side		7.55	4.05	5.76	176.13	Refer Sec 4.3.2 for the Drawings
	Side	2	5.25	1.2	5.76	72.58	Refer Sec 4.3.2 for the Drawings
					Total	**248.70**	Adding C
	Total Quantity of the item 20					**684.80**	Adding A,B&C
7	**M-25 in Superstructure**						
A.	Dirt Wall	1	5.15	2	0.3	**3.09**	Refer Appendix For Drawings
B.	Return Wall	2	5.15	2	0.3	6.18	Refer Appendix For Drawings
		3	2.1	2	0.3	3.78	Refer Appendix For Drawings
		3	1.1	2	0.3	1.98	Refer Appendix For Drawings
			3.5	3.5	0.8	9.80	Refer Appendix For Drawings
					Total	**21.74**	((9*9)+(3.5*3.5))/2
C.	Slab (M-25)						
	Soffit	2	0.9	2.05	0.25	0.92	Refer Appendix For Drawings
		2	3.25	2.18	0.2	2.83	height=(0.25+0.15)/2
		2	11.25	2.3	0.15	7.76	Refer Appendix For Drawings
					Total	**11.52**	Adding the Quantities of Soffit Slab
	Web	4	0.9	0.45	1.25	2.03	Nos. of Webs is 2
		4	3.25	0.32	1.75	7.28	Refer Appendix For Drawings
		4	11.25	0.2	1.75	15.75	Refer Appendix For Drawings
					Total	**25.06**	Adding the Quantities of Web
	Cross Beams	2	2.05	1.55	0.25	**1.59**	Refer Appendix For Drawings
	Brackets	4	1.8	0.7	0.25	**1.26**	Refer Appendix For Drawings
	Deck	4	4.15	1.16	0.2	**3.85**	Cantilever Portion
		2	2.825	4.15	0.2	**4.69**	Slab
	Total Quantity of Concrete					**72.79**	Adding A,B&C

4.5 ABSTRACT FOR THE ESTIMATION OF CONCRTE, BACKFILL& FILTER MEDIA

The calculation of the quantity of concrete, backfill and the filter media it is summarized below after referring to the table 1(a), table 1(b) and table 1(c) of section 4.4. The various quantities are:

Table-2 Quantities of Concrete, Backfill and Filter Media

Item No	Particulars of the Item	Quantity Cu m	Remarks
1.	Earthwork In Excavation	248	Refer Table 1(a)
2.	Providing and laying PCC 1:3:6	29	Refer Table 1(a)
3.	M30 in the Sub structure	346	Refer Table 1(b)
5.	Providing and laying filter media	35	Refer Table 1(a)
7	M25 in the Super structure(single span)	73	Refer Table 1(c)
20.	Backfilling with the granular material	649	Refer Table 1(a)

CHAPTER 5

QUANTITY OF STEEL

5.1 METHODOLOGY FOR STEEL ESTIMATES

When calculating the quantity of steel for steel for a structure we need to prepare it's Bar bending schedule. Hence the bar bending schedule with reference to the drawings issued by the HPPWD has been prepared using MS Excel 2010. In the drawing the Bar marks which shows that how the bar is to be bent for the structure, bar spacing and bar diameter to be considered is provided we just need to calculate the total weight of the bar of a specific diameter.

The density of steel used can be taken as 7850kg/cum and hence accordingly the amount of steel. Specification stated in the drawing for the Estimation of Steel.

1. Minimum lap length shall be 50 times the diameter of the bar (60d has been taken).
2. Minimum cover to reinforcement shall be 50mm.
3. In case of the foundation it shall be 75mm.
4. Length of L-Bends shall be minimum 15 times the Bar diameter.
5. The diameter of Bars used in the sub structure are 16mm, 10mm, 20mm, 12mm, 32mm, 25mm and 28 mm steel per meter length can be found out.

Table 3: Quantity of steel per metre

Diameter of bars (mm)	Weight per meter (kg/cum)
8	0.395
10	0.62
12	0.89
16	1.58
20	2.47
25	3.85
28	4.83
32	6.32

5.2 DRAWING FOR REINFOCEMENT DETAILS

5.2.1 Jeoli Devi Side

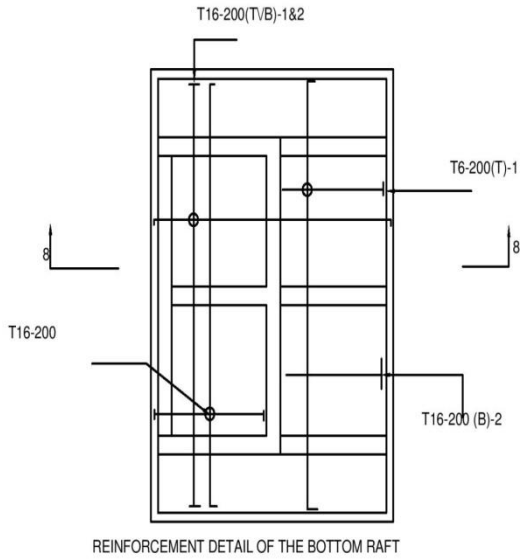


Fig.No 5.1 R.F Details of Raft Jeoli Devi

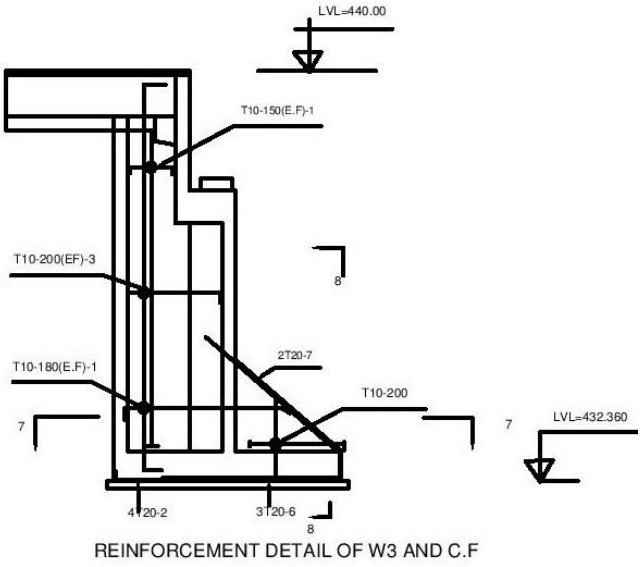


Fig.No 5.2 R.F Details of wall w3

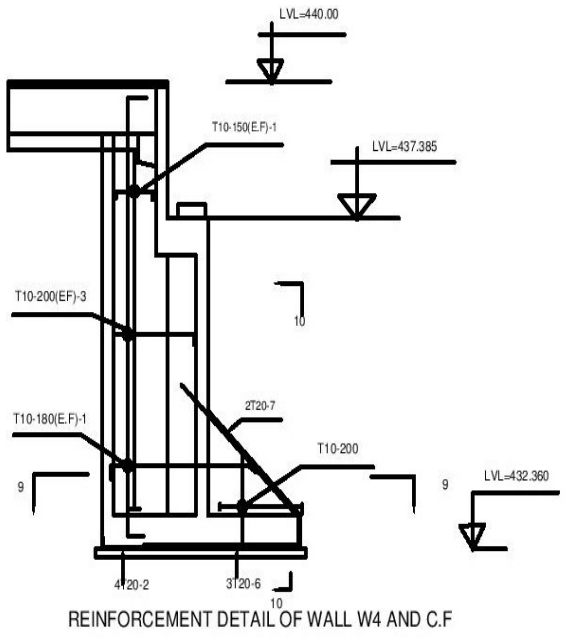


Fig.No 5.3 R.F of w4 and C.F

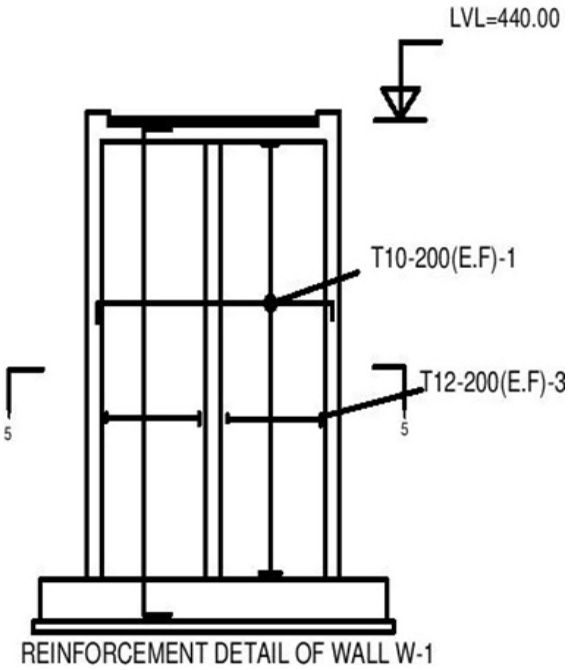


Fig.No 5.4 R.F Details Of W1 Jeoli devi

4.2.2 Saheli Side

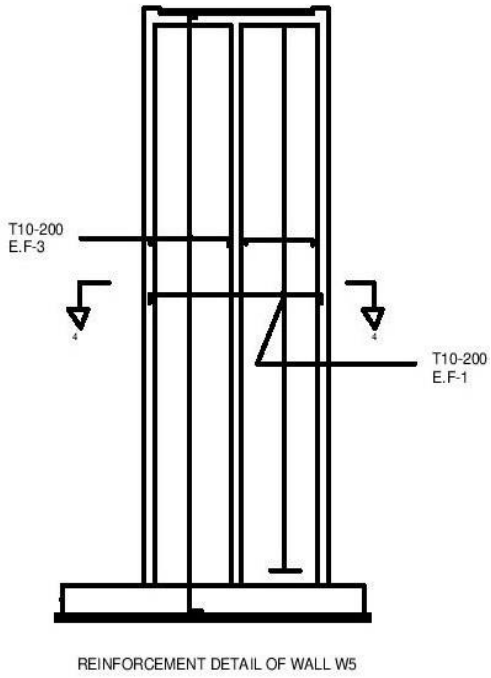


Fig.No 5.5 R.F Details of W-5 Saheli Side

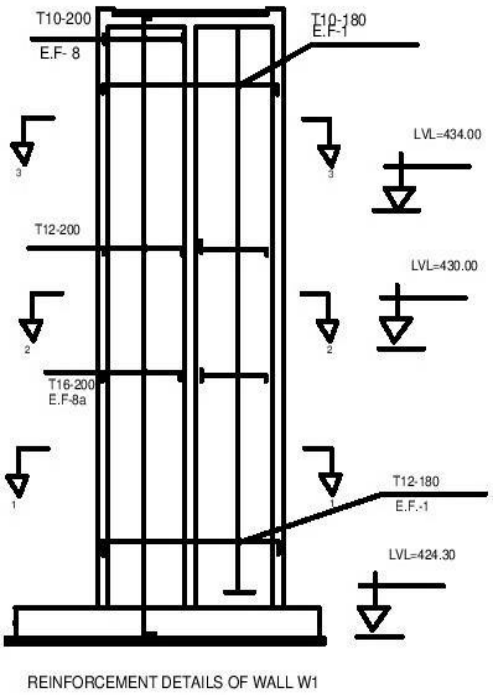


Fig.No 5.6 R.F Details of W1 Saheli

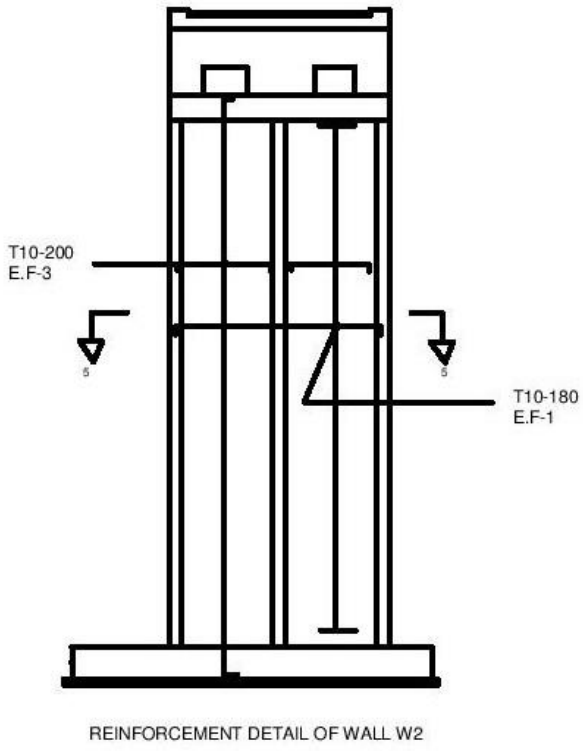


Fig.No 5.7 R.F Details Of W2 Saheli Side

5.3 ESTIMATING QUANTITY OF STEEL FOR SUBSTRUCTURE

Table 4(a) Jeoli Devi Raft, counterfort and bottom steel

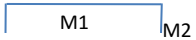
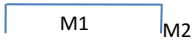
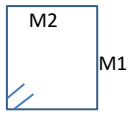
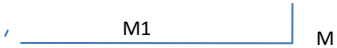
S.no	BAR MARK	BAR DIA mm	BAR SPACE mm	BAR SHAPE	Nos	M1 m	M2 m	BAR LENGTH m	TOTAL LENGTH m	WEIGHT kg	REMARKS
1	1	16ϕ	200		36	4.8	0.5	5.8	208.8	**329.9**	Refer to table 6
2	1	16ϕ	200		25	6.9	0.5	7.4	185	**292.3**	Refer to table 6
3	5	10ϕ	200		39	4.6	0.15	4.75	185.25	**114.9**	Assume a cover of 75mm
4	2	20ϕ			12	4.85	0.5	5.85	70.2	**173.4**	Refer to table 6
5	6	20ϕ			9	4.1	0.5	4.6	41.4	**102.3**	Refer to table 6
6	DOWEL	10ϕ			30	1			30	**115.5**	Refer to table 6
									TOTAL	**1128.2**	Adding 1-6

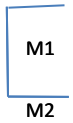
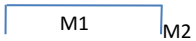
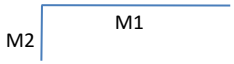
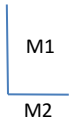
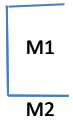
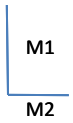
Table 4(b)Jeoli devi side abutment wall(w2)											
S.no	**BAR MARK**	**BAR DIA mm**	**BAR SPACE mm**	**BAR SHAPE**	**Nos**	**M1 m**	**M2 m**	**BAR LENGTH m**	**TOTAL LENGTH m**	**WEIGHT kg**	**REMARKS**
7	3	12ϕ	200		44	5.2	0.25	5.52	242.88	**216.2**	Refer totable 6
8	1	10ϕ	200		44	5.05	0.25	5.55	244.2	**151.4**	Refer to table 6
9	LAP	10ϕ			44	0.6	0.15	0.75	33	**20.5**	Cover 50mm
10	LAP	12ϕ			44	0.72		0.72	31.68	**28.2**	Refer to table 6
11	3	16ϕ			12	5.2	0.25	5.7	68.4	**108.1**	Refer to table 6
12	3	16ϕ			4	5.2	0.25	5.7	22.8	**36.0**	Refer to table 6
									TOTAL	**560.3**	adding7-12

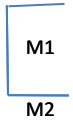
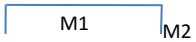
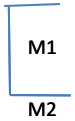
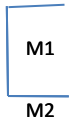
Table 4(c)Jeoli devi abutment wall (w1)											
S.no	**BAR MARK**	**BAR DIA mm**	**BAR SPACE mm**	**BAR SHAPE**	**Nos**	**M1 m**	**M2 m**	**BAR LENGTH m**	**TOTAL LENGTH m**	**WEIGHT kg**	**REMARKS**
13	3	12ϕ	200		44	5.2	0.25	5.52	242.88	**216.2**	Cover 50mm
14	1	10ϕ	200		44	5.05	0.25	5.55	244.2	**151.4**	Refer to table 6
15	LAP	12ϕ			44	0.72		0.72	31.68	**28.2**	Overlap Length is 60*dia
16	3	16ϕ			12	5.2	0.25	5.7	68.4	**108.1**	Refer to table 6
17	3	16ϕ			4	5.2	0.25	5.7	22.8	**36.0**	Refer to table 6
18	LAP	16ϕ			16	0.96		0.96	15.36	**24.3**	Refer to table 6
									TOTAL	**564.1**	adding 13-18

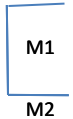
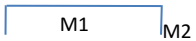
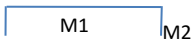
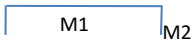
Table 4(d)Jeoli Devi side abutment wall(w3,w4)											
S.no	**BAR MARK**	**BAR DIA mm**	**BAR SPACE mm**	**BAR SHAPE**	**Nos**	**M1 m**	**M2 m**	**BAR LENGTH m**	**TOTAL LENGTH m**	**WEIGHT kg**	**REMARKS**
19	3	10ϕ	180		66	4.5	0.25	5	330	**204.6**	Refer to table 6
20	LAP	10ϕ			66	0.6		0.6	39.6	**24.6**	Refer to table 6
21	1	10ϕ	180		72	2.55	0.25	4.2	302.4	**187.5**	AT 0.00 MT TO 2 MTR ABOVE RAFT
22	1	10ϕ	180		72	2.55	0.25	3.05	219.6	**136.2**	FROM 2.00 TO 3.95m
23	1	10ϕ	150		36	1.45	0.25	1.95	70.2	**43.5**	FROM 2.00 TO 3.95m
									TOTAL	**596.3**	adding 19-23

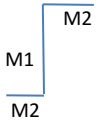
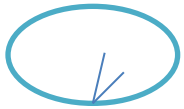
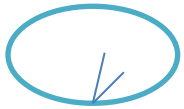
Table 4(e) Pier Column for a circula Pier											
S.no	**BAR MARK**	**BAR DIA mm**	**BAR SPACE mm**	**BAR SHAPE**	**Nos**	**M1 m**	**M2 m**	**BAR LENGTH m**	**TOTAL LENGTH m**	**WEIGHT kg**	**REMARKS**
24	3	32ϕ			36	15.36	0.65	16.66	599.76	**3790.5**	cover 50mm
25	3	32ϕ			36	15.36	0.5	16.36	588.96	**3722.2**	Refer to table 6
26	LAP	32ϕ			252	1.92		1.92	483.84	**3057.9**	Overlap Length is 60*dia
27	4	16ϕ			68	6	0.9	7.8	**530.4**	**838.0**	Refer to table 6
28	4	16ϕ			67	5	0.9	6.8	**455.6**	**719.8**	Refer to table 6
									TOTAL	**12128.5**	adding 24-28

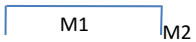
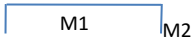
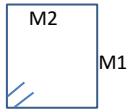
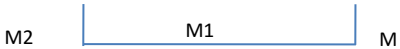
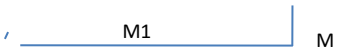
Table 4(f) Saheli Side abutment Raft and Bottom steel											
S.no	**BAR MARK**	**BAR DIA mm**	**BAR SPACE mm**	**BAR SHAPE**	**Nos**	**M1 m**	**M2 m**	**BAR LENGTH m**	**TOTAL LENGTH m**	**WEIGHT kg**	**REMARKS**
29	1	16ϕ	200		92	7.1	0.6	8.3	763.6	**1206.5**	Cover of 75mm
30	1	16ϕ	200		74	8.85	0.6	9.45	699.3	**433.6**	Refer to table 6
31	5	10ϕ	200		39	6.59	0.15	6.74	262.86	**163.0**	Refer to table 6
32	2	28ϕ			6	8.75	0.6	9.95	**59.7**	**288.4**	Refer to table 6
33	6	28ϕ			18	5.6	0.5	6.1	109.8	**530.3**	Refer to table 6
34	7	25ϕ			6	6.95	0.5	7.45	44.7	**172.1**	For the C.F
									TOTAL	**2793.8**	adding 29-34

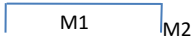
Table 4(g) Saheli Side Abutment Walls											
S.no	**BAR MARK**	**BAR DIA mm**	**BAR SPACE mm**	**BAR SHAPE**	**Nos**	**M1 m**	**M2 m**	**BAR LENGTH m**	**TOTAL LENGTH m**	**WEIGHT kg**	**REMARKS**
35	8a	25ϕ			8	6.35	0.4	6.75	54	**208**	Cover of 50mm
36	8a	16ϕ	200		80	6.25	0.4	6.65	532	**841**	Refer to table 6
37	8a	25ϕ			12	6.35	0.4	13.5	162	**624**	Refer to table 6
38	1	12ϕ			33	5.05	0.25	5.55	183.15	**163**	Refer to table 6
									TOTAL	**1835**	adding 35-38

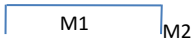
Table 4(h) Saheli Side Abutment w1											
S.no	**BAR MARK**	**BAR DIA mm**	**BAR SPACE mm**	**BAR SHAPE**	**Nos**	**M1 m**	**M2 m**	**BAR LENGTH m**	**TOTAL LENGTH m**	**WEIGHT kg**	**REMARKS**
39	8b	12			80	4	0	4	320	**285**	Refer to table 6
40	8b	25			12	4	0	8	96	**370**	Refer to table 6
41	1	12			46	5.05	0.25	5.55	255.3	**227**	Refer to table 6
									TOTAL	**882**	adding 1-4
SAHELI SIDE ABUTMENT BAR BENDIGN SCHEDULE (WALL W1) ABOVE LEVEL 434.00M TO 437.7M											
42	8b	16ϕ			8	3.7	0	3.7	29.6	**46.8**	Cover of 50mm
43	8b	10ϕ			80	3.7	0	3.7	296	**183.5**	Refer to table 6

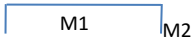
Table 4(i) Saheli Side Abutment walls											
S.no	**BAR MARK**	**BAR DIA**	**BAR SPACE mm**	**BAR SHAPE**	**Nos**	**M1 m**	**M2 m**	**BAR LENGTH m**	**TOTAL LENGTH m**	**WEIGHT kg**	**REMARKS**
44	8b	16ϕ			12	4.66	0	9.32	111.84	**176.7**	Refer table 6
45	1	12ϕ			46	5.77	0.25	6.27	288.42	**256.7**	Refer to table 6
									TOTAL	**663.7**	adding 39-45
SAHELI SIDE ABUTMENT BAR BENDIGN SCHEDULE (WALL W5) UPTO LEVEL 430.00M											
45	8a	25			12	6.35	0.4	6.75	81	**311.9**	Here M2 denotes lap
46	8a	16			4	6.25	0.4	6.65	26.6	**42.0**	Refer to table 6

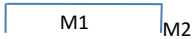
Table 4(j) Saheli Side Abutment walls											
S.no	**BAR MARK**	**BAR DIA mm**	**BAR SPACE mm**	**BAR SHAPE**	**Nos**	**M1 m**	**M2 m**	**BAR LENGTH m**	**TOTAL LENGTH m**	**WEIGHT kg**	**REMARKS**
47	8a	10			42	6.35	0.2	6.55	275.1	**170.6**	Refer to table 6
48	1	10ϕ			33	5.05	0.25	5.55	183.15	**113.6**	Cover of 50mm
									TOTAL	**638.0**	adding 45-48
SAHELI SIDE ABUTMENT BAR BENDIGN SCHEDULE (WALL W5) FROM LEVEL 430.00M TO 434.00M											
49	8b	25ϕ			12	5.5	0	5.5	66	**254.1**	Lap of 60*dia
50	8b	16ϕ			4	4.96	0	4.96	19.84	**31.3**	Refer to table 6
51	8b	10ϕ			40	4.6	0	9.2	368	**228.2**	Refer to table 6

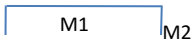
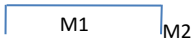
Table 4(k) Saheli Side Abutment walls											
S.no	**BAR MARK**	**BAR DIA mm**	**BAR SPACE mm**	**BAR SHAPE**	**Nos**	**M1 m**	**M2 m**	**BAR LENGTH m**	**TOTAL LENGTH m**	**WEIGHT kg**	**REMARKS**
52	1	10ϕ			42	5.55	0.25	6.05	254.1	**157.5**	Cover 50mm
									TOTAL	**671.1**	adding 49-52
SAHELI SIDE ABUTMENT BAR BENDIGN SCHEDULE (WALL W5) ABOVE LEVEL 434.00M TO 437.7M											
53	8b	25ϕ			12	5.2	0	5.2	62.4	**240.2**	Refer to table 6
54	8b	16ϕ			4	4.66	0	4.66	18.64	**29.5**	Lap of 60*dia
55	8b	10ϕ			40	4.3	0	8.6	344	**213.3**	Refer to table 6
56	1	10ϕ			38	5.65	0.25	6.15	233.7	**144.9**	Cover 50mm
									TOTAL	**627.9**	adding 53-56

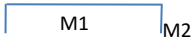
Table 4(l) Saheli Side Abutment walls											
SAHELI SIDE ABUTMENT BAR BENDIGN SCHEDULE (WALL W2) UPTO LEVEL 430.00M											
S.no	**BAR MARK**	**BAR DIA mm**	**BAR SPACE mm**	**BAR SHAPE**	**Nos**	**M1 m**	**M2 m**	**BAR LENGTH m**	**TOTAL LENGTH m**	**WEIGHT kg**	**REMARKS**
57	8a	25			8	6.35	0.4	6.75	54	**207.9**	Lap of 60*dia
58	8a	16ϕ			4	6.25	0.4	6.65	26.6	**42.0**	Refer to table 6
59	8a	10ϕ			40	6.35	0.2	6.55	262	**162.4**	Refer to table 6
60	1	10ϕ	180		42	5.05	0.25	5.55	233.1	**144.5**	cover 50mm
									TOTAL	**556.9**	adding 57-60

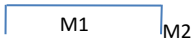
Table 4(m) Saheli Side Abutment walls											
SAHELI SIDE ABUTMENT BAR BENDIGN SCHEDULE (WALL W5) FROM LEVEL 430.00M TO 434.00M											
S.no	**BAR MARK**	**BAR DIA mm**	**BAR SPACE mm**	**BAR SHAPE**	**Nos**	**M1 m**	**M2 m**	**BAR LENGTH m**	**TOTAL LENGTH m**	**WEIGHT kg**	**REMARKS**
61	8b	25ϕ			8	5.5	0	5.5	44	**169.4**	Lap of 60*dia
62	8b	16ϕ			4	4.96	0	4.96	19.84	**31.3**	Refer to table 6
S.no	**BAR MARK**	**BAR DIA mm**	**BAR SPACE mm**	**BAR SHAPE**	**Nos**	**M1 m**	**M2 m**	**BAR LENGTH m**	**TOTAL LENGTH m**	**WEIGHT kg**	**REMARKS**
63	8b	10ϕ			40	4.6	0	9.2	368	**228.2**	Refer to table 6
64	1	10ϕ	180		92	5.05	0.25	5.55	510.6	**316.6**	Cover of 50mm
									TOTAL	**745.5**	adding 61-64

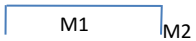
Table 4(n) Saheli Side Abutment walls											
SAHELI SIDE ABUTMENT BAR BENDIGN SCHEDULE (WALL W5) ABOVE LEVEL 434.00M TO 437.7M											
S.no	**BAR MARK**	**BAR DIA mm**	**BAR SPACE mm**	**BAR SHAPE**	**Nos**	**M1 m**	**M2 m**	**BAR LENGTH m**	**TOTAL LENGTH m**	**WEIGHT kg**	**REMARKS**
65	8b	25ϕ			8	5.2	0	5.2	41.6	**160.2**	Lap of 60* Dia
66	8b	16ϕ			4	4.66	0	4.66	18.64	**29.5**	Refer to table 6
67	8b	10ϕ			40	4.3	0	8.6	344	**213.3**	Refer to table 6
68	1	10ϕ	180		36	5.65	0.25	6.15	221.4	**137.3**	Cover 50mm

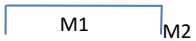
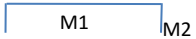
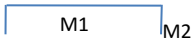
Table 4(o) Saheli Side Abutment walls											
SAHELI SIDE ABUTMENT BAR BENDIGN SCHEDULE (WALL W3) UPTO LEVEL 430.00M											
69	8a	12ϕ	110		152	6.35	0.25	6.6	1003.2	**892.8**	lap 60*dia
70	1	12ϕ	110		96	7.48	0.25	7.98	766.08	**681.8**	cover 50mm
									TOTAL	**1574.7**	adding 65-70
SAHELI SIDE ABUTMENTWALL 3 FROM LEVEL 430.00M TO 434.00M											
71	8a	12ϕ	110		152	4.72	0.25	4.97	755.44	**672.3**	lap 60*dia
72	1	12ϕ	110		96	6.27	0.25	6.77	649.92	**578.4**	cover 50mm
									TOTAL	**1250.8**	adding 71-72

Table 4(p) Saheli Side Abutment walls

SAHELI SIDE ABUTMENTWALL 3 FROM LEVEL 434.00M TO 437.00M

S.no	BAR MARK	BAR DIA mm	BAR SPACE mm	BAR SHAPE	Nos	M1 m	M2 m	BAR LENGTH m	TOTAL LENGTH m	WEIGHT kg	REMARKS
73	8b	10ϕ			152	3.7	0	3.7	562.4	**348.7**	lap 60*dia
74	1	10ϕ	180		88	5.65	0.25	6.15	541.2	**335.5**	cover 50mm
									TOTAL	**684.2**	73+74

SAHELI SIDE ABUTMENT BAR BENDIGN SCHEDULE (WALL W4) UPTO LEVEL 430.00M

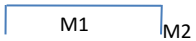
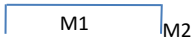
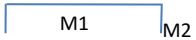
S.no	BAR MARK	BAR DIA mm	BAR SPACE mm	BAR SHAPE	Nos	M1 m	M2 m	BAR LENGTH m	TOTAL LENGTH m	WEIGHT kg	REMARKS
75	8a	12ϕ	110		152	6.35	0.25	6.6	1003.2	**892.8**	lap 60*dia
76	1	12ϕ	110		96	7.48	0.25	7.98	766.08	**681.8**	cover 50mm
									TOTAL	**1574.7**	75+76

Table 4(q) Saheli Side Abutment walls											
SAHELI SIDE ABUTMENTWALL 4 FROM LEVEL 430.00M TO 434.00M											
S.no	**BAR MARK**	**BAR DIA mm**	**BAR SPACE mm**	**BAR SHAPE**	**Nos**	**M1 m**	**M2 m**	**BAR LENGTH m**	**TOTAL LENGTH m**	**WEIGHT kg**	**REMARKS**
77	8a	12ϕ	110		152	4.72	0.25	4.97	755.44	**672.3**	lap 60*dia
78	1	12ϕ	110		96	6.27	0.25	6.77	649.92	**578.4**	cover 50mm
									TOTAL	**1250.8**	77+78
SAHELI SIDE ABUTMENTWALL 4 FROM LEVEL 434.00M TO 437.00M											
79	8b	10ϕ			152	3.7	0	3.7	562.4	**348.688**	lap 60*dia
80	1	10ϕ	180		88	5.65	0.25	6.15	541.2	**335.544**	cover 50mm
									TOTAL	**684.232**	79+80
TOTAL QUANTITY OF STEEL FOR THE SUBSTRUCTURE										**31410.4**	

5.4 QUANTITY OF STEEL IN THE SUPERSTRUCTURE

Table 5(a) Quantity of steel in slab 30M span

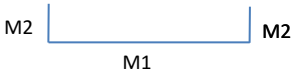
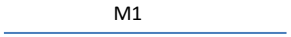
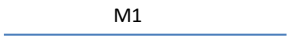
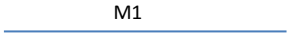
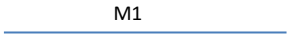
S.no	BAR DIA	BAR SHAPE	Nos	M1	M2	M3	M4	BAR LENGTH	TOTAL LENGTH	WEIGHT	REMARKS
1	25		17	30.7	0.15	0.475	0.4	31.725	539.325	2143	for span of 30m metre
2	25		17	30.6	0.05	0.425	0	31.55	536.35	2065	for span of 30m metre
3	25		10	31.55	0.2	0	0	31.75	317.5	2065	Refer table 6 & Appendix
4	25		2	7.5	0	0	0	7.5	15	58	Refer table 6 & Appendix
5	25		4	7.5	0	0	0	7.5	30	116	Refer table 6 & Appendix
6	25		2	15	0	0	0	15	30	116	Refer table 6 & Appendix
7	25		2	15	0	0	0	15	30	116	Refer table 6 & Appendix
									Total	**6679**	aadding 1-7

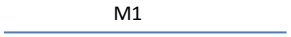
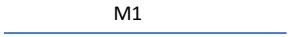
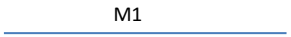
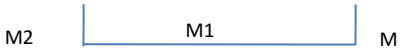
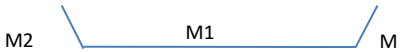
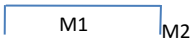
Table 5(b) Quantity of steel in slab 30M span											
S.no	**BAR DIA**	**BAR SHAPE**	**Nos**	**M1**	**M2**	**M3**	**M4**	**BAR LENGTH**	**TOTAL LENGTH**	**WEIGHT**	**REMARKS**
8	25		8	22.5	0	0	0	22.5	180	693	Refer table 6 & Appendix
9	25		6	22.5	0	0	0	22.5	135	520	Refer table 6 & Appendix
18	25		8	3.25	0.8	0.6	0	4.65	37.2	143.2	Refer table 6 & Appendix
36	25		24	2	0	0	0	2	48	185	Refer table 6 & Appendix
29	20		8	5.25	0.1	0	0	5.45	43.6	104	Refer table 6 & Appendix
27	20		8	4.35	0.45	0	0	5.25	42	86	Refer table 6 & Appendix
16	16		24	5.086	0.2	0	0	5.486	131.664	208	Refer table 6 & Appendix
									Total	**1939.2**	Adding8-16

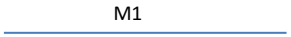
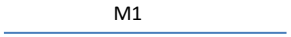
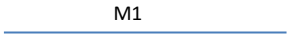
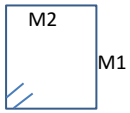
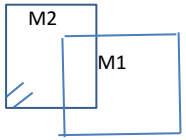
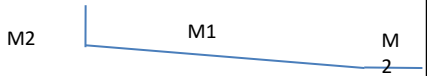
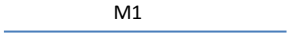
Table 5(c) Quantity of steel in slab 30M span											
S.no	**BAR DIA**	**BAR SHAPE**	**Nos**	**M1**	**M2**	**M3**	**M4**	**BAR LENGTH**	**TOTAL LENGTH**	**WEIGHT**	**REMARKS**
17	16		36	1.6	0	0	0	1.6	57.6	91	Refer table 6 & Appendix
	16		84	1.6	0	0	0	1.6	134.4	212	Refer table 6 & Appendix
	16		30	1.6	0	0	0	1.6	48	75.84	Refer table 6 & Appendix
19	16		72	1.924	0.141	0.2	0	4.33	311.76	492.58	Refer table 6 & Appendix
20	16		136	1.924	0.39	0.141	0	4.49	610.64	1149.35	Refer table 6 & Appendix
28	16		8	1.81	0.35	0.35	0	2.51	20.08	32	Refer table 6 & Appendix
30	16		16	3	0	0	0	3	48	76	Refer table 6 & Appendix
									Total	**2128.77**	adding 17-30

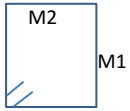
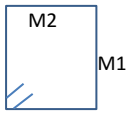
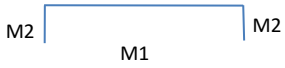
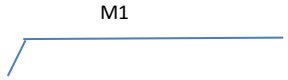
Table 5(d) Quantity of steel in slab 30M span											
S.no	**BAR DIA**	**BAR SHAPE**	**Nos**	**M1**	**M2**	**M3**	**M4**	**BAR LENGTH**	**TOTAL LENGTH**	**WEIGHT**	**REMARKS**
25	12		32	2.785	1.935	0.05	0	9.535	305.12	271.5	Refer table 6 & Appendix
26	12		32	2.25	1.715	0.05	0	8.03	256.96	229	Refer table 6 & Appendix
32	12		64	2.806	0.178	0	0	2.86	179.58	160	Refer table 6 & Appendix
33	12		6	1.578	0.178	0	0	3.612	21.66	19.28	Refer table 6 & Appendix
34	10		39	30.7	0.15	0	0	31	1054	653.48	Refer table 6 & Appendix
35	10		30	1.7	0.45	0.45	0	2.6	74	48.36	Refer table 6 & Appendix
									Total	**1381.62**	adding 25-35

Table 5(e) Quantity of steel in slab 30M span

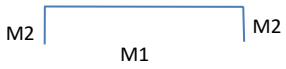
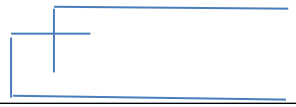
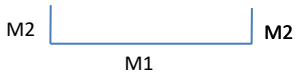
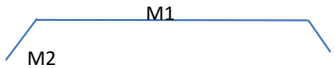
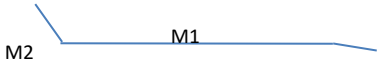
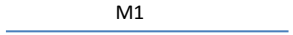
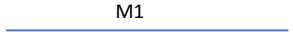
S.no	BAR DIA	BAR SHAPE	Nos	M1	M2	M3	M4	BAR LENGTH	TOTAL LENGTH	WEIGHT	REMARKS
36	10		150	5.1	0.1	0	0	5.3	795	492.9	Refer table 6 & Appendix
37	10		36	23.15	2.628	0.86	0	30.126	1084.54	672.42	Refer table 6 & Appendix
38	10		36	2.635	1.936	0	0	9.24	332.64	206.24	Refer table 6 & Appendix
39	10		36	2.38	1.715	0	0	8.29	298.44	185	Refer table 6 & Appendix
40	10		84	2.36	1.935	0	0	9.24	776.16	481.2	Refer table 6 & Appendix
41	10		84	2.38	1.915	0	0	8.69	729.96	452.58	Refer table 6 & Appendix
									Total	**2490.34**	adding 36-41

Table 5(e) Quantity of steel in slab 30M span											
S.no	**BAR DIA**	**BAR SHAPE**	**Nos**	**M1**	**M2**	**M3**	**M4**	**BAR LENGTH**	**TOTAL LENGTH**	**WEIGHT**	**REMARKS**
42	8		12	30.7	0.15	0	0	31	372	146	Refer table 6 & Appendix
43	8		310	1.4	0.2	0	0	1.6	496	196	Refer table 6 & Appendix
44	8		120	1.7	0.45	0	0	2.6	312	123.2	Refer table 6 & Appendix
45	8		84	0.535	0.25	0	0	1.035	314.64	124	Refer table 6 & Appendix
46	8		304	4.175	0	0	0	4.175	167	66	Refer table 6 & Appendix
47	8		40	0.5	0	0	0	4.175	24	9.48	Considering lap 0.50
TOTAL QUANTITY OF STEEL IN SUPERSTRUCTURE										**15283.61**	adding table 5(a)-(e)

5.5 ABSTRACT FOR THE QUANTITY OF STEEL IN SUBSTRUCTURE

After calculating the quantity of steel in the Substructure the quantity of different bars required for the construction has been summarized below after referring to table-4 (a) to Table -4(p). The total quantity of steel estimated for the Substructure is 32072kg i.e. 32.1 Tonne. Refer Table 4(a)-Table 4(o) for the results

Table-6 Summary of Quantity of Steel used in sub structure

S. no	Dia. of Bar (mm)	Quantity (Kg)
1.	10	5095
2.	12	7266
3.	16	5402
4.	20	276
5.	25	2840
6.	28	819
7.	32	1673

5.6 ABSTRACT FOR QUANTITY OF STEEL IN SUPERSTRUCTURE

The quantity of steel required in the superstructure i.e. the part of the bridge lying above the bearing level is 18390 kg i.e. 18.39 tonne for a single span i.e. the span between pier and Saheli side abutment. The requirement of steel as per the diameter of the bar has been shown in the table. Refer Table 5(a)-Table 5(e)

Table-7 Summary of Quantity of steel in the Super Structure

S. no	Dia. of Bar (mm)	Quantity (Kg)
1.	8	665kg
2.	10	4105 kg
3.	12	680 kg
4.	16	3830 kg
5.	20	190 kg
6.	25	8462 kg

CHAPTER 6

RATE ANALYSIS OF BRDIGE

6.1 METHODOLOGY FOR RATE ANALYSIS

The analysis of rate is usually worked out for the unit of payment of the particular item of work under three heads:

1. Material
2. Labour
3. Machinery

And together their cost gives the cost of the items of work. The costs of material are taken as delivered at site inclusive of the transport, local taxes, octroi, malkana toll and other charges. For tools and plants and miscellaneous petty items (sundries) which cannot be accounted in details lump-sum provision is made. A provision for water charges @ 1% of the total cost is made in the rate. Adding 10% to this cost as contractor's profit, the rate per unit of the item of work is obtained. If transport of material is to be done from a distant place more than 8kms analysis of transport work may be done separately. The cement and steel are supplied by the department and the contractor is not to invest any money on these, 10% profit is not allowed on cement and steel. The cost of carriage of cement and steel from the godown to the site off work should be allowed to the contractor. 10% profit may be added over the whole cost of the labour and material. 5% for the overhead charges is to be added on the whole cost. Here the rates have been adopted as per the rates given by the HPPWD Department.

6.2 BASIC RATES ISSUED BY HPPWD

The analysis of rates of different items of work are given, on the basis of material and labour rate prevalent at Hamirpur (HP) and actually paid by HPPWD Barsar. The rates are from the year 2015 and may vary at the current date.

Table 8 Labour Rates (Source: HPPWD Hamirpur, 2014)

SR. No	Description of the item	Unit	Rate
1	Beldar	Per day	198/-
2	Bhisti	Per day	198/-
3	Mate	Per day	198/-
4	Driller	Per day	303/-
5	Blaster	Per day	198/-
6	Stone Dresser	Per day	198/-
7	Mason 1st Class	Per day	339/-
8	Mason 2nd Class	Per day	262/-
9	Fitter	Per day	247/-
10	Black Smith 1st Class	Per day	303/-
11	Black Smith 2nd Class	Per day	247/-

Table 9 Material Rates (Source: HPPWD, Hamirpur 2014)

Sr. No	**Description of the Item**	**Unit**	**Rate (₹)**
1	40mm Aggregate	Cum	750/-
2	20mm Aggregate	Cum	900/-
3	10mm Aggregate	Cum	900/-
4	Cement	Tonne	4540/-
5	Sand	Cum	700/-
6	Detonator	Each	70/-
7	Blasting Material	Kg	3.25/-
8	HYSD Bar	Tonne	48584/-
9	Binding Wire	Kg	70/-

Table 10 Rate of the Material Used (Source HPPWD Hamirpur, 2014)

Sr. No	Description of Item	Unit	Rate (₹)
1	Cement	Tonne	221/-
2	Sand	Cum	494/-
3	Agg. 10/12.5mm	Cum	224/-
4	Agg. 20mm	Cum	224/-
5	Agg. 40mm	Cum	224/-
6	Steel Bar	Tonne	235/-
7	Boulder	Each	109/-

6.3 RATE ANALYSIS PERFORMED

In this section the rate analysis has been performed as per the rates issued by the HPPWD department. It has been done as per the format illustrated in the Standard data book 2010.
In the analysis the Overhead charges has been taken as 5% whereas the contractors profit has been taken as 10%. Labour welfare cess of 1% has been taken.
The entire cost of an item is divided into three sections.

a) Labour Cost
b) Material Cost
c) Machinery cost

The analysis has been done using the suitable output and taking the units of material and machinery used as given in the standard data book.

6.4 RATE ANALYSIS OF THE BRIDGE

Table 11(a) Earthwork Excavation							
Item No.	**MoRTH spec**	**Description**	**Unit**	**Rate Rs**	**Quantity**	**Cost Rs**	**Remarks**
1	**304**	**Excavation for structures**					
		Earth work in excavation of foundation of structures as per drawing and technical specification, including setting out, construction of shoring and bracing, removal of stumps and other deleterious matter, dressing of sides and bottom and backfilling with approved material.					Chapter 12 of Standard Data book
		Hard Soil(Requiring Blasting)					12.1 IV of Data Book
		Manual Means					
		Unit = Cum					
		Taking Output = 10cum					
		a) Labour					
		Mate	day	198	0.35	**69**	Refer Table no 8
		Driller	day	198	0.5	**99**	
		Blastor	day	198	0.25	**50**	
		Mazdoor	day	198	8	**1587**	
		b) Machinery					
		Air Compressor 250cfm with 2 jack hammer for drilling	hour	355	1	**355**	Refer Table 9
		c) Material					
		Blasting Material	Kg	70	3.5	**245**	
		Detonator	Each	3	14	**46**	Refer Table 10
		Add 5% for overhead				**123**	overhead on a+b+c
		Add 10% for Contractor Profit				**228**	C.P on a+b+c+overhead
		Add 10% for dewatering				**280**	Dewatering done
		Add 1% for Worker Welfare Cess				**31**	Labour Cess on a+b+c+overhead+CP
		Cost for 10 cum				**3112**	Adding a+b+c+OH+Cp+cess
		Rate Per cum for Excavtion				**311**	

Table 8(b) PCC 1:3:6 in foundation							
Item No.	**MoRTH spec**	**Description**	**Unit**	**Rate Rs**	**Quantity**	**Cost Rs**	**Remarks**
2	**1500,1700 & 2100**	**PCC 1:3:6 in Foundation**					
		Plain cement concrete 1:3:6 nominal mix in foundation with crushed stone aggregate 40 mm nominal size mechanically mixed, placed in foundation and compacted by vibration					Chapter 12 of Standard Data book
		Taking Output = 15cum					Sec 12.4
		a) Labour					
		Mate	day	198	0.64	**127**	
		Mason	day	340	1	**340**	
		Mazdoor	day	198	15	**2975**	Refer Table 8 for Rates
		b) Machinery					
		Concrete Mixer	hour	260	6	**1560**	Vibrator for compaction
		Generator 33KVA	hour	390	6	**2340**	
		Water tanker 6kh capacity	hour	380	2	**760**	Refer Table 9
		c) Material					
		40mm Aggregate	cum	750	13.5	**10125**	
		Sand	cum	700	6.75	**4725**	
		Cement	Tonne	4540	3.45	**15663**	
		Water	KL	50	18	**900**	Refer Table 10
		Add 5% for overhead				**1976**	overheads on a+b+c
		Add 10% for Contractor Profit				**2583**	C.P on a+b+(c-Cement)
		d) Carriage by Mechanical Transportation					
		40mm Aggregate	cum	224	13.5	**3030**	
		Sand	cum	494	6.75	**3332**	
		Cement	Ton	221	3.45	**761**	Rates from online
		Add 1% for Worker Welfare Cess				**512**	Labour Cess on a+b+c+d
		Cost for 15 cum				**51708**	
		Rate Per cum for PCC in foundation				**3447**	

Table 8(c) M30 in Substructure							
Item No	**MoRTH**	**Description**	**Unit**	**Rate Rs**	**Quantity**	**Cost Rs**	**Remarks**
3	**1500,1700 & 2100**	**RCC M30 in Sub structure**					
		Providing and laying RCC design mix to obtain minimum compressive strength of M-30 in substructure					Chapter 12 of Standard Data book
		Taking Output = 120cum					
		a) Labour					
		Mate	day	198	0.84	**167**	
		Mason	day	340	3	**1019**	
		Mazdoor	day	198	18	**3570**	Refer Table 8
		b) Machinery					Sec 12.8 G Case II
		Batching Plant	hour	2390	6	**14340**	
		Generator 100KVA	hour	585	6	**3510**	
		Loader 1 cum capacity	hour	1020	6	**6120**	
		Transit Mixer	hour	1000	15	**15000**	
		Concrete Pump	hour	270	6	**1620**	Refer Table 9
		c) Material					
		10mm Aggregate	cum	900	43.2	**38880**	
		20mm Aggregate	cum	900	64.8	**58320**	
		Sand	cum	700	54	**37800**	
		Cement	Ton.	4540	48.8	**221552**	Refer Table 10
		Add 14% for formwork				**56266**	adding a+b+c
		Add 5% for overhead				**22908**	Adding a+b+c+FW
		Add 10% for Contractor Profit				**25952**	
		d) Carriage by Mechanical Transportation					
		Aggregate	cum	224	108	**24238**	Contactor Profit wont be added for Transportation
		Sand	cum	494	54	**26658**	
		Cement	Tonn	221	48.8	**10763**	
		Add 1% for Worker Welfare Cess				**5687**	
		Cost for 120 cum				**574369**	
		Rate Per cum				**4786**	

Table 8(d) HYSD Bar in Sub Structure							
Item No.	**MoRTH spec**	**Description**	**Unit**	**Rate Rs**	**Quantity**	**Cost Rs**	**Remarks**
4	**1600&2200**	**HYSD Reinforcement in the Sub Structure**					
		Supplying, fitting and placing HYSD bar reinforcement in the sub structure in all heights including cost of binding wire and cost of cutting binding and placing in position of bars complete as per drawing					Refer to Chapter 13 of Standard Data book
		Taking Output = 1 Tonne					Sec 13.7
		a) Labour					
		Mate	day	198	0.34	**67**	
		Blacksmith	day	303	2	**607**	
		Mazdoor	day	198	6.5	**1289**	Refer Table 8 For Rates
		c) Material					
		HYSD Bar i/c 5% overlaps	Tonne	48585	1.05	**51014**	
		Binding Wire	kg	70	6	**420**	Refer Table 9
		Add 10% for overhead				**5340**	a+c
		Add 10% for Contractor Profit				**772**	a+c+CP
		d) Carriage by Mechanical Transportation					
		Steel	Tonne	235	1.05	**247**	Refer table 9
		Add 1% for Worker Welfare Cess				**598**	
		Rate for 1 Tonne				**60354**	a+c+d+OH+CP

Table 8(d) Providing Filter Media							
Item No.	**MoRTH spec**	**Description**	**Unit**	**Rate Rs**	**Quantity**	**Cost Rs**	**Remarks**
5	**2504.2.2**	**Providing Filter Media**					
		aggregates satisfying requirement laid down in clause 2504.2.2 of MoRTH specification to a thickness of not less than 600mm with smaller size towards the soil and bigger size towards the wall and providing over the entire surface behind the abutment, wing wall and return wall to the full height, compacted to a firm condition complete					Refer to Chapter 13 (Substructure) of Standard Databook
		Taking Output = 10cum					Sec 13.10
		a) Labour					
		Mate	day	198	0.32	**63**	
		Mazdoor	day	198	7	**1388**	
		Mazdoor Skilled	day	198	1	**198**	Refer Table 8
		b) Machinery					
		Water Tanker	hour	380	0.06	**23**	
		c) Material					
		Filter Media	cum	450	12	**5400**	Refer Table 9
		Add 5% for overhead				**354**	a+b+c
		Add 10% for Contractor Profit				**743**	a+b+c
		d) Carriage by Mechanical Transportation					
		Filter Media	cum	109	12	**1307**	rates Table 9
		Add 1% for Worker Welfare Cess				**95**	(a+b+c+d)*0.01
		Cost for 10 cum				**9571**	addin lmp and OH
		Rate Per cum for granular material				**957**	

Table 8(f) M25 in Super Structure							
Item No.	**MoRTH**	**Description**	**Unit**	**Rate Rs**	**Quantity**	**Cost Rs**	**Remarks**
		RCC M25 in Super Structure					
		Providing and laying reinforced cement concrete design mix to obtain minimum compressive strength of M-25					Refer to Chapter 14 Super Structure
		Taking Output = 120cum					Sec 14.1 B case I
		a) Labour					
		Mate	day	198	0.84	**167**	
		Mason	day	340	3	**1019**	
		Mazdoor	day	198	18	**3570**	Refer table 8
		b) Machinery					
		Batching Plant	hour	2390	6	**14340**	
		Generator 100KVA	hour	585	6	**3510**	
		Loader 1 cum capacity	hour	1020	6	**6120**	Refer Table 9
		Transit Mixer	hour	1000	15	**15000**	
		Concrete Pump	hour	270	6	**1620**	
7	**15,001,700**	**c) Material**					
		10mm Aggregate	cum	900	43.2	**38880**	
		20mm Aggregate	cum	900	64.8	**58320**	Refer Table 10
		Sand	cum	700	54.2	**37940**	
		Cement	Tonn	4540	47.95	**217693**	
		Add 58% for formwork above 10m height				**230943**	a+b+c
		Add 5% for overhead				**31456**	a+b+c+formwork
		Add 10% for Contractor Profit				**44288**	a+b+c+OH
		d) Carriage by Mechanical Transportation					
		Aggregates	cur	224	108	**24238**	
		Sand	cur	494	54.2	**26757**	CP not give on Tranportation
		Cement	To	221	47.95	**10575**	
		Add 1% for Worker Welfare Cess				**7664**	a+b+c+d
		Cost for 120 cum				**774101**	a+b+c+d+OH+FW
		Rate Per cum forM25 in SuperStructure				**6451**	

Table 8(g) HYSD bar in Superstructure							
Item No.	**MoRTH spec**	**Description**	**Unit**	**Rate Rs**	**Quantity**	**Cost Rs**	**Remarks**
9	**1002,1010 &1202**	**HYSD Bars in the Super Structure**					
		Supplying, fitting and placing HYSD bar reinforcement in super structure in all heights including the cost of binding wire and cost of cutting binding and placing in position of bars.					Refer Chapter 14 Super-Structure of Standard Databook
		Taking Output = 15cum					Sec. 14.2
		a) Labour					
		Mate	day	198	0.44	87	Refer table 8
		Blacksmith	day	303	3	910	
		Mazdoor	day	198	8	1587	
		c) Material					
		HYSD Bar i/c 5% overlap	cum	48585	1.05	51014	Refer table 9
		Binding Wire	cum	70	8	560	
		Add 10% for overhead				**5416**	adding a) and b)
		Add 10% for Contractor Profit				**856**	a+b+OH
		d) Carriage by Mechanical Transportation					
		HYSD Bar	Tonne	235	1.05	247	CP not included Transportation
		Add 1% for Worker Welfare Cess				**604**	
		Cost for 1Tonne				**61281**	
		Rate Per cum for HYSD in Superstructure				**61281**	

6.6 ABSTRACT FOR THE RATE ANALYSIS

After performing the rate analysis using the Morth Standard Data book 2005 and Ms excel 2010 the rates obtained for various items has been summarize below referring to Table 8(a)-Table 8(e) of section 6.5.

Table -4 Summary of the Analysis of Rates

Item No.	Description of the Item	Unit	Rate (₹)
1	Earth work in excavation for the foundation of bridge	Per cum	311/-
2	Providing and laying lean concrete 1:3:6	Per Cum	3447/-
3	Providing and laying M-30 in foundation and Sub structure.	Per Cum	4786/-
4	Supplying and fitting HYSD bars in sub structure and foundation.	Per Cum	60354/-
20	Providing and laying filter media with granular crushed aggregates	Per Cum	957/-
6	Providing, furnishing and placing reinforced cement concrete of Strength M-25 in the superstructure	Per Cum	6451/-
7	HYSD Bar in Super Structure	Per Tonne	61281/-

CHAPTER 7

SCHEDULING OF THE BRIDGE

7.1 METHODOLOGY

The activities identified for the project are as shown in the excel sheets in the coming pages. The scheduled to be calculated will be the actual schedule i.e. the actual numbers of days taken to complete the project are used in the scheduling. The construction of the bridge has been completed. In the project the scheduling the substructure as per the data provided by the firm. And in this way the schedule provided can serve as a reference for scheduling of other projects in the future.

The construction is divided into three structures. The construction of the jeoli devi side abutment, Saheli Side Abutment and the pier. Since the work started in March it is very important that first the construction of pier be carried out due to the monsoon approaching in the month of June and July because in the rainy season the Man khad reached it High Flood Level and it may hamper the rate of construction. At the construction site a team of 12 labor specialised in the Bar Bending, Reinforcement fixing and concreting. Where as in the portions where the amount of concreting is high special labor force of 13 labours were appointed. The construction of pier column and the abutment wall were carried out in lifts of height 1.3 metre.

After the completion of the pier till the pier cap the construction of the abutments were carried out. The construction of Jeoli Devi abutment followed by Saheli side abutment was carried out. The working hours of labor were 8hr/day and they work for 7 days/week. From the schedule we can create the productivity norm for the labor and for the rate of exaction. The rate of concreting can also be calculated from the above results. The nos. of days required for the completion of the project are shown in the excel sheet in the following pages.

7.2 IDENTIFICATION OF ACTIVITIES

An activity is the actual performance of a task. It is the work work required to complete a specific event. An activity is a recognizable part of a work project that requires time and resources for its completion.

A significant activity must be:

a) A positive, specific, tangible and meaningful effort

b) Such that the primary responsibility of effort can be determined.

c) Having a description understandable by all concerned with the project.

In order to Plan and manage the project the first and foremost thing is to identify the activities involved in the project. Hence the Activities has been Classified as under:

1. **Preliminary Activities**

a) Setting up of site office

b) Setting of labor camp

c) Excavation

d) PCC layer

2. **Foundation**

a) Raft foundation for Pier

b) Raft foundation for Jeoli Devi Abutment

3. **Substructure**

a) Pier

b) Pier Cap

c) Bed block

4. **Superstructure**

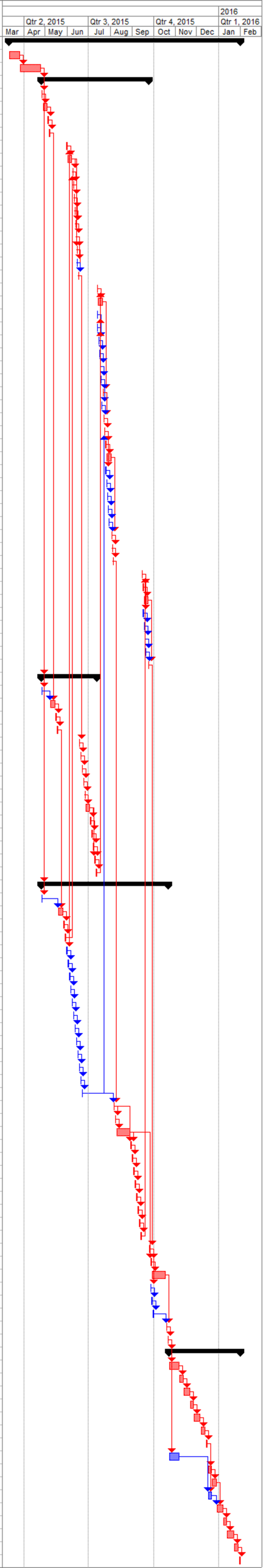
a) Cast in situ RCC Box Girder

b) Construction of deck slab

7.3 SCHEDULING ON MS PROJECT 2003

In this section with the help of MS project the schedule for the bridge has been prepared. The date of start of the construction of the bridge is taken as 11th march 2015 and the numbers of days required for the completion are 327 days. The following section shows the Gantt chart view of the project schedule identifying critical and non-critical activities.

ID	Task Name	Duration	Start	Finish	Predecessors
1	**Brdge construction**	**327 days**	**Wed 3/11/15**	**Sun 1/31/16**	
2	Preliminary activities	15 days	Wed 3/11/15	Wed 3/25/15	
3	Excavation	30 days	Thu 3/26/15	Fri 4/24/15	2
4	**Pier**	**152 days**	**Sat 4/25/15**	**Wed 9/23/15**	**3**
5	PCC layer for Pier	2 days	Sat 4/25/15	Sun 4/26/15	3
6	Reinforc. fixing for raft	7 days	Mon 4/27/15	Sun 5/3/15	5
7	Shuttering for raft	2 days	Mon 5/4/15	Tue 5/5/15	6
8	Concreting for raft	2 days	Wed 5/6/15	Thu 5/7/15	7
9	Deshuttering of reeinforcement	2 days	Sat 5/30/15	Sun 5/31/15	70
10	Curing	7 days	Mon 6/1/15	Sun 6/7/15	9
11	Reinforcement pier col. 1st lift	1 day	Mon 6/8/15	Mon 6/8/15	70,10
12	shuttering pier col 1st lift	1 day	Tue 6/9/15	Tue 6/9/15	11
13	concreting pier col 1st lift	1 day	Wed 6/10/15	Wed 6/10/15	12
14	Reinforcement pier 2nd lift	1 day	Thu 6/11/15	Thu 6/11/15	13
15	shuttering pier col 2nd lift	1 day	Fri 6/12/15	Fri 6/12/15	13FS+1 day,14
16	concreting pier col 2nd lift	1 day	Sat 6/13/15	Sat 6/13/15	15
17	reinforcement pier 3rd lift	1 day	Sun 6/14/15	Sun 6/14/15	16,10
18	shuttering pier 3rd lift	1 day	Sun 6/14/15	Sun 6/14/15	16
19	concreting pier 3rd lift	1 day	Tue 6/16/15	Tue 6/16/15	18,17FS+1 day
20	Deshuttering	1 day	Mon 7/13/15	Mon 7/13/15	65
21	Curing	7 days	Tue 7/14/15	Mon 7/20/15	20
22	Reinforcement pier col. 4th lift	1 day	Mon 7/13/15	Mon 7/13/15	65
23	shuttering pier col 4th lift	1 day	Mon 7/13/15	Mon 7/13/15	65
24	concreting pier col 4th lift	1 day	Wed 7/15/15	Wed 7/15/15	23,22FS+1 day
25	Reinforcement pier 5th lift	1 day	Thu 7/16/15	Thu 7/16/15	24
26	shuttering pier col 5th lift	1 day	Fri 7/17/15	Fri 7/17/15	25
27	concreting pier col 5th lift	1 day	Sat 7/18/15	Sat 7/18/15	26
28	reinforcement pier 5th lift	1 day	Tue 7/21/15	Tue 7/21/15	27,21
29	shuttering pier 5th lift	1 day	Sun 7/19/15	Sun 7/19/15	27
30	concreting pier 5th lift	1 day	Wed 7/22/15	Wed 7/22/15	29FS+1 day,28
31	Reinforcement pier col. 6th lift	1 day	Thu 7/23/15	Thu 7/23/15	82,30
32	Deshuttering	2 days	Fri 7/24/15	Sat 7/25/15	31
33	Curing	7 days	Sun 7/26/15	Sat 8/1/15	32
34	shuttering pier col 6th lift	2 days	Fri 7/24/15	Sat 7/25/15	31
35	concreting pier col 6th lift	1 day	Sun 7/26/15	Sun 7/26/15	34
36	Reinforcement pier 7th lift	1 day	Mon 7/27/15	Mon 7/27/15	35
37	shuttering pier col 7th lift	1 day	Tue 7/28/15	Tue 7/28/15	36
38	concreting pier col 7th lift	1 day	Wed 7/29/15	Wed 7/29/15	37
39	reinforcement pier 8th lift	1 day	Sun 8/2/15	Sun 8/2/15	38,33
40	shuttering pier 8th lift	1 day	Mon 8/3/15	Mon 8/3/15	39
41	concreting pier 8th lift	1 day	Tue 8/4/15	Tue 8/4/15	40
42	Reinforcement pier col. 9th lift	1 day	Mon 9/14/15	Mon 9/14/15	93
43	Deshuttering	2 days	Tue 9/15/15	Wed 9/16/15	42
44	Curing	6 days	Thu 9/17/15	Tue 9/22/15	43
45	shuttering pier col 9th lift	2 days	Tue 9/15/15	Wed 9/16/15	42
46	concreting pier col 9th lift	1 day	Thu 9/17/15	Thu 9/17/15	45
47	Reinforcement pier 10th lift	1 day	Fri 9/18/15	Fri 9/18/15	46
48	shuttering pier col 10th lift	1 day	Sat 9/19/15	Sat 9/19/15	47
49	concreting pier col 10th lift	1 day	Wed 9/23/15	Wed 9/23/15	48,44
50	**JeoliDevi Abutment**	**79 days**	**Sat 4/25/15**	**Sun 7/12/15**	**3**
51	PCC layer for jeoli Devi Abutment	2 days	Sat 4/25/15	Sun 4/26/15	3
52	reinforcement for raft	7 days	Fri 5/8/15	Thu 5/14/15	8,51
53	Shuttering for Raft	2 days	Fri 5/15/15	Sat 5/16/15	52
54	concreting of Raft	2 days	Sun 5/17/15	Mon 5/18/15	53
55	Reinforcement for walls 1st lift	2 days	Wed 6/17/15	Thu 6/18/15	19
56	shuttering for walls 1st lift	2 days	Fri 6/19/15	Sat 6/20/15	55
57	concreting for wall 1st lift	2 days	Sun 6/21/15	Mon 6/22/15	56
58	reinforcement for walls 2nd lift	2 days	Tue 6/23/15	Wed 6/24/15	57
59	Deshuttering	1 day	Thu 6/25/15	Thu 6/25/15	58
60	Curing	7 days	Fri 6/26/15	Thu 7/2/15	59
61	shutteirng for wall 2nd lift	2 days	Fri 7/3/15	Sat 7/4/15	60
62	concreting for wall 2nd lift	2 days	Sun 7/5/15	Mon 7/6/15	61
63	reinforcement for wall 3rd lift	2 days	Tue 7/7/15	Wed 7/8/15	62
64	shuttering for wall 3rd lift	2 days	Thu 7/9/15	Fri 7/10/15	63,60
65	concreting for wall 3rd lift	2 days	Sat 7/11/15	Sun 7/12/15	64
66	**Saheli side abutment**	**180 days**	**Sat 4/25/15**	**Wed 10/21/15**	**3**
67	pcc layer for saheli side	2 days	Sat 4/25/15	Sun 4/26/15	3
68	reinforcement for raft saheli	7 days	Tue 5/19/15	Mon 5/25/15	54,67
69	shuttering for raft	2 days	Tue 5/26/15	Wed 5/27/15	68
70	concreting for raft	2 days	Thu 5/28/15	Fri 5/29/15	69
71	reinforcement fixng for walls 1st l	2 days	Sat 5/30/15	Sun 5/31/15	70
72	shuttering for wall 1st lift	2 days	Mon 6/1/15	Tue 6/2/15	71
73	concreting for wall 1st lift	2 days	Wed 6/3/15	Thu 6/4/15	72
74	reinforcement fixing 2nd lift	2 days	Fri 6/5/15	Sat 6/6/15	73
75	shuttering 2nd lift	2 days	Sun 6/7/15	Mon 6/8/15	74
76	concreting 2nd lift	2 days	Tue 6/9/15	Wed 6/10/15	75
77	reinforcement fixng 3rd lift	2 days	Thu 6/11/15	Fri 6/12/15	76
78	shuttering 3rd lift	2 days	Sat 6/13/15	Sun 6/14/15	77
79	concreting for 3rd lift of wall	2 days	Mon 6/15/15	Tue 6/16/15	78
80	reinforcement fixing 4th lift of wal	2 days	Wed 6/17/15	Thu 6/18/15	79
81	shuttering for 4th lift	2 days	Fri 6/19/15	Sat 6/20/15	80
82	concreting for 4th lift	2 days	Sun 6/21/15	Mon 6/22/15	81
83	reinforcement fixng for walls 5th l	2 days	Wed 8/5/15	Thu 8/6/15	41,82
84	Deshutering	2 days	Fri 8/7/15	Sat 8/8/15	83
85	Curing	20 days	Sun 8/9/15	Fri 8/28/15	84
86	shuttering for wall 5th lift	2 days	Sat 8/29/15	Sun 8/30/15	83,85
87	concreting for wall 5th lift	2 days	Mon 8/31/15	Tue 9/1/15	86
88	reinforcement fixing 6th lift	2 days	Wed 9/2/15	Thu 9/3/15	87
89	shuttering 6th lift	2 days	Fri 9/4/15	Sat 9/5/15	88
90	concreting 6th lift	2 days	Sun 9/6/15	Mon 9/7/15	89
91	reinforcement fixng 7th lift	2 days	Tue 9/8/15	Wed 9/9/15	90
92	shuttering 7th lift	2 days	Thu 9/10/15	Fri 9/11/15	91
93	concreting for 7th lift of wall	2 days	Sat 9/12/15	Sun 9/13/15	92
94	reinforcement fixing 8th lift of wal	2 days	Thu 9/24/15	Fri 9/25/15	49
95	Deshuttering	2 days	Sat 9/26/15	Sun 9/27/15	94,85
96	Curing	20 days	Mon 9/28/15	Sat 10/17/15	95
97	shuttering for 8th lift	1 day	Sat 9/26/15	Sat 9/26/15	94
98	concreting for 8th lift	2 days	Sun 9/27/15	Mon 9/28/15	97
99	reinforcement fixing for 9th lift	2 days	Tue 9/29/15	Wed 9/30/15	98
100	shuttering of 9th lift	2 days	Sun 10/18/15	Mon 10/19/15	99,96
101	concreting 9th lift	2 days	Tue 10/20/15	Wed 10/21/15	100
102	**super structure**	**102 days**	**Thu 10/22/15**	**Sun 1/31/16**	**101**
103	Erection of Cribs 1st span	15 days	Thu 10/22/15	Thu 11/5/15	101
104	shuttering of soffit slab	6 days	Fri 11/6/15	Wed 11/11/15	103
105	reinforcement of the soffit slab	9 days	Thu 11/12/15	Fri 11/20/15	104
106	Shuttering of deck slab	5 days	Sat 11/21/15	Wed 11/25/15	105
107	reinforcement of deck slab	10 days	Thu 11/26/15	Sat 12/5/15	106
108	Approach slab	7 days	Sun 12/6/15	Sat 12/12/15	107
109	concreting of soffit slab and deck	3 days	Sun 12/13/15	Tue 12/15/15	108
110	Erection of Cribs	15 days	Thu 10/22/15	Thu 11/5/15	101
111	Deshutterring	6 days	Wed 12/16/15	Mon 12/21/15	109
112	Curing	7 days	Tue 12/22/15	Mon 12/28/15	111
113	shuttering of soffit slab	6 days	Wed 12/16/15	Mon 12/21/15	110,109
114	reinforcement of the soffit slab	9 days	Tue 12/29/15	Wed 1/6/16	113,112
115	Shuttering of deck slab	5 days	Thu 1/7/16	Mon 1/11/16	114
116	reinforcement of deck slab	10 days	Tue 1/12/16	Thu 1/21/16	115
117	Approach slab	7 days	Fri 1/22/16	Thu 1/28/16	116
118	concreting of soffit slab and deck	3 days	Fri 1/29/16	Sun 1/31/16	117



CHAPTER 8

CONCLUSION

8.1 RESULTS OBTAINED

After the estimation of the quantities of various items as stated in the BOQ the quantities have been summarised in this section. The estimated quantities have been compared with the quantities in the BOQ and the differences in the quantities have been shown with the help of a graph. Other than that the results for the rated analysis and project scheduling has also been summarized. [APPENDIX]

8.1.1 Result for Estimation of Quantities of Concrete, Backfill and filter media in the bridge

Table-12 Quantities of Concrete, Backfill and Filter Media

Item No	Particulars of the Item	Unit	Quantity
1.	Earthwork In Excavation	Cum	248
2.	Providing and laying PCC 1:3:6	Cum	29
5.	Providing and laying filter media	Cum	35
20.	Backfilling with the granular material	Cum	649
3.	M30 in the Sub structure	Cum	346
7	M25 in the Super structure(single span)	Cum	74

8.1.2 Result for Quantities of Steel Estimated for the bridge

1. The quantity of steel for the Substructure is 32 Tonne. The quantities of various bars:

Table 13 Result Quantities of Steel in Substructure

S. no	Dia. of Bar (mm)	Quantity (Kg)
1	10	5095
2.	12	7266
3.	16	5402
4.	20	276
5.	25	2840
6.	28	819
7.	32	1673

2. The quantity of steel for Superstructure is 1.5 Tonne. The quantities of various bars:

Table-14 Result of Quantity of steel in the Super Structure

S. no	Dia. of Bar (mm)	Quantity (Kg)
1.	8mm	665
2.	10mm	4105
3.	12mm	680
4.	16mm	3830
5.	20mm	190
6.	25mm	8462

8.1.3 Results for Rate Analysis

Table -15 Result of the Analysis of Rates

Item No.	Description of the Item	Unit	Rate (₹)
1	Earth work in excavation for the foundation of bridge	Per cum	311/-
2	Providing and laying lean concrete 1:3:6	Per Cum	3447/-
3	Providing and laying M-30 in foundation and Sub structure.	Per Cum	4786/-
4	Supplying and fitting HYSD bars in sub structure and foundation.	Per Cum	60354/-
5	Providing and laying filter media with granular crushed aggregates	Per Cum	957/-
6	Providing, furnishing and placing reinforced cement concrete of Strength M-25 in the superstructure	Per Cum	6451/-
7	HYSD Bar in Super Structure	Per Tonne	61281

8.1.4 Results for the Scheduling of the bridge

The start date of the Project is taken as 11th march 2015 and the number of days required for the completion of the construction of the project is 327 days whereas the time allotted for the completion is 1 year.

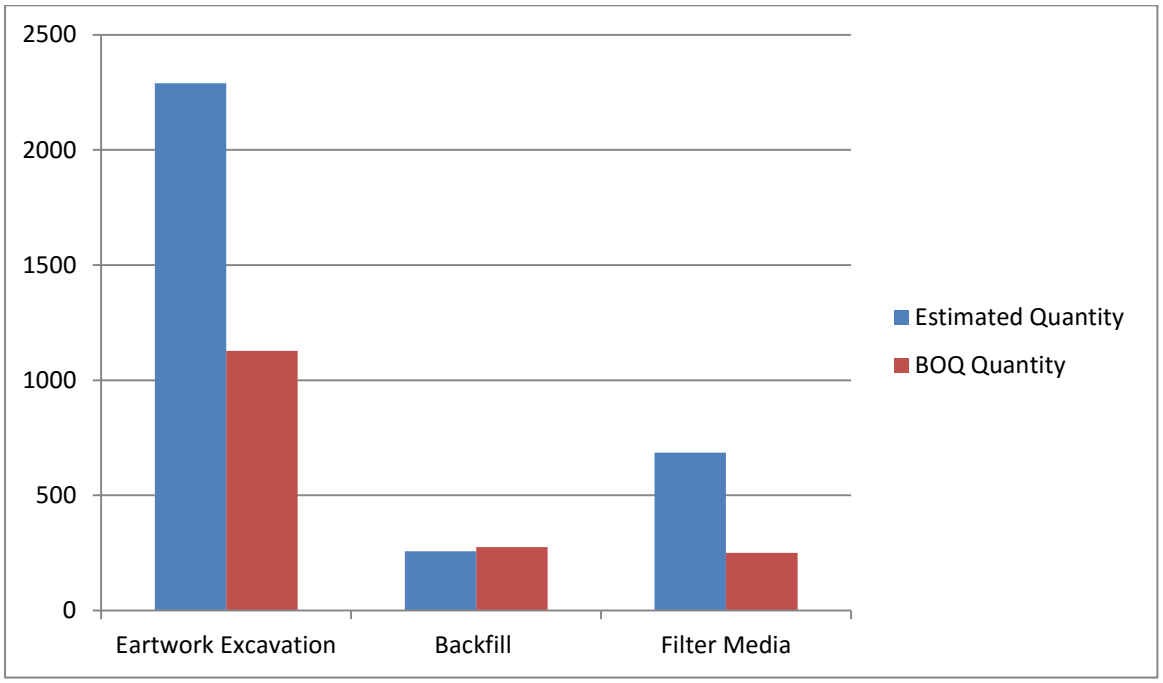
8.2 COMPARISON BETWEEN THE QUANTITIES OF BOQ AND ESTIMATED QUANTITIES

The estimates given in the BOQ are always approximate estimates whereas the estimates provided by the contractor are detailed estimates. And the difference between the detailed and approximate estimate can vary from very small to very large. In the table below the estimates have been compared.

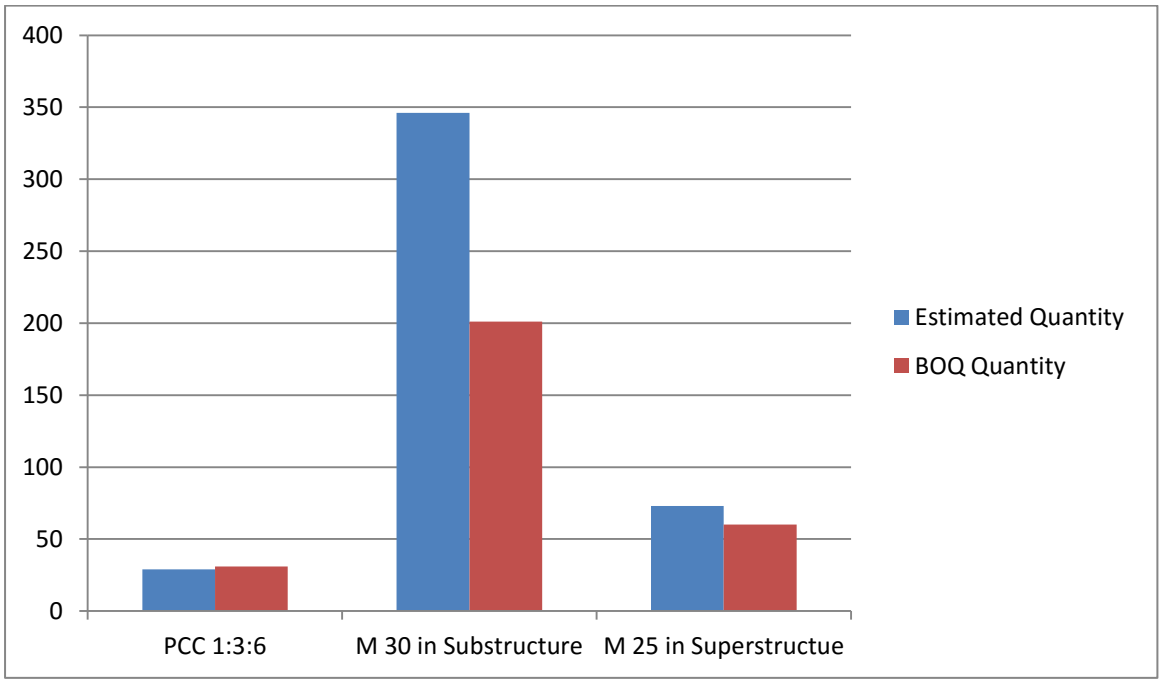
Table 16: Comparison between quantities in BOQ and Estimated

Item No.	Description of the Item	Estimated Quantity	BOQ Quantity	Remarks
1.	Earthwork in excavation	2289 Cu m	1128 Cu m	Refer to Table 12
2.	Providing and laying PCC in 1:3:6	29 Cu m	31 Cu m	Refer to Table 12
3.	Providing and laying M30 in Foundation and Substructure	346 Cu m	201 Cu m	Refer to Table 12
5.	Providing and laying filter media	257 Cu m	276 Cu m	Refer to Table 12
20.	Backfilling with granular material	685 Cu m	251 Cu m	Refer to Table 12
11.	Supplying fitting and lacing HYSD bar in sub structure	32 Tonne	31 Tonne	Refer to Table 13
9.	Providing and laying M25 in the Superstructure.	73 Cu m	60 Cu m	Refer to Table 12
12.	Supplying fitting and lacing HYSD bar in Superstructure.	1.5 Tonne	1 Tonne	Refer to Table 13

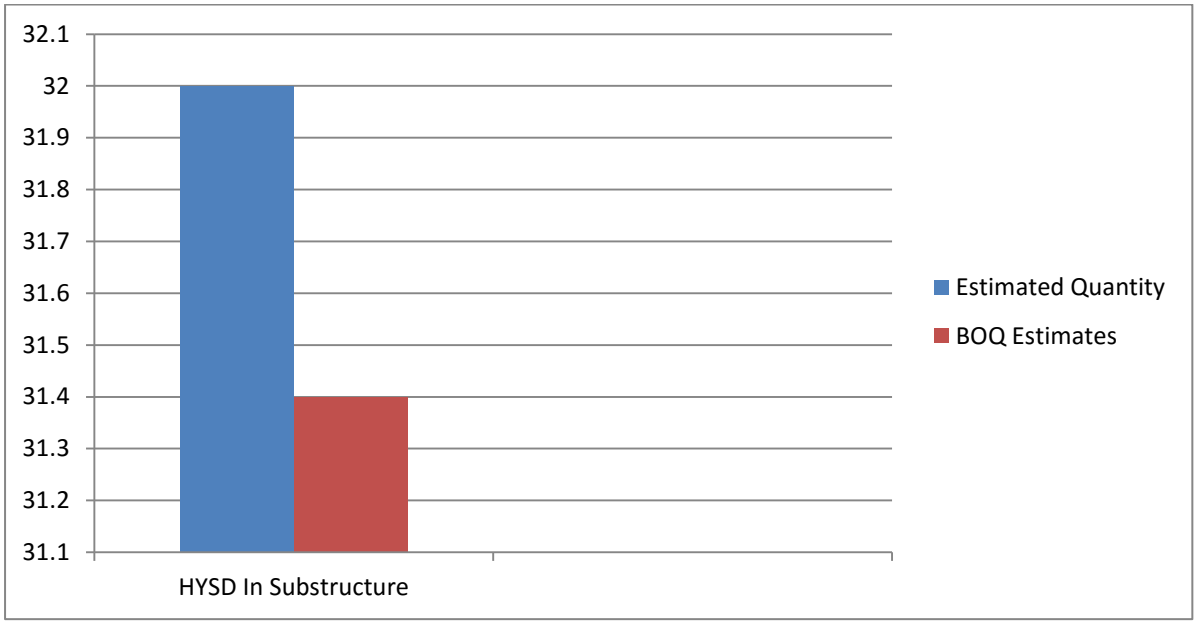
Graph 1- Comparison of quantities of excavation, backfill and filter media in bridge



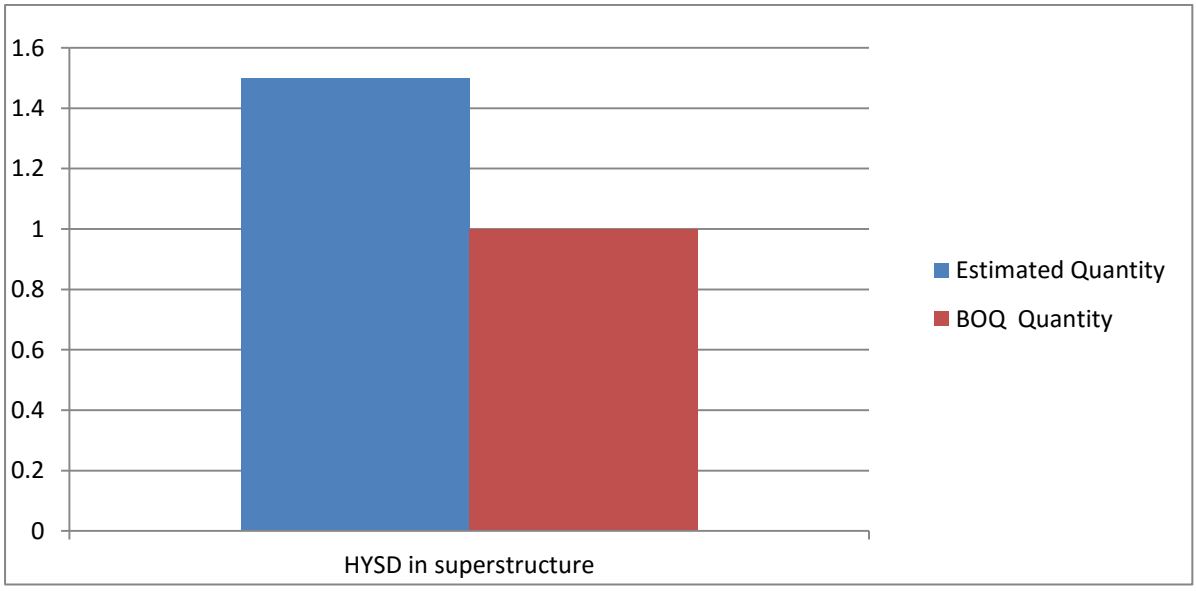
Graph 2 – Comparision of Quantity of Concrete



Graph 3- Comparision of Quantity of Steel in Substructure



Graph 4 -Comparision of Quantity of Steel in Superstructure



8.3 ANALYSIS OF THE RESULT OBTAINED

1. The quantity of the excavation provided in the BOQ is 1128.16 cu m. whereas the quantity estimated is 2288.6 cu m. the variations may be due to the different depths of excavation taken and the additional working space provided. In the estimate an extra working space of 35cm has been provided.
2. For the second item the quantity provide in the BOQ is 29.29 cu m and the quantity estimated is 31.26 cu m. the variation is due to the fact that sue to the revision of the drawing done later in the course of work. As the drawing has to be revised because the height of the Jeoli Devi side abutment was falling short by approx. 2m which was observed by the contractor the drawing was sent for revision. And the estimates have been prepared referring to the revised drawing.
3. For the item no. 3 the quantity given in the BOQ is 200.96 whereas the quantity estimated is 346.26 cu m. the variation is due to the fact that sue to the revision of the drawing done later in the course of work. As the drawing has to be revised because the height of the Jeoli Devi side abutment was falling short by approx. 2m which was observed by the contractor the drawing was sent for revision. And the estimates have been prepared referring to the revised drawing.
4. For the item no 5 the quantity given in the BOQ is may be due to the variation in the depth of the abutment taken.
5. For the item no 20 the quantity of backfill provided 251.00 cu m and the estimated is 648.8 and the reason for that is against the revision of drawings. And the working space provided which will again have to be backfilled.
6. The number of days for the completion of the project is coming out to be 327days whereas the time span allotted for the completion of the project is 1 year. The scheduling of the project is excluding the time required for the construction of railings and providing wearing coat.

REFERENCES

1. Dutta B.N (2002) Estimation and Costing in Civil Engineering . UBS Publishers and Distrubutors Roorkee . (Twenty Seventh revised edition)
2. Johnson Victor(2003) Essentials of Bridge Engineering. Oxford & IBH Publication.(Sixth Revised Edition)
3. Punnamia B.C (1987) Project Planning and Control with PERT CPM. Laxmi Publications. (Twenty Third Revised edition)
4. HPPWD(2012) Bill of Quantity for c/o 60M long BOX girder Bridge over Man Khad, Barsar
5. Ministry of Roads Transportation & Highway (2005) Standard Data Book(Road & Bridge works)
6. HPPWD (2012) Drawing for c/o of 60M long RCC Box Girder Bridge over Man Khad, Barsar. (Second Revised Drawings)
7. HPPWD (2012) Rates of material, carriage & labour. (Second Revised Edition)

APPENDIX

ANNEXURE I

SCHEDULE OF WORKS

Sl. No.	Description of work	No.or Qty.	Unit	Estimated Rate (in. Rs.)
1.00 Sign	Earth work in excavation for foundation of bridge structure in all type of classification of soil comprising of ordinary rock, hard rock, chiseling/ wedging out of rocks (where blasting in prohibited) as per drawing and technical specification clause and as per direction of the Engineer-in- Charge including setting out, construction of shoring and bracing removal of stumps and other deleterious materials and disposal of materials upto all leads and lift, including dressing of sides and bottom including shoring and strutting and pumping , bailing out water (surface and sub soil water) upto any depth and any quantum of water including cleaning of slush which may arise out during dewatering as per the direction of the Engineer-in- Charge including carriage of materials within all leads and lifts and other incidentals . The rate are inclusive of octroi , royalty , Malkana, toll tax, sale tax or other taxes imposed by the Government.	1611.39	Per cubic metre	
Sl. No.	**Description of work**	**No.or Qty.**	**Unit**	**Estimated Rate (in. Rs.)**
2.00	Providing and laying mechanically mixed and vibrated cement concrete nominal mix 1:3:6 (one cement :three Sand :six graded crushed stone aggregate 40mm (forty millimeter nominal size) on ground or under water and curing complete including pumping or bailing out water, dewatering removal of shush as required at site which may arise at the time of laying under water complete for all heights and depths including cost of form work for plain concrete in open foundations for all types of structures complete as per drawing and technical specifications clause 802,803, 1202 &1203 and as per direction of Engineer-in- Charge including carriage of material within all leads and lifts and other incidentals . The rates are inclusive of octroi, royality malkhana ,toll tax, sale tax or other taxes imposed by the Government	27.35	Per cubic metre	

ANNEXURE I

Sl. No.	Description of work	No.or Qty.	Unit	Estimated Rate (in. Rs.)
3.00	Providing and laying reinforced cement concrete design mix to obtain minimum compressive strength of M-30 (M-Thirty) in solid slab super structure above 10metre height or all heights including cost of form work and curing complete including carriage of material within all leads and lifts and other incidentals . The rates are inclusive of octroi, royality malkhana ,toll tax, sale tax or other taxes imposed by the Government	352.75	Per cubic metre	
4.00	Supplying ,fitting and placing HYSD bar reinforcement in sub structure in all heights including cost of binding wire and cost for cutting binding and placing in position of bars complete as per drawings and technical specification Clauses 1002,1010 and 1202 including carriage of material within all leads and lifts and other incidentals The rates are inclusive of octroi, royality malkhana ,toll tax, sale tax or other taxes imposed by the Government	70.71	Per Tonne	
5.00	Providing and laying filter media with granular crushed aggregates satisfying requirement laid down in clause 2504.2.2 of MoRTH specification to a thickness of not less than 600mm with smaller size towards the soil and bigger size towards the wall and providing over the entire surface behind abutment , wing wall and return wall to the full height, compacted to a firm condition complete as per drawing and technical specification including carriage of materials within all leads and lifts and other incidentals . The rates are inclusive of octroi, royality malkhana ,toll tax , sale tax or other taxes imposed by the Government	284.00	Per cubic metre	
7.00	Providing , furnishing and placing reinforced / Prestressed cement concrete design mix to obtain minimum compressive strength of M-25 (M-twenty five) in super structure as per drawing and technical specification above 10metre height by using batching plant transit mixer and concrete pump including cost of form work and curing complete including carriage of material within all leads and lifts and other incidentals . The rates are inclusive of octroi, royality malkhana ,toll tax sale tax or other taxes imposed by the Government	123.18	Per cubic metre	

ANNEXURE I

Sl. No.	Description of work	No.or Qty.	Unit	Estimated Rate (in. Rs.)
11.00	Supplying ,fitting and placing HYSD bar reinforcement in super structure in all heights including cost of binding wire and cost for cutting binding and placing in position of bars complete as per drawings and technical specification Clauses 1002,1010 and 1202 including carriage of material within all leads and lifts and other incidentals . The rates are inclusive of octroi, royality malkhana ,toll tax sale tax or other taxes imposed by the Government	31.44	Per Tonne	
20.00	Back filling behind abutment wing wall and return wall with granular material complete as per drawing and technical specification clause 1204.3.8 including carriage of material within all leads and lifts and other incidentals. The rates are inclusive of octroi, royality malkhana ,toll tax sale tax or other taxes imposed by the Government	251.00	Per cubic metre	