INTERNSHIP REPORT

ON

ESTIMATION WORK OF PHE LABORATORY AND SITE INSPECTION OF OVER HEAD TANKS IN SUBDIVISION-DABRA

Submitted to-

MADHAV INSTITUTE OF TECHNOLOGY AND SCIENCE GWALIOR

(A Govt. Aided Autonomous Institute under RGPV, Bhopal (M.P) Established in 1957)

In Partial Fulfillment for Requirement for The Award Of The Degree

OF

BACHELOR of TECHNOLOGY
IN
CIVIL ENGINEERING

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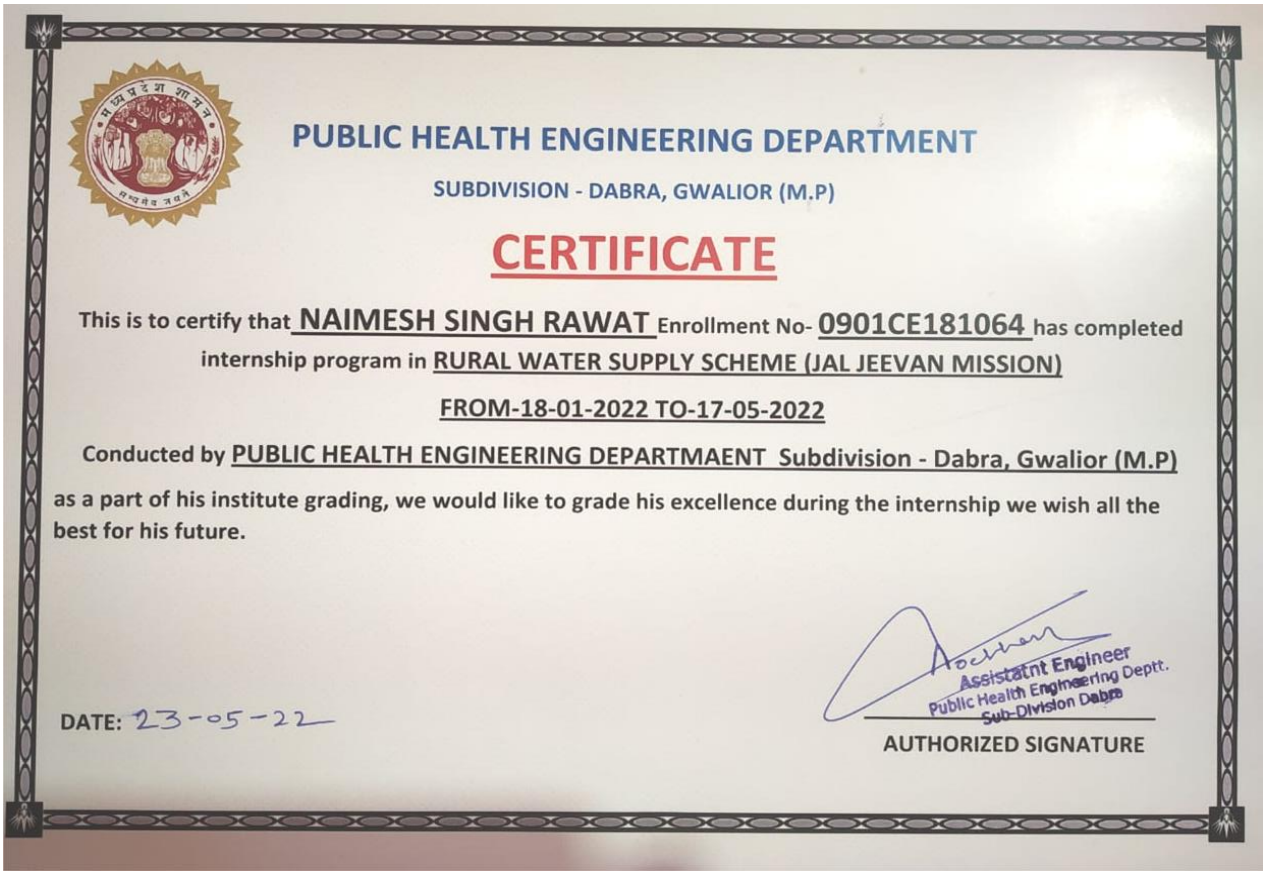

PUBLIC HEALTH ENGINEERING DEPARTMENT

SUBDIVISION - DABRA, GWALIOR (M.P)

CERTIFICATE

This is to certify that NAIMESH SINGH RAWAT Enrollment No- 0901CE181064 has completed internship program in RURAL WATER SUPPLY SCHEME (JAL JEEVAN MISSION)

FROM-18-01-2022 TO-17-05-2022

Conducted by PUBLIC HEALTH ENGINEERING DEPARTMAENT Subdivision - Dabra, Gwalior (M.P)

as a part of his institute grading, we would like to grade his excellence during the internship we wish all the best for his future.

DATE: 23-05-22

Assistatnt Engineer
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Sub-Division Dabra

AUTHORIZED SIGNATURE

Madhav Institute of Technology & Science, Gwalior

(A Govt. Aided UGC Autonomous &NAAC Accredited Institute Affiliated to R.G.P.V. Bhopal)

CERTIFICATE

This is the certify that the internship report entitled **"Estimation Work Of PHE Laboratory And Site Inspection Of Over Head Tanks In Subdivision-Dabra"** which is being submitted by **Naimesh Singh Rawat** in partial fulfillment for the award of the Degree of Bachelor of Engineering in Civil Engineering is a record of their own work.

All the information in this document has been obtained and presented in accordance with academic rules and ethical conduct. To the best of your knowledge the matter presented in this report has not been submitted for the award of any other Diploma or Degree certificate.

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ACKNOWLEDGEMENT

It has been a wonderful & intellectually stimulating experience working on “Construction of Over Head Water Tank and Estimation Work of PHE Laboratory” which is a very important and essential topic in the field of civil engineering.

I gratefully acknowledge the Management and Administration of Madhav Institute of Technology and Science for providing the opportunity and hence the environment to initiate and partially complete the internship till now.

For providing us with the finest suggestions for the internship, we are greatly thankful to Head of the Department Prof. M. K. Trivedi. He provided us the way to get the job done, by providing the concept behind the complexities so that we can make better use of existing knowledge & build up higher skills to meet the industry needs.

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ABSTRACT

A brief study about the different topics of estimation and quantity calculation was done. Going through all the important theory and methods was a necessary step for the estimation work.

Initially, to understand the various concepts of estimation and costing, I studied various books and rate of schedules for getting the required knowledge of the important fields. I also collected various design details, plans and drawings of the PHE laboratory and studied about the provisions given in various IS codes such as IS-456:2000. Then we followed the Unified Schedule of Rate-2018 of the PHED for making the estimate.

By using techniques given in IS: 3370 (Code of practice for Concrete Structures for the Storage of Liquids), the over head water tanks of various storage capacity were designed by the engineers of the department. All these OHT are being constructed under Jal Jeevan Mission scheme of government. After practicing estimation work, I started frequent site inspection with field quality engineer.

The inspection process requires checking various points on the construction site. For the same purpose clear knowledge of the various concepts and design standards is essential. Stability of the structure and safety of the workers both should be kept under consideration. Every civil engineer should have the basic field knowledge for maintaining the quality and standards as per the designs.

ABSTRACT IN HINDI

आकलन और मात्रा गणना के विभिन्न विषयों का संक्षिप्त अध्ययन किया गया। आकलन कार्य के लिए सभी महत्वपूर्ण सिद्धांतों और विधियों का अध्ययन करना एक आवश्यक कदम था।

प्रारंभ में, अनुमान और लागत की विभिन्न अवधारणाओं को समझने के लिए, मैंने महत्वपूर्ण क्षेत्रों का आवश्यक ज्ञान प्राप्त करने के लिए विभिन्न पुस्तकों और अनुसूचियों की दर का अध्ययन किया। मैंने पीएचई प्रयोगशाला के विभिन्न डिजाइन विवरण, योजना और चित्र भी एकत्र किए और विभिन्न आईएस कोड जैसे आईएस -456: 2000 में दिए गए प्रावधानों के बारे में अध्ययन किया। फिर हमने अनुमान लगाने के लिए पीएचईडी की एकीकृत दर-2018 अनुसूची का पालन किया।

आईएस:3370 (तरल पदार्थ के भंडारण के लिए कंक्रीट संरचनाओं के लिए अभ्यास संहिता) में दी गई तकनीकों का उपयोग करके, विभाग के इंजीनियरों द्वारा विभिन्न भंडारण क्षमता के ऊपरी पानी के टैंक डिजाइन किए गए थे। इन सभी ओएचटी का निर्माण सरकार की जल जीवन मिशन योजना के तहत किया जा रहा है। आकलन कार्य का अभ्यास करने के बाद, मैंने फील्ड क्वालिटी इंजीनियर के साथ लगातार साइट निरीक्षण शुरू किया।

निरीक्षण प्रक्रिया के लिए निर्माण स्थल पर विभिन्न बिंदुओं की जाँच की आवश्यकता होती है। इसी उद्देश्य के लिए विभिन्न अवधारणाओं और डिजाइन मानकों का स्पष्ट ज्ञान आवश्यक है। संरचना की स्थिरता और श्रमिकों की सुरक्षा दोनों को ध्यान में रखा जाना चाहिए। डिजाइन के अनुसार गुणवत्ता और मानकों को बनाए रखने के लिए प्रत्येक सिविल इंजीनियर को बुनियादी क्षेत्र का ज्ञान होना चाहिए।

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1. INTRODUCTION

In the year 1856 Lord Dalhousie established an Engineering Department called as Public Works Department or PWD for construction of Buildings, Water supply, Sewerage, Roads, Canals, Dams, and other similar construction jobs. Later on P.W.D. was divided into three different Departments known as first P.W.D. or Public Works Department, second P.H.E.D. or Public Health Engineering Department and third as Irrigation Department as we know them today.

The primary objective of Public Health Engineering Department is to provide potable water in all the areas in the country, carrying out of waste water treatment and disposal schemes in urban towns. All these schemes are currently maintained by local municipal authorities. On demand for new / augmentation of Drinking Water Supply and Sewerage Collection and Disposal Scheme/Project, are prepared by the PHE department, and after official sanction and approval, carrying out of the construction is taken in hand as Deposit Work. After completion of construction, the facilities are handed over to urban authorities for operation and management.

Now main work is in rural sector, such as:

- To carry out of schemes for providing potable water in rural areas
- Management of Hand Pumps in Rural area.
- To carry out schemes of regular Supply of Water.
- Monitoring of Quality of Water of current water sources and to make required arrangements where Quality of Water is not fit for use.

For the task of examining of samples of water and to maintain quality of water now in each and every district of the state, in all the divisions and in all Sub-Divisions, laboratories are created, having all the modern equipments and experts to operate the lab smoothly. In these labs samples of water are frequently examined, to maintain the quality of water.

The projects under Public Health Engineering department, subdivision Dabra are:

1. Estimation work of PHE laboratory at subdivision office.

   New laboratory of the department is under-construction near the old sub-division office in Dabra. The laboratory will have all the modern equipments for testing of water samples at regular intervals. For the above reason the estimation of the construction work is executed.

2. Site Inspection of under-construction OHT and Sump well in nearby villages under Jal Jeevan Mission.

   JJM or Jal Jeevan Mission is a scheme of government to connect every household in rural area with piped water supply system. For this purpose OHT are being constructed in rural areas. Quality control is very important for constructing a stable structure. With the field quality engineer frequent site inspection was carried out to maintain the quality of construction work and follow all the required guidelines.

1.1 Weekly Schedule of Internship

S. No.	Week No.	Content
1	Week – 1	Overview of Estimation and Costing
2	Week – 2	Understanding concepts of Quality Calculation
3	Week – 3	Reading design details, plans and section of PHE laboratory
4	Week – 4	Quantity Calculation of different structure components
5	Week – 5	Filling out Measurement sheets
6	Week – 6	Reading and Understanding Schedule of Rates
7	Week – 7	Cost Calculation with Calculated Quantities
8	Week – 8	Filling out Abstract sheets
9	Week – 9	Overview of Over Head Tanks, Sump well and Pump House
10	Week – 10	Understanding Design Details of OHT and Site Inspection
11	Week – 11	Understanding Standard Codes and Guidelines
12	Week – 12	Site Inspection of Excavation and PCC
13	Week – 13	Site Inspection before casting of Foundation and Columns
14	Week – 14	Site Inspection during casting of Braces and Columns
15	Week – 15	Inspection Of Sump well and Pump House
16	Week – 16	Inspection of HDPE pipes for water supply

2. Estimation work of PHE laboratory at subdivision office

2.1 Overview

2.1.1 Definition and Purpose of Estimation

An estimate is the anticipated or probable cost of work and is usually prepared before the construction is taken up. The main objective of carrying out the estimation is to find out the beforehand cost of construction.

2.1.2 Principles of estimating

(i) Make each item of a dimension as clear and intelligible as possible so that everyone will be able to understand it without any difficulty.

(ii) Arrange the items in the same order as work executes in field.

(iii) Accuracy in measurements is depends upon the rate of an item so that the actual cost does not vary by more than 10%.

2.1.3 Methods of Estimation

(i) Approximate methods

This is an estimate to calculate the approximate cost or to get a general overview of the overall amount of money required, for the project in short time. Such an estimate is prepared for preliminary studies of various aspects of work or proposal of the department concerned, to decide the financial aspects of the construction work.

Few examples of these methods are:

- Service unit method
- Plinth area method
- Cubic-meter method

(ii) Detailed methods

On approval of the approximate estimated cost or after getting the "Appropriate Approval" this estimate is prepared for getting "Technical Sanction" by the concerned authority of technical department.

Detailed estimate consists of finding out the quantities of different item of works, and work out the total sum of money required. The Detailed estimate is prepared in two stages:

i. Details of measurement and calculation of quantities
ii. Abstract of estimated cost

Few examples of these methods are:

- Revised Estimate
- Annual Repair OR Annual Maintenance Estimate
- Supplementary Estimate

2.1.4 Methods of Taking out quantities

(i) Out-to-Out and In-to-In OR Long Wall and Short Wall OR Individual Wall method

- Length of long wall = Out-to-Out measurement = Centre to centre length + Width
- Length of short wall = In-to-In measurement = Centre to centre length – Width

(ii) Centre line method

- In case of walls having no junction, measure the length of centre line of walls
- In case of walls having junction

  Length of centre line = Total centre to centre length of walls - 1/2 of width per junction (T-Shape)

2.1.5 Estimated cost

Sum of following heads –

i. Cost of items calculated in measurement sheet
ii. 3% of cost of items as contingencies for miscellaneous small items which do not come under any classified head of items
iii. 2% of cost of items for work charged establishment

2.2 Estimation work of under construction PHE laboratory

The new PHE laboratory which is under construction near the Subdivision office, Dabra, Gwalior (M.P) is the first project under my training in PHE department. For every civil engineer making a reliable and accurate estimate is very important skill. The required documents for estimation are details of the drawing, plan, section and elevation of the proposed structure.

2.2.1 Plans and Drawing details of the PHE laboratory

As the PHE lab is a government building the plan and other drawing details all are confidential and can not the published outside the department. Few drawings, plans and details of the proposed laboratory are given below:

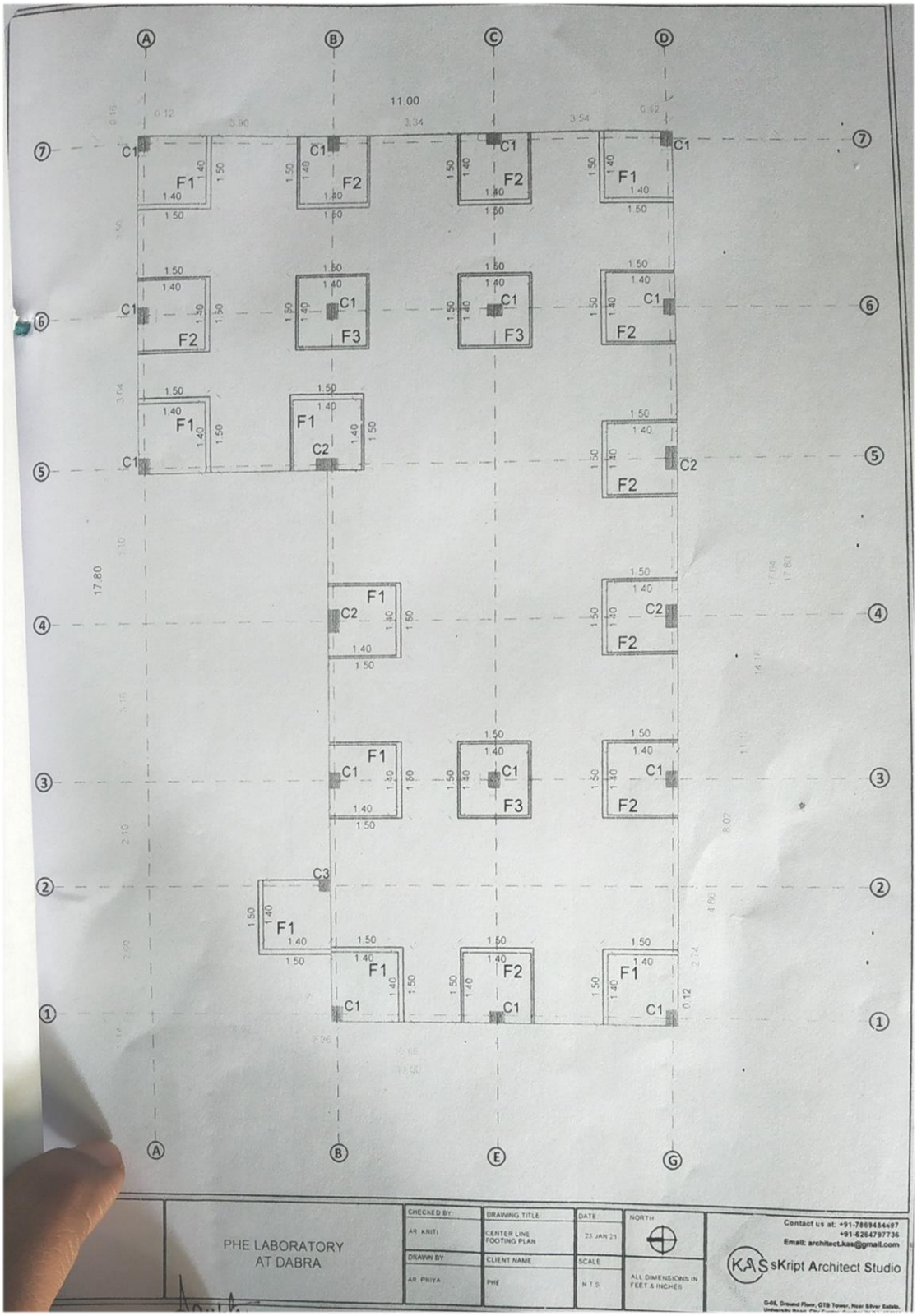


Fig 2.1 Footing Plan

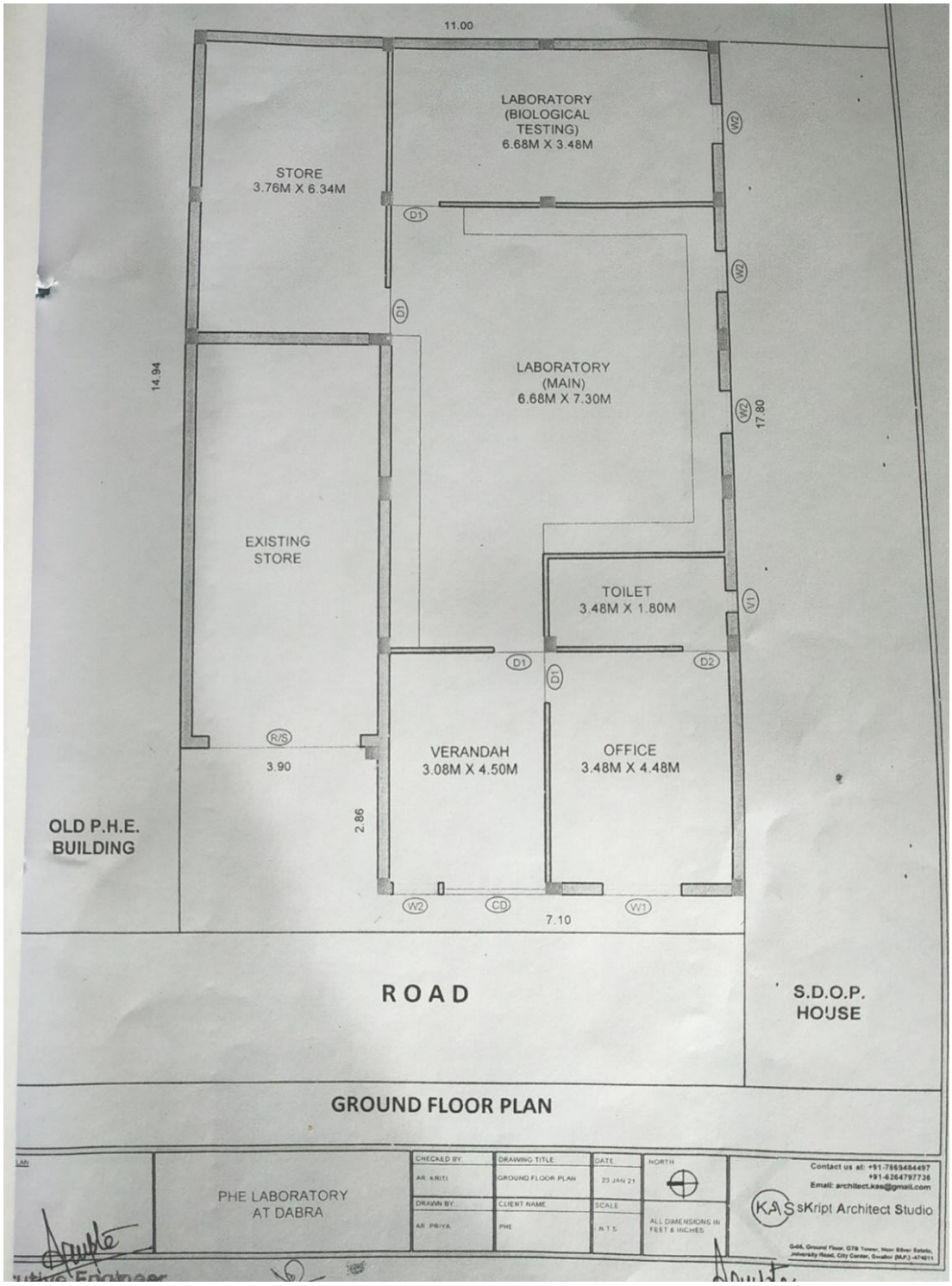
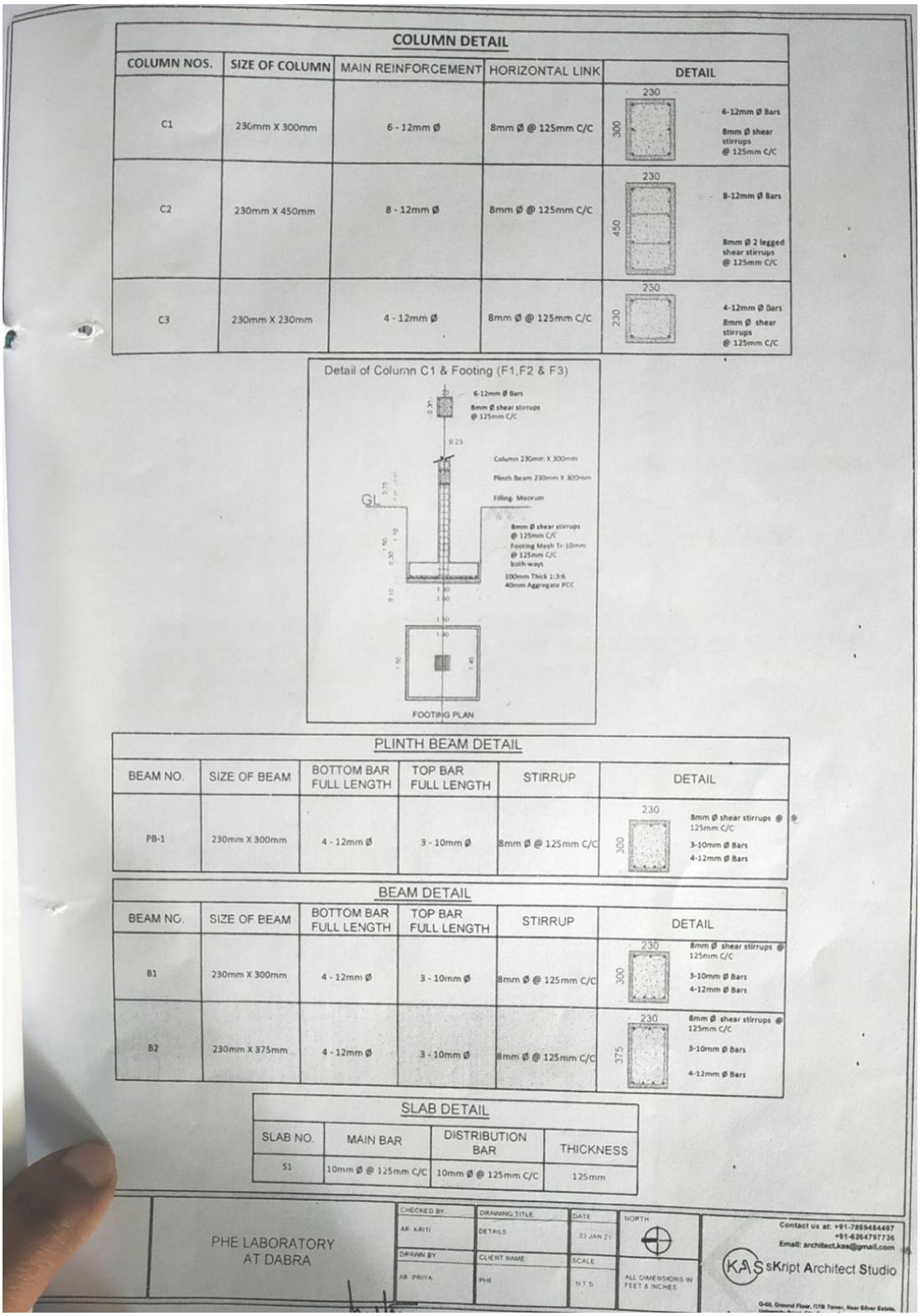


Fig 2.2 Floor plan



COLUMN DETAIL

COLUMN NOS.	SIZE OF COLUMN	MAIN REINFORCEMENT	HORIZONTAL LINK	DETAIL
C1	230mm X 300mm	6 - 12mm Ø	8mm Ø @ 125mm C/C	6-12mm Ø Bars; 8mm Ø shear stirrups @ 125mm C/C
C2	230mm X 450mm	8 - 12mm Ø	8mm Ø @ 125mm C/C	8-12mm Ø Bars; 8mm Ø 2 legged shear stirrups @ 125mm C/C
C3	230mm X 230mm	4 - 12mm Ø	8mm Ø @ 125mm C/C	4-12mm Ø Bars; 8mm Ø shear stirrups @ 125mm C/C

Detail of Column C1 & Footing (F1,F2 & F3)

FOOTING PLAN

PLINTH BEAM DETAIL

BEAM NO.	SIZE OF BEAM	BOTTOM BAR FULL LENGTH	TOP BAR FULL LENGTH	STIRRUP	DETAIL
PB-1	230mm X 300mm	4 - 12mm Ø	3 - 10mm Ø	8mm Ø @ 125mm C/C	8mm Ø shear stirrups @ 125mm C/C; 3-10mm Ø Bars; 4-12mm Ø Bars

BEAM DETAIL

BEAM NO.	SIZE OF BEAM	BOTTOM BAR FULL LENGTH	TOP BAR FULL LENGTH	STIRRUP	DETAIL
B1	230mm X 300mm	4 - 12mm Ø	3 - 10mm Ø	8mm Ø @ 125mm C/C	8mm Ø shear stirrups @ 125mm C/C; 3-10mm Ø Bars; 4-12mm Ø Bars
B2	230mm X 375mm	4 - 12mm Ø	3 - 10mm Ø	8mm Ø @ 125mm C/C	8mm Ø shear stirrups @ 125mm C/C; 3-10mm Ø Bars; 4-12mm Ø Bars

SLAB DETAIL

SLAB NO.	MAIN BAR	DISTRIBUTION BAR	THICKNESS
S1	10mm Ø @ 125mm C/C	10mm Ø @ 125mm C/C	125mm

PHE LABORATORY AT DABRA

CHECKED BY: AR. KRITI | DRAWING TITLE: DETAILS | DATE: 23 JAN 21 | NORTH

DRAWN BY: AR. PRIYA | CLIENT NAME: PHE | SCALE: N.T.S | ALL DIMENSIONS IN FEET & INCHES

Contact us at: +91-7859484497, +91-6264797736
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KAS sKript Architect Studio

Fig 2.3 Design Details

2.2.2 Quantity Calculation and Measurement Sheet

The quantity calculation for different construction works are given in the measurement sheets below

Table 2.1: Measurement sheet for Foundation

Item No.	Item	Nos.	Length (m)	Width (m)	Depth / Height (m)	Total Quatity
1	Earthwork in foundation	20	1.5	1.5	1.5	3.375 m^3
2	PCC base under footing 10 cm thick M-10 (1:3:6)	20	1.5	1.5	--	2.25 m^2
3	Steel bars for mesh (10 mm Ø)	440	1.4	--	--	616 m
4	RCC for footing M-20 (1:1.5:3)	20	1.4	1.4	0.3	0.588 m^3

Table 2.2: Measurement sheet for Column up to Plinth

Item No.	Item	Nos.	Length (m)	Width (m)	Depth / Height (m)	Total Quatity
	No of C-1 Columns	15				
1	Main bars (12 mm Ø)	6	2.066	--	--	12.4 m
2	Stirrups (8 mm Ø)	15	0.92	--	--	13.8 m
3	RCC work M-20 (1:1.5:3)	1	1.85	0.23	0.3	0.128 m^3
	No of C-2 Columns	4				
1	Main bars (12 mm Ø)	8	2.066	--	--	16.528 m
2	Stirrups (8 mm Ø)	30	0.96	--	--	28.8 m
3	RCC work M-20 (1:1.5:3)	1	1.85	0.23	0.45	0.191 m^3

	No of C-3 Columns	1				
1	Main bars (12 mm Ø)	4	2.066	--	--	8.264 m
2	Stirrups (8 mm Ø)	15	0.78	--	--	11.25 m
3	RCC work M-20 (1:1.5:3)	1	1.85	0.23	0.23	0.098 m^3

Table 2.3: Measurement sheet for Roof Beam

Item No.	Item	Nos.	Length (m)	Width (m)	Depth / Height (m)	Total Quatity
	B-1 Type Beam					
1	Bottom bars (12 mm Ø)	4	93.844	--	--	375.38 m
2	Top bars (10 mm Ø)	3	92.98	--	--	278.94 m
3	Stirrups (8 mm Ø)	710	0.92	--	--	653.2 m
4	RCC work M-20 (1:1.5:3)	1	88.66	0.23	0.3	6.118 m^3
	B-2 Type Beam					
1	Bottom bars (12 mm Ø)	4	13.712	--	--	54.848 m
2	Top bars (10 mm Ø)	3	13.64	--	--	40.92 m
3	Stirrups (8 mm Ø)	107	1.07	--	--	114.49 m
4	RCC work M-20 (1:1.5:3)	1	13.28	0.23	0.375	1.146 m^3

2.2.3 Cost Calculation and Abstract Sheet

Table 2.4: Abstract sheet for Foundation

Item No.	Item	Quantity	Unit	Rate (₹/Unit)	Amount
1	Earthwork in foundation	3.375 m^3	m^3	₹140/m^3	₹475
2	PCC base under footing 10 cm thick M-10 (1:3:6)	2.25 m^2	m^2	₹4113/m^2	₹9,260
3	Steel bars for mesh (10 mm Ø)	616 m / 382 kg	kg	₹55/kg	₹21,010
4	RCC for footing M-20 (1:1.5:3)	0.588 m^3	m^3	₹4751/m^3	₹2,800

Table 2.5: Abstract sheet for Column up to Plinth

Item No.	Item	Quantity	Unit	Rate (₹/Unit)	Amount
1	Main bars (12 mm Ø)	260 m / 231 kg	kg	₹55/kg	₹12,705
2	Stirrups (8 mm Ø)	334 m / 132 kg	kg	₹55/kg	₹7,260
3	RCC work M-20 (1:1.5:3)	2.782 m^3	m^3	₹4751/m^3	₹13,128

Table 2.6: Abstract sheet for Roof Beam

Item No.	Item	Quantity	Unit	Rate (₹/Unit)	Amount
1	Bottom bars (12 mm Ø)	431 m / 383 kg	kg	₹55/kg	₹21,065
2	Top bars (10 mm Ø)	320 m / 198 kg	kg	₹55/kg	₹10,890
3	Stirrups (8 mm Ø)	768 m / 304 kg	kg	₹55/kg	₹16,720
4	RCC work M-20 (1:1.5:3)	7.264 m^3	m^3	₹4787/m^3	₹34,773

3 Construction of OHT and Sump well under Jal Jeevan Mission

3.1 Overview

Reinforced cement concrete tanks are constructed for storing water all over the world. The design of RCC water tank is based on IS 3370: 2009 (Parts I – IV). The design procedure depends on the location of tanks, i.e. overhead, on ground or underground water tanks. The tanks are made in different shapes generally circular or rectangular shapes are used. The tanks can be made of reinforced cement concrete, masonry or steel. The overhead tanks (elevated tanks) are usually elevated from the ground through column, while the other tanks are rested on the ground level or underground foundation.

3.2 Components of an Over Head Tank

1. Foundation : solid / annular raft
2. Column
3. Bracing beam
4. Office room : roof slab
5. Landing slab & beam
6. Junction 1
7. Bottom dome
8. Junction 2
9. Cylindrical wall
10. Junction 3
11. Top dome
12. Ventilation shaft

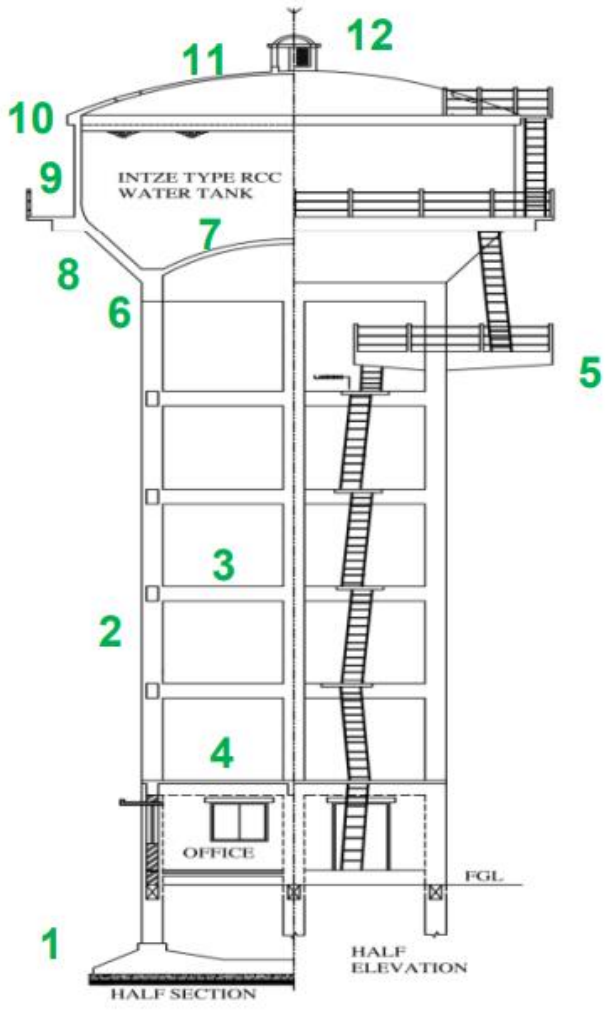

Fig 3.1 Components of an Over Head Tank

3.3 Construction Procedure for Over Head Water Tank

3.3.1 Excavation for foundation

Excavation is carried out by both methods mechanically and manually; the depth of excavation is generally between 2 – 3m. Normally 1- 2 earth excavators are required for excavation. Sufficient side slope is provided for ease of work in future. The excavated soil is used for back filling generally.

3.3.2 PCC work in the Foundation

After the excavation and preparation of the soil base a 10cm thick layer of PCC of grade M-10 is placed. The mix ratio for the same is 1:3:6.

3.3.3 Laying of Reinforcement bars (Main and Distribution) in Foundation

First main bars are laid down in radial direction on the layer of PCC then distribution bars are placed on main bars in circular pattern. Special care is taken in maintaining the proposed spacing between the bars, when binding the bars and overlapping the bars.

3.3.4 Laying of Foundation Ring Beam

After lying of foundation bars, ring beam bars are placed on them. Steel bars for the columns are also binded with the ring beam before the casting of the foundation.

3.3.5 Casting of Foundation, Columns and Braces

When the lying of reinforcement bars is completed form work is fitted before the casting of the foundation. Generally M-25 or M-30 grade of concrete is used for casting as given in the design details. Proper care is taken in placing cover blocks before casting. After casting of foundation foam work for columns and braces is prepared. Same procedure is repeated of casting columns and braces until desired height is achieved.

3.3.6 Construction of Bottom Dome, Side Walls and Top Dome

After attaining required staging reinforcement for bottom is placed on proper shuttering. When lying is complete casting of bottom is carried out. Cover blocks are essential and should be placed always. In the same way casting of side walls and top dome is carried

3.3.7 Construction Procedure for Sump Well and Pump House

Sump well and Pump House are also constructed nearby over head tank as per the requirement and as described in the design.

3.4 Site Inspection during Construction work

Fig 3.2 Inspection of Placed Ring Beam

Fig 3.3 Ring Beam placed on the Foundation Bars

Fig 3.4 Formwork for Columns and Braces

Fig 3.5 Scaffoldings for Construction Work

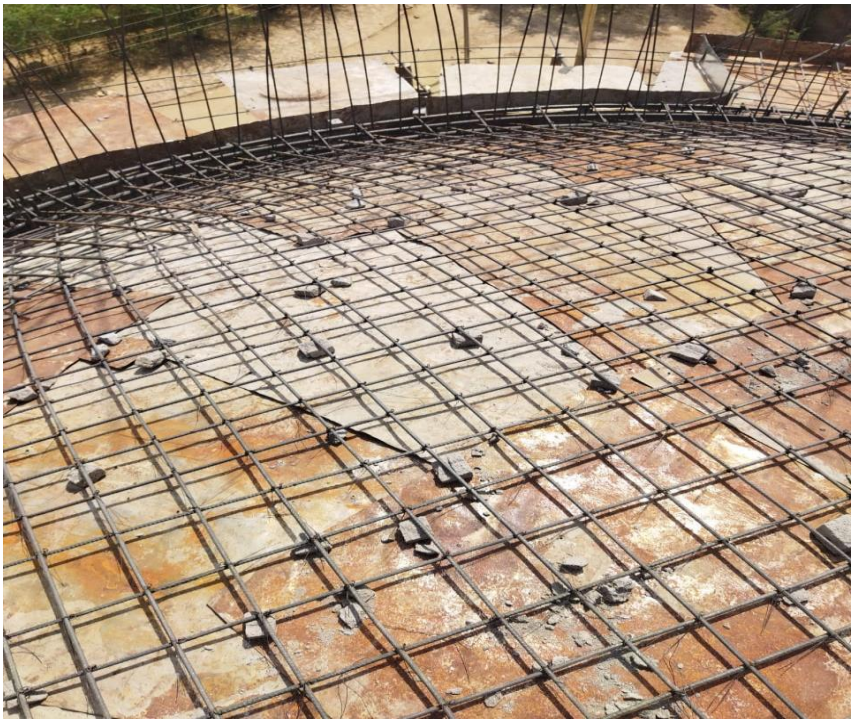

Fig 3.6 Reinforcement Bars lying for Bottom Dome

Fig 3.7 Casted Sump Well

Fig 3.8 Under-construction Pump House

Fig 3.9 Constructed OHT

4 Conclusion

In the current internship, I studied and understood various concepts of estimation and quantity calculation on a broad view and how to use different methods and how to read various SOR for the purpose of estimation and costing. I also gained valuable field experience and the important difference between the classroom and the field work.

The estimation work as a whole look very easy and simple but can be very complicated and hectic. Estimation work is a major part of any civil engineering project. It has to be accurate and reliable so that the construction work can be feasible. Proper practice is required to become good in understanding design details and calculating quantities from the drawings.

Jal Jeevan Mission, is a scheme of Govt. of India to provide safe drinking water through household connections to all rural households in India by 2024. The designing process of over head water tank can be tough but understanding the designs and maintaining the quality in the field can also be a difficult task in itself for a beginner but with practice and patience nothing is too difficult to learn or understand.

Every step in the construction procedure has its own important. From excavation of soil for foundation to casting of water tank, every component has its own significance. And it is duty of every civil engineer working as field quality controller to try his best to follow all the standards and stick with the given guidelines.

LIST OF REFERENCES

1. IS - 456:2000, Code of Practice for plain and Reinforced Concrete
2. IS - 3370:1967, Code of practice for Concrete Structures for the Storage of Liquids
3. IS -11682:1985, Criteria for Design of RCC staging for Overhead Water Tanks
4. Unified Schedule of Rates – 2018
5. http://www.mpphed.gov.in/phehistory.pdf
6. Estimating and Costing in Civil Engineering: Theory and Practice Including Specifications and Valuations, by B.N. Dutta
7. https://jaljeevanmission.gov.in/
8. http://bsdma.org/images/publication/RC%20WATER%20TOWER%20GUIDELINES.pdf

Appendix-1 (USOR-2018)

SOR for Excavation Works

S.No.	Items	Unit	Rates in Rs.
	EXCAVATION		
16.1	Surface dressing of the ground including removing vegetation and in - equalities not exceeding 15 cm deep and disposal of rubbish, lead up to 50 m and lift up to 1.5 m. All kind of soil	100 Sqm	1038.00
16.2(a)	Clearing jungle including uprooting of rank vegetation, grass, brush wood, trees and saplings of girth up to 30 cm measured at a height of 1 m above ground level and removal of rubbish up to a distance of 50 m outside the periphery of the area cleared.	100 Sqm	535.00
16.2(b)	Clearing grass and removal of rubbish up to a distance of 50 m outside the periphery of the area cleared.	100 Sqm	274.00
16.3	Installation of HDPE pipe by Horizontal Direction Drilling Method including preparing and setting up the plant and equipment, making string of new pipe material, installing new pipe string and making the system ready for commissioning by HDD operation including drilling, stringing, reaming and pulling back the new pipe on the designed bore path alignment, proper disposal of drilling fluid, as per code of practice for horizontal direction drilling technique suiting indian conditions. Required pipes/ specials and other civil work shall be paid separately-in all types of soils. (This item shall be executed only after prior permission of Superintending Engineer)		
	HDPE pipe of any class-90 mm outer dia	Meter	451.00
	HDPE pipe of any class-110 mm outer dia	Meter	492.00
16.4	Earth work in excavation by mechanical means (Hydraulic excavator) / manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including disposal of excavated earth, lead up to 50 m and lift up to 1.5 m, disposed earth to be leveled and neatly dressed. All kind of soil	Cum	140.00
16.5	For muddy area	cum	210.00

SOR for PCC Works

	CEMENT CONCRETE		
16.22	**Providing and laying mechanically mixed cement concrete with crushed stone aggregate excluding centering and shuttering (with 40mm nominal size graded stone aggregate)**		
(a)	In foundation and plinth		
i	1:5:10 (M-5)	cum	3472.00
ii	1:4:8 (M-7.5)	cum	3682.00
iii	1:3:6 (M-10)	cum	3965.00
iv	1:2:4 (M-15)	cum	4661.00
(b)	**In walls & Superstructure up to 4 mt. height above plinth (with 40mm nominal graded metal)**		
i.	1:3:6 (M-10)	cum	4038.00
ii.	1:2:4 (M-15)	cum	4733.00
16.23	**Providing & laying mechanically mixed cement concrete 20mm nominal size graded crushed stone excluding cost of centering & shuttering.**		
(a)	**In Plinth & foundation**		
i	1:3:6 (M-10)	cum	4113.00
ii	1:2:4 (M-15)	cum	4695.00
iii	1:1$^{1}/_{2}$:3 (M-20)	cum	5161.00
iv	1:1:2 (M-25)	cum	6385.00

SOR for RCC Works

	REINFORCED CEMENT CONCRETE		
16.24 (a)	**Providing & laying mechanically mixed R.C.C. excluding centering & shuttering and reinforcement in foundation/plinth (20mm graded metal)**		
i	1:1.5:3 (M 20)	cum	4751.00
ii	1:1:2 (M 25)	cum	5974.00
iii	1:0.75:1.5 (M 30)	cum	6294.00
(b)	**Providing & laying mechanically mixed R.C.C. excluding centering & shuttering and reinforcement in superstructure up to 4 mtr. Height above plinth level (20mm graded metal)**		
i	1:1.5:3 (M 20)	cum	4787.00
ii	1:1:2 (M 25)	cum	6010.00
iii	1:0.75:1.5 (M 30)	cum	6331.00

	STEEL		
16.25 (a)	Providing and placing in position cold twisted steel and hot rolled deformed steel reinforcement for R.C.C. work i/c cutting, bending, binding etc. complete i/c cost of binding wire and wastage.	Kg	55.00
(b)	Structural steel work in single section, fixed with or without connecting plate, including cutting, hoisting fixing in position and applying a priming coat of approved steel primer all complete.	Kg	59.00
(c)	Structural steel work riveted, bolted or welded in built-up section trusses and framed work i/c cutting /hoisting /fixing in position and applying a priming coat of approved steel primer all complete.	Kg	76.00
(d)	Steel work in welded built-up section/ framed work, including cutting hoisting, fixing in position and applying a priming coat of approved steel primer using structural steel etc. as required.		

Appendix-2 (Filled FPRs)

FORMAT

FORTNIGHTLY PROGRESS REPORT (FPR) FROM INDUSTRY MENTOR

Name of student	Naimesh Singh Rawat		Department	CE	
Industry/Organization	PHED, Dabra, Gwalior		Date/Duration	18/01/22 - 1/02/22	
Criterion	**Poor**	**Average**	**Good**	**Very Good**	**Excellent**
Punctuality/Timely completion of assigned work					✓
Learning capacity/Knowledge up gradation				✓	
Performance/Quality of work				✓	
Behaviour/Discipline/Team work					✓
Sincerity/Hard work					✓
Comment on nature of work done/Area/Topic	⊙ Overview of estimation and Costing. ⊙ Understanding concepts of quantity calculation.				
OVERALL GRADE (Any one)	**POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT**				
Name of Industry Mentor	Mr. Satyam Kumar				
Signature of Industry Mentor	Team Leader (TPI) Fortress Infracon Ltd. Gwalior (M.P.)				

Receiving Date	7/2/22	**Name of Faculty Mentor**	Prof. Aditya Agarwal	**Sign**	5/2/22

FORMAT

FORTNIGHTLY PROGRESS REPORT (FPR) FROM INDUSTRY MENTOR

Name of student	Naimesh Singh Rawat		Department	CE	
Industry/Organization	PHED, Dabra, Gwalior		Date/Duration	2/02/22 - 16/02/22	
Criterion	**Poor**	**Average**	**Good**	**Very Good**	**Excellent**
Punctuality/Timely completion of assigned work				✓	
Learning capacity/Knowledge up gradation				✓	
Performance/Quality of work					✓
Behaviour/Discipline/Team work				✓	
Sincerity/Hard work					✓
Comment on nature of work done/Area/Topic	⊙ Understanding and reading design details, plans and section of the PHE laboratory.				
OVERALL GRADE (Any one)	**POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT**				
Name of Industry Mentor	Mr. Satyam Kumar				
Signature of Industry Mentor	Team Leader (TPI) Fortress Infracon Ltd. Gwalior (M.P.)				

Receiving Date	21/2/22	**Name of Faculty Mentor**	Prof. Aditya Agarwal	**Sign**	21/2/22

FORMAT

FORTNIGHTLY PROGRESS REPORT (FPR) FROM INDUSTRY MENTOR

Name of student	Naimesh Singh Rawat		Department	CE	
Industry/Organization	PHED, Dabra, Gwalior		Date/Duration	17/02/22 - 3/03/22	
Criterion	**Poor**	**Average**	**Good**	**Very Good**	**Excellent**
Punctuality/Timely completion of assigned work				✓	
Learning capacity/Knowledge up gradation					✓
Performance/Quality of work					✓
Behaviour/Discipline/Team work				✓	
Sincerity/Hard work				✓	
Comment on nature of work done/Area/Topic	⊙ Quantity Calculation and filling out Measurement sheets.				
OVERALL GRADE (Any one)	**POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT**				
Name of Industry Mentor	Mr. Satyam Kumar				
Signature of Industry Mentor	Team Leader (TPI) Fortress Infracon Ltd. Gwalior (M.P.)				

Receiving Date	7/3/22	**Name of Faculty Mentor**	Prof. Aditya Agarwal	**Sign**	7/3/22

FORMAT

FORTNIGHTLY PROGRESS REPORT (FPR) FROM INDUSTRY MENTOR

Name of student	Naimesh Singh Rawat		Department	CE	
Industry/Organization	PHED, Dabra, Gwalior		Date/Duration	4/03/22 - 18/03/22	
Criterion	**Poor**	**Average**	**Good**	**Very Good**	**Excellent**
Punctuality/Timely completion of assigned work					✓
Learning capacity/Knowledge up gradation					✓
Performance/Quality of work				✓	
Behaviour/Discipline/Team work				✓	
Sincerity/Hard work					✓
Comment on nature of work done/Area/Topic	⊙ Cost Calculation with appropriate SOR and filling out Abstract sheet. ⊙ Reading rates from Schedule of Rates available.				
OVERALL GRADE (Any one)	**POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT**				
Name of Industry Mentor	Mr. Satyam Kumar				
Signature of Industry Mentor	Team Leader (TPI) Fortress Infracon Ltd. Gwalior (M.P.)				

Receiving Date	21/3/22	**Name of Faculty Mentor**	Prof. Aditya Agarwal	**Sign**	21/3/22

FORMAT

FORTNIGHTLY PROGRESS REPORT (FPR) FROM INDUSTRY MENTOR

Name of student	Naimesh Singh Rawat		Department	CE	
Industry/Organization	PHED, Dabra, Gwalior		Date/Duration	19/03/22 - 02/04/22	
Criterion	**Poor**	**Average**	**Good**	**Very Good**	**Excellent**
Punctuality/Timely completion of assigned work				✓	
Learning capacity/Knowledge up gradation					✓
Performance/Quality of work					✓
Behaviour/Discipline/Team work				✓	
Sincerity/Hard work					✓
Comment on nature of work done/Area/Topic	⊙ Understanding design details of Over Head Tanks. ⊙ Reading standard codes and guidelines. ⊙ Understanding components of Over Head Tand.				
OVERALL GRADE (Any one)	**POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT**				
Name of Industry Mentor	Mr. Satyam Kumar				
Signature of Industry Mentor	Team Leader (TPI) Fortress Infracon Ltd. Gwalior (M.P.)				

Receiving Date	11/4/22	**Name of Faculty Mentor**	Prof. Aditya Agarwal	**Sign**	11/4/22

FORMAT

FORTNIGHTLY PROGRESS REPORT (FPR) FROM INDUSTRY MENTOR

Name of student	Naimesh Singh Rawat		Department	CE	
Industry/Organization	PHED, Dabra, Gwalior		Date/Duration	03/04/22 - 17/04/22	
Criterion	**Poor**	**Average**	**Good**	**Very Good**	**Excellent**
Punctuality/Timely completion of assigned work				✓	
Learning capacity/Knowledge up gradation				✓	
Performance/Quality of work					✓
Behaviour/Discipline/Team work					✓
Sincerity/Hard work				✓	
Comment on nature of work done/Area/Topic	⊙ Site inspection for of the reinforcement work before casting. ⊙ Understanding constution procedure of OHT, Sump well and Pump House				
OVERALL GRADE (Any one)	**POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT**				
Name of Industry Mentor	Mr. Satyam Kumar				
Signature of Industry Mentor	Team Leader (TPI) Fortress Infracon Ltd. Gwalior (M.P.)				

Receiving Date	25/4/22	**Name of Faculty Mentor**	Prof. Aditya Agarwal	**Sign**	25/4/22

FORMAT

FORTNIGHTLY PROGRESS REPORT (FPR) FROM INDUSTRY MENTOR

Name of student	Naimesh Singh Rawat		Department	CE	
Industry/Organization	PHED, Dabra, Gwalior		Date/Duration	18/04/22 - 02/05/22	
Criterion	**Poor**	**Average**	**Good**	**Very Good**	**Excellent**
Punctuality/Timely completion of assigned work					✓
Learning capacity/Knowledge up gradation				✓	
Performance/Quality of work					✓
Behaviour/Discipline/Team work				✓	
Sincerity/Hard work				✓	
Comment on nature of work done/Area/Topic	⊙ Site visit after casting of Columns and first Brace. ⊙ Checking the dimensions as per the design details.				
OVERALL GRADE (Any one)	**POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT**				
Name of Industry Mentor	Mr. Satyam Kumar				
Signature of Industry Mentor	Team Leader (TL) Fortress Infracon Ltd. Gwalior (M.P.)				

Receiving Date	5/5/22	**Name of Faculty Mentor**	Prof. Aditya Agalwal	**Sign**	5/5/22

FORMAT

FORTNIGHTLY PROGRESS REPORT (FPR) FROM INDUSTRY MENTOR

Name of student	Naimesh Singh Rawat		Department	CE	
Industry/Organization	PHED, Dabra, Gwalior		Date/Duration	03/05/22 - 17/05/22	
Criterion	**Poor**	**Average**	**Good**	**Very Good**	**Excellent**
Punctuality/Timely completion of assigned work				✓	
Learning capacity/Knowledge up gradation					✓
Performance/Quality of work				✓	
Behaviour/Discipline/Team work					✓
Sincerity/Hard work					✓
Comment on nature of work done/Area/Topic	⊙ Casting of Bottom dome, walls and Top dome ⊙ Constitution of Sump well and Pump House ⊙ Lying of HDPE pipes for water supply.				
OVERALL GRADE (Any one)	**POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT**				
Name of Industry Mentor	Mr. Satyam Kumar				
Signature of Industry Mentor	Team Leader (TL) Fortress Infracon Ltd. Gwalior (M.P.)				

Receiving Date	24/05/22	**Name of Faculty Mentor**	Prof. Aditya Agarwal	**Sign**	24/5/22

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Civil Engineering Department

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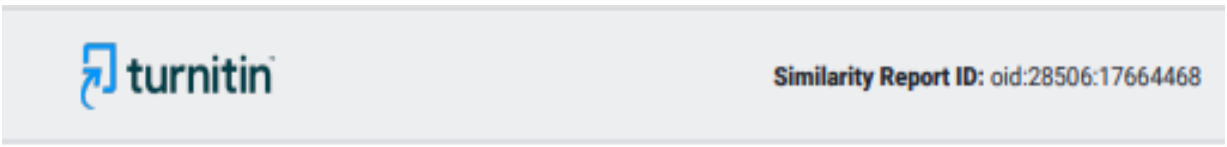

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