

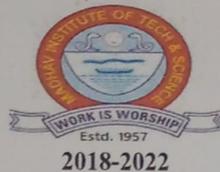
INTERNSHIP REPORT  
ON  
**“ROAD CONSTRUCTION AND ESTIMATING AND  
COSTING”**

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**



Submitted By-

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**Madhav Institute of Technology & Science, Gwalior**  
(A Govt. Aided UGC Autonomous & NAAC Accredited Institute Affiliated to R.G.P.V. Bhopal)

## CERTIFICATE



**PROJECT DEVELOPMENT AND MANAGEMENT CONSULTANT**  
For Implementation of Smart City Mission Project  
Of Gwalior City

### CERTIFICATE

Date: 23.05.2022

This is in reference to the ongoing Internship of **Ms. Himanshi Agrawal** at IPE Global Limited under Gwalior Smart City Project from 18<sup>th</sup> January, 2022 to 23<sup>th</sup> May, 2022.

We found her sincere, hardworking, and technically sound and result oriented. She worked well as a part of the team during her tenure. We take this opportunity to thank and wish her all the best for her future.

As a part of her institute grading we would like to grade her as **Excellent** during these course of months.

For IPE Global Limited

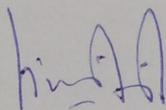
Authorized Signatory



Address: 1000, 1<sup>st</sup> floor, Moti Mahal, Gwalior

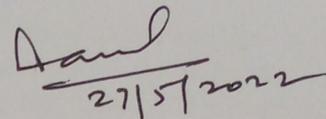
## RECOMMENDATION

It is hereby recommended that the internship report entitled — Road Construction and Estimation and Costing which is being submitted by Himanshi Agrawal completed under the guidance of Dr. Rajeev Kansal may be accepted in the partial fulfillment of the award of the degree of Bachelor of Engineering in Civil Engineering.



*for* Prof. and Head  
Civil Engineering Department  
MITS, Gwalior

Guided by



Dr. Rajeev Kansal  
Civil Engineering Department  
MITS, Gwalior

## ACKNOWLEDGEMENT

When it comes to properly acknowledging someone's support and assistance, it may be a challenging undertaking, chiefly when the support offered is so wholehearted and unwavering.

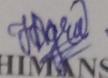
I am eternally grateful to my renowned guide, **Dr. Rajeev Kansal**, Professor of Civil Engineering Department, MITS Gwalior.

Also, I would like to thank **Dr. M.K. Trivedi**, Head of Civil Engineering Department, MITS Gwalior, and all other academics and staff members of MITS Gwalior's Civil Engineering Department for their unwavering support throughout the project.

I am really grateful to **Dr. R. K. Pandit**, Director of MITS Gwalior, for establishing an outstanding institutional environment and for giving all facilities and assistance in the preparation of my dissertation. I also acknowledge with gratitude to our supporting **Mr. VIKRAM** for providing the facilities needed for the accomplishment of this project.

I take great pleasure for my institute **IPE Global and Gwalior Smart City Development Corporation Limited** for providing the opportunities.

The environment of company has been valuable experience for me. It has provided an opportunity to learn at our own pace in discipline of interest. I would like to thank all those who helped me during different stages of completion of this project.

  
**HIMANSHI AGRAWAL**  
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## ABSTRACT

This report includes the brief study and details of my work during my internship at Gwalior Smart City Development Corporation Limited (GSCDCL) for duration of four months from 18th January, 2022 to 23rd May, 2022.

GSCDCL is an unpublished public company unified on 25th October, 2016. It is classified as a State government company and is situated in Gwalior, Madhya Pradesh.

In this period I was allotted different sites of road construction as well as a site of building construction.

In this period of my internship, I learned about the Flexible Pavement and materials used in the road construction and the road side development. I learned about how a road is constructed and the tests which are done before to ensure the material quality and safety of the road. Also, I learned about the underground utility works (Power duct for underground cables of electricity, storm water drains, etc.) which are essential for a road to function properly for a smart city.

Along with these, I also learned about the Quantity Estimation in which I learnt about preparation of BBS, measurement sheets, BOQ, and details of Estimation and some basics about AutoCAD and how to design a road by AutoCAD.

I was responsible of visiting sites regularly , checking progress of it.

I also cross checked various estimations of upcoming projects of GSCDCL

## सारांश

इस रिपोर्ट में 18 जनवरी, 2022 से 23 मई, 2022 तक चार महीनों की अवधि के लिए ग्वालियर स्मार्ट सिटी डेवलपमेंट कॉर्पोरेशन लिमिटेड (जीएससीडीसीएल) में मेरी इंटरशिप के दौरान मेरे काम का संक्षिप्त अध्ययन और विवरण शामिल है।

ग्वालियर स्मार्ट सिटी डेवलपमेंट कॉर्पोरेशन लिमिटेड (GSCDCL) 25 अक्टूबर, 2016 को एकीकृत एक अप्रकाशित सार्वजनिक कंपनी है। इसे एक राज्य सरकार की कंपनी के रूप में वर्गीकृत किया गया है और यह ग्वालियर, मध्य प्रदेश में स्थित है।

इस अवधि में मुझे सड़क निर्माण के विभिन्न स्थलों के साथ-साथ भवन निर्माण की एक साइट आवंटित की गई थी।

मेरी इंटरशिप की इस अवधि में, मैंने सड़क निर्माण और सड़क के किनारे के विकास में उपयोग किए जाने वाले लचीले फुटपाथ और सामग्रियों के बारे में सीखा। मैंने सीखा कि सड़क का निर्माण कैसे किया जाता है और सड़क की सामग्री की गुणवत्ता और सुरक्षा सुनिश्चित करने के लिए पहले किए जाने वाले परीक्षण। इसके अलावा, मैंने भूमिगत उपयोगिता कार्यों (बिजली के भूमिगत केबलों, तूफान के पानी के नालों, आदि के लिए पावर डक्ट) के बारे में सीखा जो स्मार्ट सिटी के लिए सड़क को ठीक से काम करने के लिए आवश्यक हैं।

इनके साथ, मैंने मात्रा अनुमान के बारे में भी सीखा जिसमें मैंने बीबीएस, माप पत्रक, बीओक्यू की तैयारी के बारे में सीखा, और अनुमान के विवरण और ऑटोकैड के बारे में कुछ मूल बातें और ऑटोकैड द्वारा सड़क को कैसे डिजाइन किया जाए।

मैं नियमित रूप से साइटों का दौरा करने, इसकी प्रगति की जांच करने के लिए जिम्मेदार था।

मैंने जीएससीडीसीएल की आगामी परियोजनाओं के विभिन्न अनुमानों की भी जांच की

## List of Abbreviations

BBS.....	Bar Bending Schedule
BC.....	Bituminous Concrete
BOQ.....	Bill Of Quantities
CPWD .....	Central Public Work Department
GRMC.....	Gajra Raja Medical College
GSB.....	Granular Sub Base
WMM.....	Wet Mix Macadam
SOR .....	Schedule Of Rates

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## INTRODUCTION

### 1.1 Company Overview

Gwalior Smart City Development Corporation Limited (GSCDCL) is an unlisted public organization brought together on 25th October, 2016. It is delegated a State government organization and is situated in Gwalior, Madhya Pradesh..

Gwalior Smart City Suggestion was chosen by the govt. of India under Smart City Mission inside the second round of shrewd urban communities challenge.

GSCDCL was integrated as a Special Purpose Vehicle to execute the Smart City drives. The Chairman of the company is District Collector and Executive Director of the Company is Municipal Commissioner. GSCDCL hopes to apply part of this resource for the said consultancy organizations. GSCDCL expects to apply part of this asset for the said consultancy administrations. Compliant with above, GSCDCL welcomes qualified counselling substances to give consultancy administrations to arranging, plan and execution of smart city ventures of Gwalior.

### 1.2 Pavement

Pavement are engineered structure and are noteworthy for our regular day to day existence, business and exchange, and protection. Land transportation is the most widespread means of transportation on the planet, and national improvements are often appreciated in terms of kilo meters of fully open roads. The development of roads is and will keep on being a significant industry in emerging countries, and as the framework develops, it will be a significant industry in created nations too.

The main function of the pavement is to endure the load applied from a vehicle like a truck or an airplane, without deforming unnecessarily.

#### 1.2.1 Types of Pavements

There are two types of pavement namely:

- i. Rigid Pavement
- ii. Flexible Pavement

In this report we will discuss about Flexible Pavement.

## Flexible Pavement

Flexible Pavement are pavements that are constructed from bituminous material or unbound material and the pressure is passed on to the sub-level by means of the parallel dispersion of the applied burden with profundity.

. It has many layers; The top most layer should be of top-quality, to endure maximum compressive stress.

The initial cost of flexible pavement is lower as compared to Rigid pavement.

It is used to transfer the wheel load stresses to the bottom layers or sub layers

In other terms flexible pavements is expressed as the pavement layer, which consists of a combination of aggregate and bitumen, is heated and mixed properly, and placed on a bed of granular layers and compressed.

### 2.1 Layers Of Flexible Pavement

There are mainly five layers namely

1. Soil Subgrade
2. Sub-base course
3. Base Course
4. Binder Course
5. Surface/Wearing course



Fig 1

- 1) **Soil Subgrade** : It is the lowermost layer of Flexible Pavement also called as the foundation layer consisting compacted natural soil layer upto the required depth.

It is generally of 150-300 mm depth. It should be strong enough to endure the stress coming from above layers.

**Sub Base Course** : It is simply under the base course and gives extra assistance to the courses above it in administering the heaps. It likewise helps in keeping away from soil grains of the subgrade from encroaching into the base course above, and balances ice activity. It includes balanced out soil or soil total blends, which empower waste of free water from the asphalt. It interferes with the base course and subgrade. The material utilized for this layer will satisfy the particulars regarding degree, strength, and plastic attributes. This layer is essential if the subgrade is of inferior quality. Its thickness is between 100-300 mm.

It acts as a drainage layer and drain out water that percolates and helps subgrade from losing its shear strength from getting wet.

- 2) **Base Course** : It is underneath the surface course and its capacity is to disperse the burdens communicate through the surface course consistently onto the layers beneath. Perpetually, it involves granular or bituminous material, and goes about as a major primary piece of the asphalt. The base course is the main layer that transfers the burdens created because of traffic impacts through the wearing course. The base course layer gives the expected establishment inflexibility and primary strength. The minimum thickness recommended for this layer is 100mm.
- 3) **Binder Course** : It is second layer from top, it is built by aggregates and bitumen. In general its thickness is between 50mm – 100mm. Its function is to transfer the loads from surface course to base course.
- 4) **Surface Course** : It is the highest layer. Its capacity is to give a smooth, solid, scraped spot safe and actually impermeable course. Since it is straightforwardly in touch with the vehicle tires, it needs to go against the forced wheel stacks and communicate them securely to the layer beneath. The material might be granular, bituminous or concrete substantial which relies upon the idea of the development. For adaptable asphalts, the bituminous surface is the wearing course though unbending asphalt asphalt the substantial surface goes about as the base course that is wearing course. It must be waterproof. The thickness of this layer is between 25-50 mm.

Other than these layer, 2 kinds of coats are applied in the Flexible Pavement:

1. **Primer Coat** : This coat is applied amid base course and binder course. It fills the capillary voids. It provides adhesion between granular and bituminous material. This coat is provided 24 hours before applying the next layer.
2. **Tack Coat** : It is very light application of asphalt. This coat is sprayed after the prime coat, and forms adhesive bond in between the previous and the following layer. It is applied around 4-6 hours before laying next layer. Guarantees a good connection between the two binder courses. It is applied at the rate of 6.0 to 7.5 kg/10 sqm area.

## Details of Project

The Project which we were working on was Flexible pavement construction with footpath from Mahal Gate to Mandre ki Mata.

This road was divided into three parts

- Mahal Road
- Katoraatal Road
- GRMC Road

The total length of the road was 1 km and width of the road was 8.4 m on each side and footpath width of 2 m.

Along with and footpath underground utility ducts and storm water Drainage were constructed.

The road was constructed in 4 layers

- First Layer: Granular Sub Base was of 200 mm depth
- Second layer: Wet Mix Macadam was of 250 mm depth
- Third layer: Dense Bituminous Macadam was of 115 mm depth
- Fourth layer: Bituminous Concrete was of 40 mm depth.

## Road Construction Process

The road was constructed in various steps which includes the following:

- ❖ **Dismantling:** It was the very first step of road construction, in this dismantling of existing layer of BC and GSB was done.
- ❖ **Excavation:** In this step excavation and transportation of the dismantled layer was done.
- ❖ **Preparation of subgrade:** The subgrade was prepared by compacting the existing subgrade by vibratory rollers of 8-10 tons.
- ❖ **Layering of GSB:** It consists of crushed gravel, river sand, crushed stone, kankar etc. The layer of GSB of 200 mm depth was laid after the subgrade. the gradation of this layer was of 53mm passing.
- ❖ **Layering of WMM:** It consists of unsoiled, crushed, graded aggregates premixed with other constituents and water. The layer of WMM of 250 mm depth was laid above the layer of GSB, the gradation of this layer was of 53mm passing, then compaction was done till the desired compaction was achieved.
- ❖ **Application of prime coat:** A thin layer of prime coat was applied by a sprayer at the rate of  $750 \text{ g/m}^2$  about 24 hours before layering of DBM.
- ❖ **Application of tack coat:** A thin layer of tack coat was applied by a sprayer at the rate of  $250\text{-}300 \text{ g/m}^2$ , about 4-6 hours before layering of DMB.
- ❖ **Layering of DBM:** A layer of DBM of 115 mm was laid. It consists of bitumen, coarse aggregate, fine aggregate and filler. The layer was laid in 2 layers of 60mm and 55mm for by auto sensor paver machine. The gradation of this layer was 37.5mm passing. While laying this layer the temperature should not be less than  $90^\circ$  and the temperature inside the machine should around  $120^\circ$ .
- ❖ **Application of tack coat:** Again a thin layer of tack coat was applied for bonding between DBM and BC layer.
- ❖ **Layering of BC:** A final layer of BC of 40mm depth was laid. It comprises of coarse aggregates, fine aggregates, filler and binder. It can be well graded, open graded, gap graded or unbounded as per the requirements.



Fig. 4.1

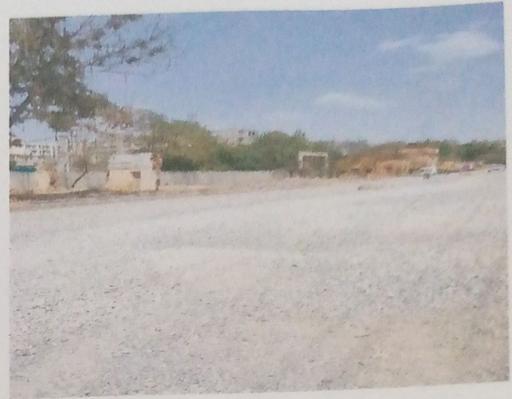


Fig. 4.2



Fig 4.3



Fig 4.4



Fig 4.5

## UNDERGROUND UTILITY WORK

Underground utilities are any open assistance structures introduced underneath the ground . It incorporate electronic links, media transmission and information links, water and sewer pipelines, and oil and gas pipelines. These utility lines are much of the time a life saver of human culture and assist a local area with working appropriately. They are normally introduced underneath the ground for accommodation, wellbeing, and stylish reasons.

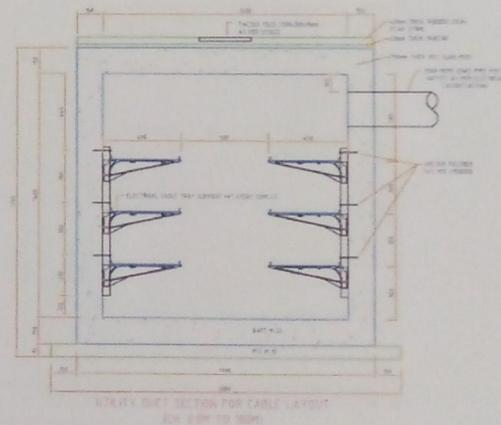
### 6.1 POWERDUCT FOR UNDERGROUND CABLES OF ELECTRICITY

Underground ducting refers to the protective pipework through which essential utility pipes and cables are run underground to provide buildings with power, etc.

At the Katorataal site:-

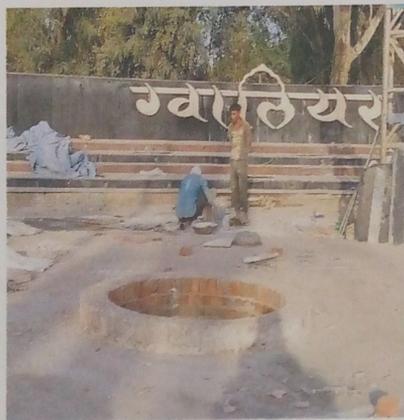
Specifications:-

- Width = 2000mm (150mm+1700mm+150mm)
- Height = varies as per site



## Place making

Its main focus is to transform public spaces to strengthen the connections between them and people. It is a people centered process focusing on their needs, desires and aspirations



## On Site Test

The toughness of the pavement isn't directly judged through appearance of the ultimate product, but is guaranteed by, good materials, proper design and proper construction procedures. The quality of materials used in construction affect the road severely, therefore appropriate design and use of good quality materials for pavement construction is important in construction. So to ensure that several on site tests are conducted while constructing the flexible pavement. It is essential to conduct test and find out the properties of aggregates and soil used for constructions.

The following on site tests were carried out during the road construction of our project.

- Sieve Analysis test
- Sand Replacement Density Test
- Rapid Moisture Measurement Test
- Bitumen Extraction Test

The above mentioned test are conducted to ensure the quality of materials and prevent road from various failures such as cracking, surface defects, deformation and structural failure.

## 7.1 Sieve Analysis Gradation Test

Sieve Analysis is done for gradation of aggregates. The outcomes are utilized to decide the consistence, particle size distribution with applicable specification requirements and the data needed to regulate the production of various aggregate products and mixtures, including aggregates.

In this test a sample of dry aggregates of known weight is passes from the bunch of sieves of different sizes, Once passed, the weight of the particles that retained on each sieve is determined and noted and compared to the total sample weight. article size distribution is then expressed as a percentage weight retained on each sieve size. Results are usually presented in tabular or graph format.

The sieves used in this test for WMM and GSB are ranged from 53mm to 75 microns.

The sieves used in this test for DBM are ranged from 37.5mm to 75 micron.

The aggregates should be 100% passing from 53mm sieve for WMM and GSB.

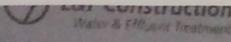
If material doesn't passes 100% from 53mm sieve that mean we need to add more coarse aggregate in it.



Fig 7.1



Fig. 7.2


**Project Name:-Gwalior Smart City Project**

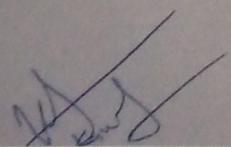
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**SIEVE ANALYSIS REPORT FOR GRANULAR SUB BASE [As per MoSRT & H ]**

Laboratory Job No.	LE20M159	Date Of Sample	17/01/22
Type of Material	GSB GRADE	Sampled By	H T / PAME
Source		Date of Testing	17/01/22
Location	Mixed up ch <sup>1</sup> ~ 0+100	Tested By	H T & PAME
Proposed Use	BT work	Testing Method	

grams Total Weight of sample

Sieve size	Wt. Retained (gm)	% wt. Retained (gm)	Cum. % Retained	Cum. % Passing	% Passing as per Specification MoRT&H			Remarks
					Grading 1	Grading 2	Grading 3	
53.00 MM	280	2.96	2.96	97.04	80-100	100	100	GSB is As per MoRTH limits Grading
26.5 MM	3650	41.58	44.54	55.46	55-90	70-100	55-75	
9.5 MM	3410	38.84	83.38	16.62	35-65	50-80	-	
4.75 MM	640	7.29	90.67	9.33	25-55	40-65	10-30	
2.36 MM	180	2.05	92.72	7.28	20-40	30-50	-	
425 MIC	170	1.93	94.65	5.35	10-15	10-15	-	
75 MIC	460	5.24	99.89	0.11	0-5	0-5	0-5	
Pan wt.	08							
Total wt.	8778							



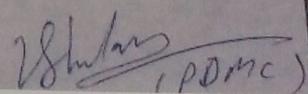


Fig. 7.3

SIEVE ANALYSIS REPORT OF DENSE BITUMINOUS MACADAM [As per MoSRT & H ]

Laboratory Job No.	LF 20M159	Date Of Sample	09/03/22
Type of Material	DBM	Sampled By	H T & P D M L
Source	Bidways / Hot mix plant	Date of Testing	09/03/22
Location	Kadodol Road, Ch. 545-765 (H.E.)	Tested By	H T & P D M L
Proposed Use	B T ROAD WORKS	Testing Method	Dry sieve Analysis

grams Total Weight of sample						Remarks
Sieve size	Wt. Retained (gm)	% wt. Retained (gm)	Cum. % Retained	Cum. % Passing	% Passing as per Specification MoSRT&H	
37.5 MM	0	0	0	100	95-100	DBM GRADE-I is As per MoRTH
26.5 MM	658	14.61	14.61	85.39	63-93	
13.2 MM	765	16.99	31.60	68.40	55-75	
4.75 MM	845	18.77	50.37	49.63	38-54	
2.36 MM	540	11.99	62.36	37.64	28-42	
300 Mic	810	17.99	80.35	19.65	7-21	
75 MIC	635	14.10	94.45	5.55	2-8	
Pan wt.	250					
Total wt.	4503					

*[Handwritten signature]*

*[Handwritten signature]*

Fig. 7.4

## 6.2 SAND REPLACEMENT DENSITY TEST

It is also called as sand Cone Method Test. SRD tests are used to measure the density of natural or compacted soils using sand pouring cylinders on the site itself. Generally, the layer after compaction in the field must be checked for the predetermined dry density. This is generally done by the sand replacement method. The determination of dry density is most extreme significance as it is expected for the bearing capacity of the soil. The general test system for deciding the dry thickness of soil by the sand substitution strategy is somewhat basic and simple to lead. This test can be done utilizing a little or huge chamber. Normally, it is led utilizing an enormous chamber. The sand substitution test is generally done either at the ground level or the development level.

The field density test of soil is conducted in the field to know whether the specified compaction is achieved or not

For better results, the sample of sand used should be uniform, dry and clean and should pass 1 mm sieve and retained on 600 micron sieve.



Fig. 7.5



Fig. 7.6


**L&T Construction**  
Water & Effluent Treatment

**LARSEN & TOUBRO CONSTRUCTION**  
 Project Name: Gwalior Smart City Project

SL NO: 000  
 Format No: QMSG-CIVIL-7

**FIELD DENSITY TEST REPORT (Core Cutting Method) AS per IS 2720 - Part -29**

Report No.		Length - (Rmt)	
Date	18.01.2022	V = Volume of Mould (2.14704/47) (cc)	98.1
Area / Structure	Market Road CH-115 L&T5 (110-130)	W = Wt. of Mould (gm)	950
Source of Sand		M = Maximum Dry Density (gm/cc)	2.047
		Optimum Moisture content (%)	11.05

Sl.no	Details	Sample I	Sample II	Sample III
1	Sample Location			
2	W1=Weight of Mould + Weight of Sample (gm)	3025	3005	
3	W2=Weight of Sample (gm)	2075	2055	
4	B = Bulk Density W2 / V (gm/cc)	2.005	2.094	
5	Moisture gauge reading content w (%)	67	5.27	
6	D= Dry Density ( B / ( 100+w ) ) *100 (gm/cc)	1.995	1.930	
7	Degree of Compaction ( D / M ) *100 (%)	97.458	97.215	
8	Remarks	PASS		

Fig 7.7

### 6.3 RAPID MOISTURE MEASUREMENT TEST

Rapid moisture meter method is a quick method to determine the water content in a soil sample. Oven Dried moisture content test take days to find out the moisture content of soil and aggregates whereas this method takes only few minutes

This method is performed by an equipment called Rapid moisture meter.

Water content assurance ordinarily requires around 16-24 hours by broiler drying technique. To rapidly decide the water content at site, utilization of Rapid Moisture Meter is extremely valuable. In this technique, water not entirely settled from the gas pressure is achieved by the response of calcium carbide (absorbent) with free water of the sample. From the adjusted size of the tension measure, the level of water on all out (wet) mass of soil test is accomplished and the equivalent is changed to water content on dry mass of soil.

Meter gives the value of percentage of amount water present in the soil sample. That is if we get the value on the meter as 4 % then that means in the soil sample 4 % is water and 96% is solids



Fig 7.8

## 5.4 BITUMEN EXTRACTION TEST

Bitumen Extraction Test is used to figure out the percentage of bitumen content in the road layer or pavement by cold solvent extraction method.

The properties of flexible pavement such as a durability, compatibility and resistance from defects bleeding, ravelling and aging of flexible pavement are majorly depends upon the percentage of bitumen used along with the aggregate to lay the pavement.

In this test sample of know weight is collected and then centrifuged with the solvent, the speed of revolution in increased gradually upto max speed of 3600 rev/min.

More solvent is added once the solvent is flushed out the of the apparatus. The process is repeated until the colour of extract is clear and pale yellow.

Then the filter paper is removed slowly with the residue, and residue is weighed.

We can us petrol as the solvent in this test.



Fig 7.9



Fig 7.10

Project Name:-Gwalior Smart City Project

SL NO: 000

Format No : QMSG-CIVIL-22

Bitumen Content Test

Material:	D.B.M		
Source:	Bilaspur / Hot mix / Kato/entul RD / Kato/entul RD Pleat / CH-515-785 / CH-480-510		
Test as per IS:	13826 Part - 7	Date	09/03/22

Sl. No.	Particular	Unit	Test No.	
			1	2
1	Weight of Sample taken (W1)	gm	500	500
2	Weight of Sample after extraction (W2)	gm	479.7	478.8
3	Bitumen Content $(W1-W2)/W1*100$	%	4.06	4.24
4	Average	%	4.15	

Remarks:-

*[Handwritten signature]*

*[Handwritten signature]*

Fig 7.11

## Estimation and Costing in Civil Engineering

Estimation is a very major part of any construction project. It is termed as the method of calculating or computing the different quantities and the probable cost to be incurred on a specific work or project. The estimate gives the possible expense of the work.

The essential goal of an estimate is to empower one to figure out the plausible cost of the work before finishing of the venture. In the event that the estimate is arranged cautiously and accurately there won't be a lot of contrast between estimated and genuine expense.

### 8.1 Standards of estimating

- (i) Make everything of an aspect as clear and coherent as conceivable so everyone have the option to figure out it easily.
- (ii) Arrange the things in a similar request as work executes in field.
- (iii) Accuracy in estimations relies on the pace of a thing with the goal that the genuine expense doesn't change by over 10%.

### 8.2 Importance of Estimation

The estimate is important for setting the financial plan for the purposed project.

- It is vital for working out the necessary amounts of materials and workers for the project.
- Repairing the finish time of the proposed project is vital.
- It is likewise useful to cross check the works done by workers for hire during and after the completion.
- It is expected for planning tenders for the venture.
- It is fundamental for the valuation of land and building

### **8.3 Data required for estimation and costing**

1. Drawing i.e. plans, elevation, sections, etc
2. Specifications
3. BBS
4. Rates
5. Methods of measurement
6. Schedule of Rates

### **8.4 Types of Estimate:**

1. Approximate Method : This is an estimate to figure out the surmised cost or to take a idea of the expense, of the proposal in brief time frame. Such an estimate is ready for fundamental investigations of different parts of work or venture of the division concerned, to conclude the monetary parts of the development work.
2. Detailed Method : On consent of rough estimate or after getting the “Administrative Approval” this estimate is set for getting “Technical sanction” by the experienced authority of technical department.

Detailed estimate comprises of finding out the quantities of each item of works, and work out the expenses.

The Detailed estimate is prepared in two stages:

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

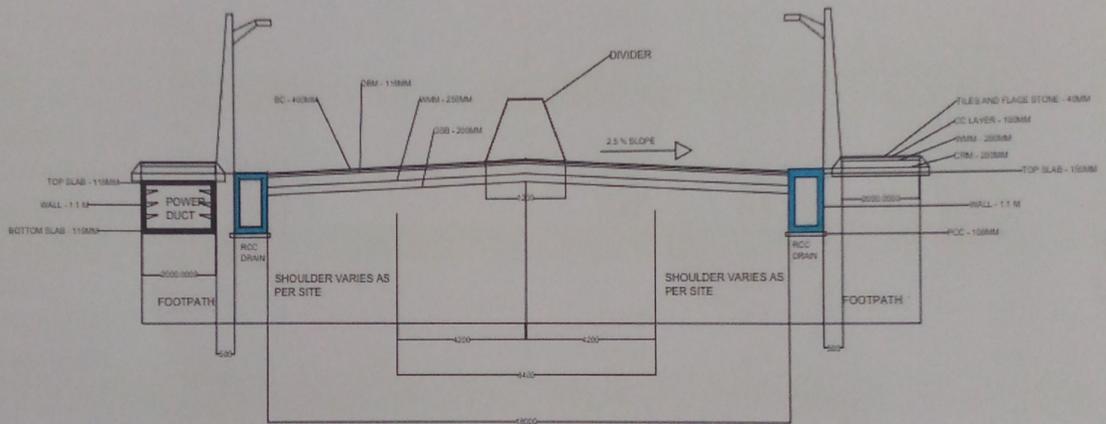
### **8.5 The Schedule Of Rates (SOR)**

After analyzing the market prices for various items, a list of rates for these items is generated. Such a document is known as Schedule of Rates. It is created by large concerns such as CPWD, State Governments etc.

The SOR comprises of group of items such as demolishing items, excavation items, concrete items etc, also information regarding the present wages of labour and prices of different items is given in it

.The SOR is renewed or updated nearly every year because of the changes in the various rates. It consists of basic rates of more than 2500 items and finished rates of more than 3000 items.

## Design Of Katora Taal Road



# Estimate of Mahal Road

s.no	Description of Item	No.	Length	Width	Height	Quantity	Unit
<b>A Road Works</b>							
<b>Dismantling</b>							
	Dismantling of bc layer and dbm layer (RHS)		1005	8.4	0.08	675.36	cum
	Dismantling of bc layer and dbm layer (LHS)		1005	8.4	0.08	675.36	cum
	Dismantling of GSB layer (RHS)		1005	8.4	0.2	1688.4	cum
	Dismantling of GSB layer (LHS)		1005	8.4	0.2	1688.4	cum
			Total			4727.52	cum
<b>Excavation</b>							
	Excavation in Road (LHS)	1	1005	8.4	0.325	2743.65	cum
	Excavation in Road (RHS)	1	1005	8.4	0.325	2743.65	cum
			Total			5487.3	cum
<b>LAYERING</b>							
<b>Granular Sub Base</b>							
	Granular Sub Base (RHS)	1	1005	8.4	0.2	1688.4	cum
	Granular Sub Base (LHS)	1	1005	8.4	0.2	1688.4	cum
			Total			3376.8	cum
<b>Wet Mix Macadam</b>							
	Wet Mix Macadam (RHS)	1	1005	8.4	0.25	2110.5	cum
	Wet Mix Macadam (LHS)	1	1005	8.4	0.25	2110.5	cum
			Total			4221	cum
<b>Prime Coat</b>							
	Prime Coat (RHS)	1	1005	8.4		8442	sqm
	Prime Coat (LHS)	1	1005	8.4		8442	sqm
			Total			16884	sqm
<b>Tack Coat</b>							
	Tack Coat (RHS)	1	1005	8.4		8442	sqm
	Tack Coat (LHS)	1	1005	8.4		8442	sqm
			Total			16884	sqm
<b>Dense Bituminous Macadam</b>							
	Dense Bituminous Macadam (RHS)	1	1005	8.4	0.115	970.83	cum
	Dense Bituminous Macadam (LHS)	1	1005	8.4	0.115	970.83	cum
			Total			1941.66	cum
<b>Tack Coat</b>							
	Tack Coat (RHS)	1	1005	8.4		8442	sqm
	Tack Coat (RHS)	1	1005	8.4		8442	sqm
			Total			16884	sqm

<b>Bituminous Concrete</b>						
Bituminous Concrete (RHS)	1	1005	8.4	0.4	3376.8	cum
Bituminous Concrete (LHS)	1	1005	8.4	0.4	3376.8	cum
Total					6753.6	cum

## B Footpath

### Excavation

Concrete Block Excavation (RHS)	1	960	0.1	0.2	19.2	cum
Concrete Block Excavation (LHS)	1	905	0.1	0.4	36.2	cum
Concrete Block Excavation (LHS)	1	100	0.1	0.5	5	cum
Total					60.4	cum

PCC laying for footpath (LHS)	1	1005	1.4	0.1	140.7	cum
PCC bed below the concrete block (RHS)	1	1005	0.1	0.1	10.05	cum
PCC bed below the concrete block (LHS)	1	1005	0.1	0.1	10.05	cum
Total					160.8	cum

### Stone Dust

Stone Dust (RHS)	1	1005	2	0.025	50.25	cum
Stone Dust (LHS)	1	1005	2	0.025	50.25	cum
Total					100.5	cum

### Cobble Stone

Cobble Stone (RHS)	1	1005	1.7	0.075	128.1375	cum
Cobble Stone (LHS)	1	1005	1.7	0.075	128.1375	cum
Total					256.275	cum

### Concrete Block

Concrete Block (RHS)	1	1005	0.1	0.4	40.2	cum
Concrete Block (LHS)	1	1005	0.1	0.4	40.2	cum
Total					80.4	cum

## C Drain

### Excavation

Excavation (RHS)	1	1005	0.9	1.5	1356.75	cum
Excavation (LHS)	1	1005	0.9	1.5	1356.75	cum
Total					2713.5	cum

### PCC

PCC (RHS)	1	1005	0.9	0.1	90.45	cum
PCC (LHS)	1	1005	0.9	0.1	90.45	cum
Total					180.9	cum

### RCC

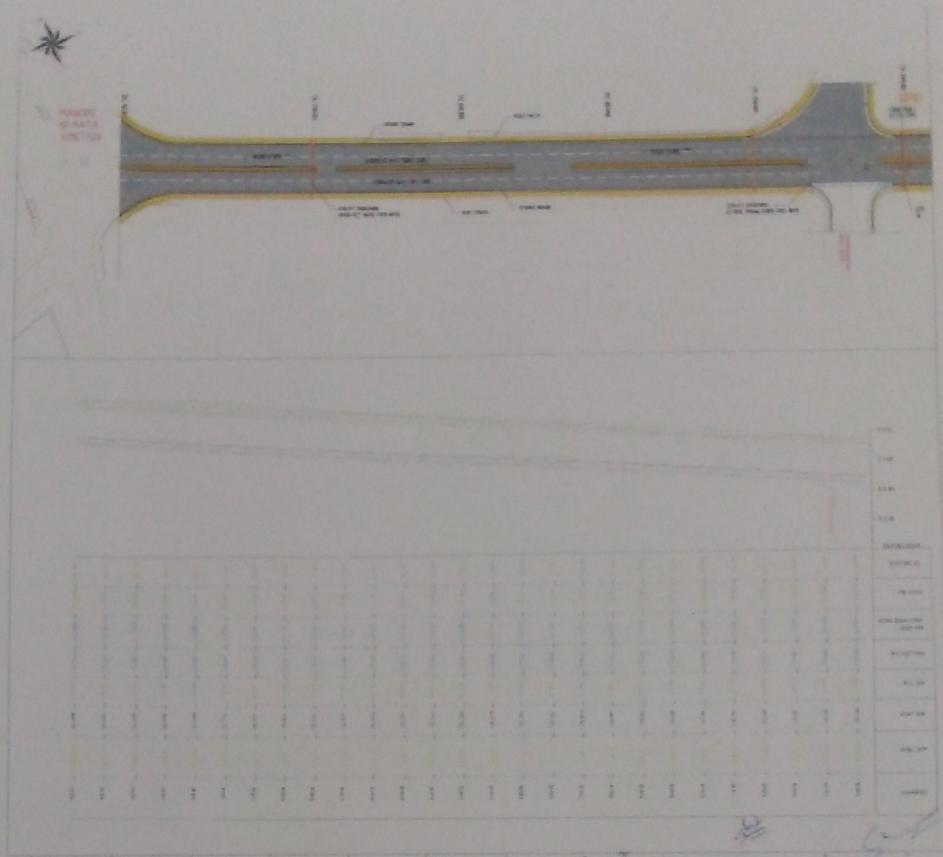
RCC (RHS)	2	1005	0.15	1.1	165.825	cum
Wall	1	1005	0.9	0.15	135.675	cum
Top Slab	1	1005	0.9	0.15	135.675	cum
Bottom Slab	1	1005	0.9	0.15	135.675	cum
RCC (LHS)	2	1005	0.15	1.1	165.825	cum
Wall	1	1005	2	0.15	301.5	cum
Top Slab	1	1005	2	0.15	301.5	cum
Bottom Slab	1	1005	2	0.15	301.5	cum
Total					1206	cum

D

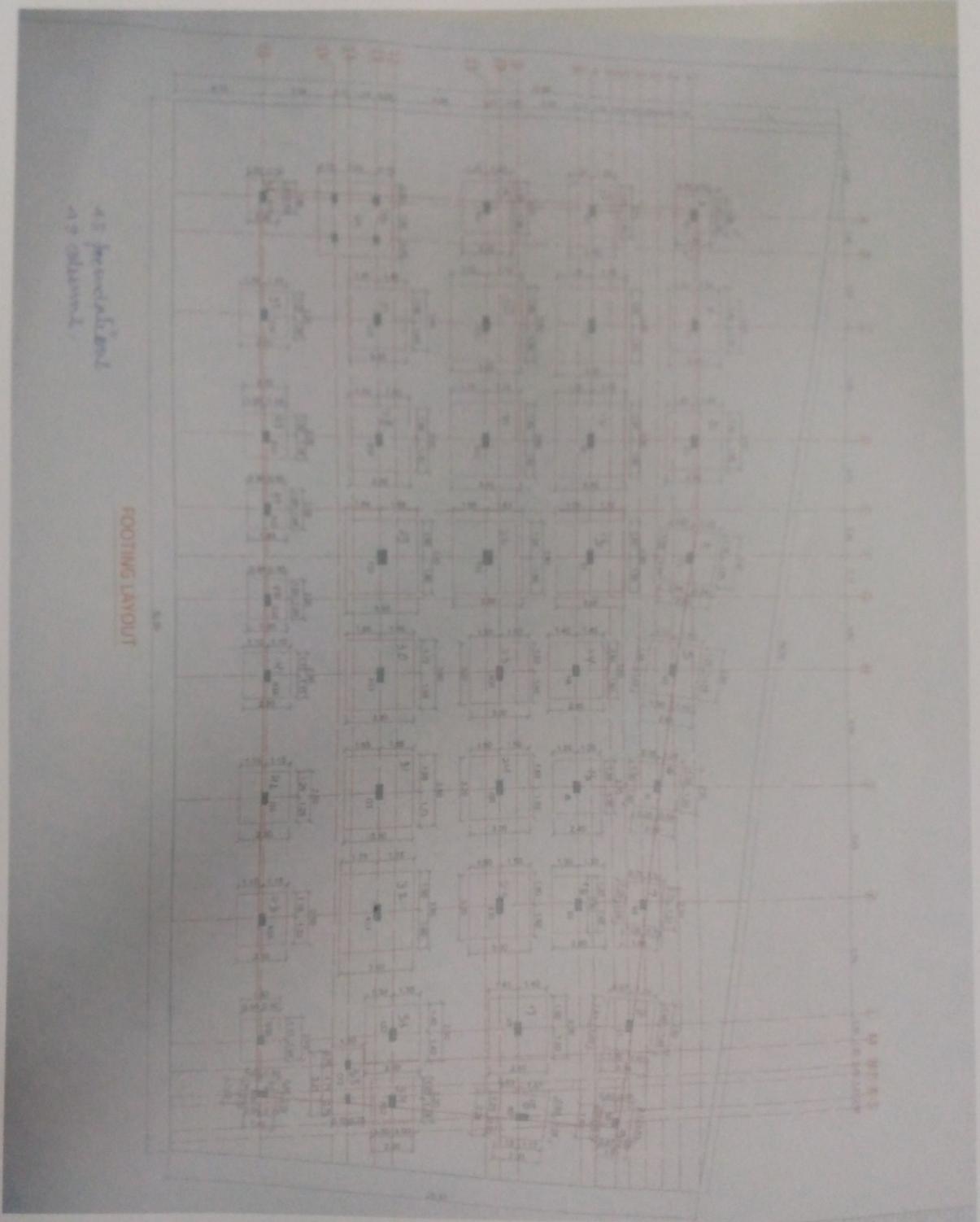
**Power Duct**

Excavation (RHS)	1	1005	2	1.5	3015	cum
PCC (RHS)	1	1005	2	0.1	201	cum
Wall	2	1005	0.15	1.1	165.825	cum
Top Slab	1	1005	2	0.15	301.5	cum
Bottom Slab	1	1005	2	0.15	301.5	cum
Total					768.825	cum

# Katorataal Road Design

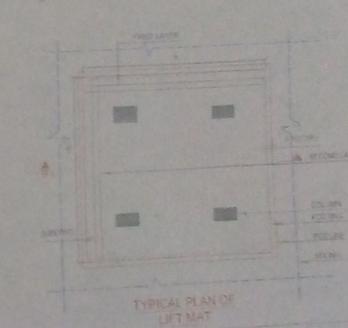
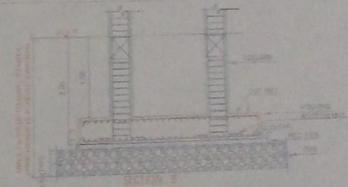
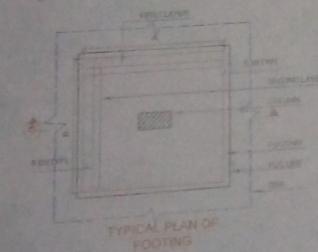
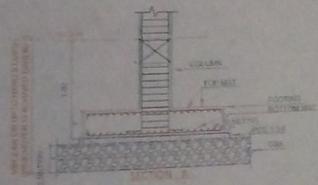


# Footing Layout Of Huzraat Mandi



## Schedule of Footing of Huzraat Mandi

SL. NO.	GRID NO.	LENGTH (M)	WIDTH (M)	THICKNESS (M)	BOTTOM MAT		TOP MAT	
					FIRST LAYER	SECOND LAYER	FIRST LAYER	SECOND LAYER
1	A1 E16 G16	2.00	1.80	0.55	Ø10@125mm c/c	Ø10@100mm c/c		
2	A7 A11 & R	2.70	2.40	0.70	Ø12@125mm c/c	Ø12@100mm c/c		
3	C11 (A13, R13, A25 & B25)	REFER. 105		0.45	Ø10@125mm c/c	Ø10@125mm c/c	Ø10@200mm c/c	Ø10@200mm c/c
4	C12 (M14 & P14)	REFER. 105		0.50	Ø10@125mm c/c	Ø10@125mm c/c	Ø10@200mm c/c	Ø10@200mm c/c
5	A16	1.95	1.40	0.45	Ø10@125mm c/c	Ø10@100mm c/c		
6	C3 F1 H1 K5 & L12	2.80	2.80	0.75	Ø12@125mm c/c	Ø12@100mm c/c		
7	C7 C11 O7 D11 F7 & K13	3.80	3.50	0.90	Ø16@100mm c/c	Ø16@150mm c/c	Ø10@200mm c/c	Ø10@200mm c/c
8	C13 D1 H6 & L9	3.00	2.80	0.80	Ø12@125mm c/c	Ø12@100mm c/c		
9	C16 H16 J3 & R9	2.30	2.20	0.65	Ø12@150mm c/c	Ø12@125mm c/c		
10	D13	3.30	3.00	0.75	Ø16@100mm c/c	Ø16@125mm c/c		
11	D16 & P12	2.20	2.00	0.60	Ø12@150mm c/c	Ø12@125mm c/c		
12	F11 & F13	3.80	3.50	0.90	Ø16@150mm c/c	Ø16@150mm c/c	Ø10@200mm c/c	Ø10@200mm c/c
13	H10 J10 K10	3.20	3.00	0.85	Ø12@100mm c/c	Ø12@100mm c/c		
14	H13 & J13	3.20	3.30	0.85	Ø16@100mm c/c	Ø16@150mm c/c		
15	J16 K16 & L5	2.50	2.30	0.75	Ø12@125mm c/c	Ø12@125mm c/c		
16	K4 & L16	2.10	1.80	0.55	Ø10@200mm c/c	Ø10@100mm c/c		
17	N16	1.40	1.20	0.40	Ø10@150mm c/c	Ø10@125mm c/c		
18	S6	1.65	1.50	0.45	Ø10@125mm c/c	Ø10@125mm c/c		



## Measurement sheet of Huzraat Mandi

S.No.	Footing Mark	Nos	Length	Width(m)	Thickness
1	A1, E16, G16	3	2	1.8	0.55
2	A7,A11,J8	3	2.7	2.4	0.7
3	CF1(A13,B13,A15,B15)	1	3.7	3.52	0.45
4	CF2(M14,P14)	1	3.21	1.5	0.5
5	A16	1	1.65	1.4	0.45
6	C1,F1,H2,K8,L12	5	2.8	2.6	0.75
7	C7,C11,D7,D11,F7,K13	6	3.8	3.5	0.9
8	C13,D1,H8,L9	4	3	2.8	0.8
9	C16,H16,J3,R9	4	2.3	2.2	0.65
10	D13	1	3.3	3	0.75
11	D16,P12	2	2.2	2	0.6
12	F11,F13	2	3.8	3.5	0.9
13	H10,J10,K10	3	3.2	3	0.85
14	H13,J13	2	3.6	3.3	0.85
15	J16,K16,L5	3	2.5	2.3	0.65
16	K4,L16	2	2.1	1.8	0.55
17	N16	1	1.4	1.2	0.4
18	S6	1	1.65	1.5	0.45

## Measurement Sheet of Huzraat Mandi continued

RCC Qty	Length	Width	Thickness	PCC qty	
5.94	2.2	2	0.1	1.32	
13.61	2.9	2.6	0.1	2.26	
5.86	3.9	3.72	0.2	2.90	
2.41	3.41	1.7	0.2	1.16	
1.04	1.85	1.6	0.1	0.30	
27.30	3	2.8	0.1	4.20	
71.82	4	3.7	0.1	8.88	
26.88	3.2	3	0.1	3.84	
13.16	2.5	2.4	0.1	2.40	
7.43	3.5	3.2	0.1	1.12	
5.28	2.4	2.2	0.1	1.06	
23.94	4	3.7	0.1	2.96	
24.48	3.4	3.2	0.1	3.26	
20.20	3.8	3.5	0.1	2.66	
11.21	2.7	2.5	0.1	2.03	
4.16	2.3	2	0.1	0.92	
0.67	1.6	1.4	0.1	0.22	
1.11	1.85	1.7	0.1	0.31	
266.49				41.80	

## Huzraat mandi Measurement Sheet Continued

S.no	Grid No	No of footings	Length (mm)	Width (mm)	Thickness (mm)	First Layer (A)		Second Layer (B)	
						Diameter (mm)	Spacing c/c (mm)	Diameter(mm)	Spacing c/c (mm)
1	A1, E16, G16	3	2000	1800	550	10	125	10	100
2	A7, A11, J8	3	2700	2400	700	12	125	12	100
3	CF1(A13,B13,A15,B15)	1	3700	3520	450	10	125	10	125
4	CF2(M14,P14)	1	3210	1500	500	10	125	10	125
5	A16	1	1600	1400	450	10	150	10	100
6	C1,F1,H2,K8,L12	5	2800	2600	750	12	125	12	100
7	C7,C11,D7,D11,F7,K13	6	3800	3500	900	16	100	16	150
8	C13,D1,H8,L9	4	3000	2800	800	12	125	12	100
9	C16,H16,J3,R9	4	2300	2200	650	12	150	12	125
10	D13	1	3300	3000	750	16	100	16	125
11	D16,P12	2	2200	2000	600	12	150	12	125
12	F11,F13	2	3800	3500	900	16	150	16	150
13	H10,J10,K10	3	3200	3000	850	12	100	12	100
14	H13,J13	2	3600	3300	850	16	100	16	125
15	J16,K16,L5	3	2500	2000	650	12	125	12	125
16	K4,L16	2	2100	1800	550	10	100	10	100
17	N16	1	1400	1200	400	10	150	10	125
18	S6	1	1650	1500	450	10	125	10	125

### Quantity of reinforcement in footing

B)	No of bars				Cutting Length		Weight of Steel		Total Steel Quantity
	First Layer		Second layer		First Layer (mm)	Second Layer(mm)	First layer (kg/m)	Second Layer	
	round off	roundoff	roundoff	roundoff					
100	14.6	15	20	20	2760	2540	25.668	31.496	171.492
100	19.4	20	27	27	3752	3428	66.7856	82.37484	447.48132
125	28.36	29	29.8	30	4260	4060	76.5948	75.516	152.1108
125	12.2	13	25.88	26	3870	2140	31.1922	34.4968	65.689
100	9.666666667	10	16	16	2160	1940	13.392	19.2448	32.6368
100	21	21	28	28	3952	3728	73.86288	92.90176	833.8232
150	35	35	25.66666667	26	5236	4904	289.5508	201.45632	2946.04272
100	22.6	23	30	30	4252	4028	87.03844	107.5476	778.34416
125	15	15	18.6	19	3252	3128	43.4142	52.89448	385.23472
125	30	30	26.6	27	4436	4104	210.2664	175.07664	385.34304
125	13.66666667	14	17.8	18	3052	2828	38.02792	45.30456	166.66496
150	23.66666667	24	25.66666667	26	5236	4904	198.54912	201.45632	800.01088
100	30	30	32	32	4552	4328	121.5384	123.26144	734.39952
150	33	33	24.33333333	25	4936	4604	257.36304	181.858	878.44208
125	16.2	17	20.2	21	3452	2928	52.22876	54.72432	320.85924
100	18	18	21	21	2860	2540	31.9176	33.0708	129.9768
125	8.333333333	9	11.4	12	1860	1640	10.3788	12.2016	22.5804
125	12.2	13	13.4	14	2210	2040	17.8126	17.7072	35.5198
Total Steel Quantity									9286.65144

## Conclusion

In this following four months internship I was able to gain practical knowledge about pavement construction, learn about flexible pavement, materials used in it, process of Construction, what are the challenges that are faced while construction of pavement and how to tackle it.

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. Few of the guidelines are given below which I learnt during the inspection visit of various construction sites

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.

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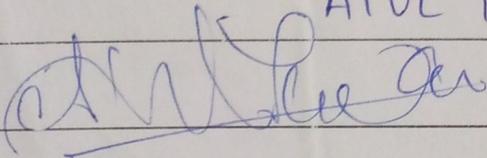
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**FORMAT**

**FORTNIGHTLY PROGRESS REPORT (FPR) FROM INDUSTRY MENTOR**

Name of student	HIMANSHI AGRAWAL		Department	CIVIL <del>DEPT</del>	
Industry/Organization	SMART CITY GWL (GSCDCL)		Date/Duration	DD/MM/YR - DD/MM/YR 10/01/22 - 15/02/22	
<b>Criterion</b>	<b>Poor</b>	<b>Average</b>	<b>Good</b>	<b>Very Good</b>	<b>Excellent</b>
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	Roads, Building work RCC. Reinf.				
<b><u>OVERALL GRADE (Any one)</u></b>	<b><u>POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT</u></b>				
<b><u>Name of Industry Mentor</u></b>	ATUL TEWARI				
<b><u>Signature of Industry Mentor</u></b>	 				

Receiving Date	Name of Faculty Mentor	DR. RAJEEV KANSAL	Sign	 27/5/2022
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**FORMAT**

**FORTNIGHTLY PROGRESS REPORT (FPR) FROM INDUSTRY MENTOR**

Name of student	HIMANSHI AGRAWAL		Department	CIVIL	
Industry/Organization	GSCDCL		Date/Duration	DD/MM/YR - DD/MM/YR 16/02/22 - 28/02/22	
<b>Criterion</b>	<b>Poor</b>	<b>Average</b>	<b>Good</b>	<b>Very Good</b>	<b>Excellent</b>
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	Estimation & Costing of building & Road works.				
<b><u>OVERALL GRADE (Any one)</u></b>	<b><u>POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT</u></b>				
<b><u>Name of Industry Mentor</u></b>	ADARSH KUMAR				
<b><u>Signature of Industry Mentor</u></b>	Ad k				

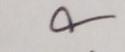


Receiving Date	Name of Faculty Mentor	DR. RAJEEV KANSAL	Sign	27/5/2022
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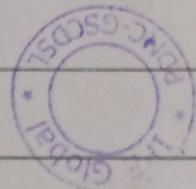
FORTNIGHTLY PROGRESS REPORT (FPR) FROM INDUSTRY MENTOR

Name of student	HIMANSHI AGRAWAL		Department	CIVIL	
Industry/Organization	GSCDCL		Date/Duration	DD/MM/YR - DD/MM/YR 01/03/22 - 15/03/22	
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	Site visit for building & Road Projects. Estimation at office during office hours.				
<u>OVERALL GRADE (Any one)</u>	<u>POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT</u>				
<u>Name of Industry Mentor</u>	ADARSH KUMAR				
<u>Signature of Industry Mentor</u>	AL K 				

Receiving Date	Name of Faculty Mentor	DR. RAJEEV KANSAL	Sign	 27/5/2022
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FORMAT

FORTNIGHTLY PROGRESS REPORT (FPR) FROM INDUSTRY MENTOR

Name of student	HIMANSHI AGRAWAL		Department	CIVIL	
Industry/Organization	GSCDCL		Date/Duration	DD/MM/YR -DD/MM/YR 16/03/22 - 31/03/22	
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	Estimation for Building Structure Quantity Estimation for Sub-structure components				
<u>OVERALL GRADE (Any one)</u>	<u>POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT</u>				
<u>Name of Industry Mentor</u>	ADARSH KUMAR				
<u>Signature of Industry Mentor</u>	Adh 				

Receiving Date		Name of Faculty Mentor	DR. RAJEEV KANSAL	Sign	 27/5/2022
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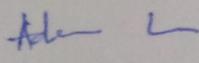
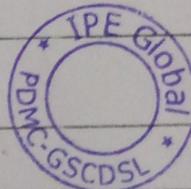
**FORMAT**

**FORTNIGHTLY PROGRESS REPORT (FPR) FROM INDUSTRY MENTOR**

Name of student	HIMANSHI AGRAWAL		Department	CIVIL	
Industry/Organization	GSCDSL		Date/Duration	DD/MM/YR - DD/MM/YR 01/04/22 - 15/04/22	
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	Estimation for Amkha Bus stand Road Checked.  ✓				
<b><u>OVERALL GRADE (Any one)</u></b>	<b><u>POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT</u></b>				
<b><u>Name of Industry Mentor</u></b>	ADARSH KUMAR				
<b><u>Signature of Industry Mentor</u></b>	AL L 				
Receiving Date	Name of Faculty Mentor	Dt. RAJEEV KANSAL	Sign	9 27/5/2022	

**FORMAT**

**FORTNIGHTLY PROGRESS REPORT (FPR) FROM INDUSTRY MENTOR**

Name of student	HIMANSHI AGRAWAL		Department	CIVIL	
Industry/Organization	GSCDCL		Date/Duration	DD/MM/YR - DD/MM/YR 01/05/22 - 23/05/22	
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	ISBT Estimation checked and worked for it.				
<u>OVERALL GRADE (Any one)</u>	POOR/AVERAGE/GOOD/VERY GOOD/EXCELLENT				
<u>Name of Industry Mentor</u>	ADARSH KUMAR				
<u>Signature of Industry Mentor</u>	 				
Receiving Date	Name of Faculty Mentor	DR. RASEEV KANSAL	Sign	