PROJECT ID-315946

HIGH-RISE RESIDENTIAL BUILDING

A PROJECT REPORT

Submitted by

DHRUV AJAYKUMAR PATEL

(190170106039)

In partial fulfillment for the award of the degree of

BACHELOR OF ENGINEERING

In

Civil Engineering

Vishwakarma Government Engineering College, Ahmedabad

Gujarat Technological University, Ahmedabad

(May, 2023)

Vishwakarma Government Engineering College

Nr. Visat Three Road Sabarmati-Koba Highway,

Chandkheda Ahmedabad-382424

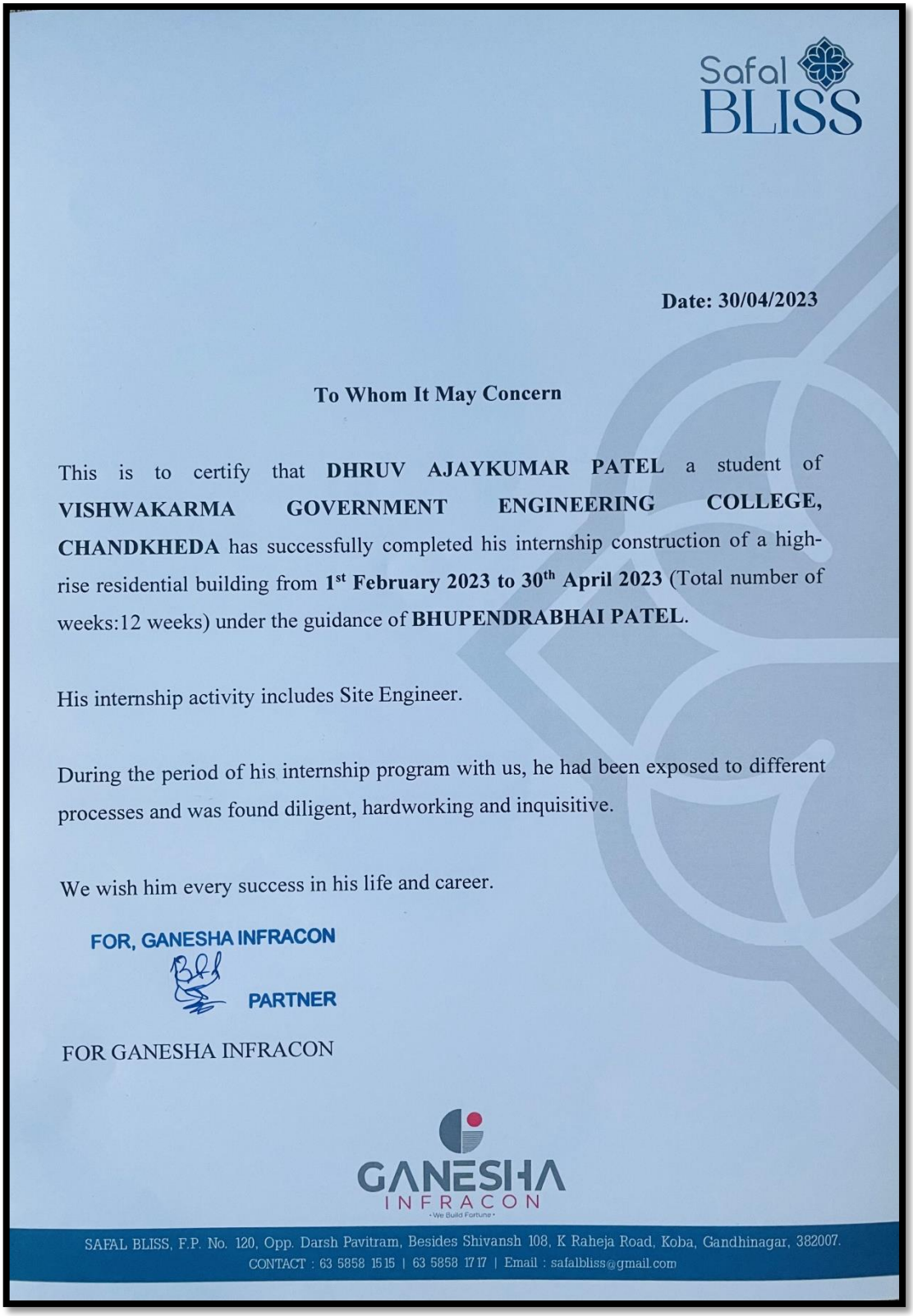
CERTIFICATE

This is to certify that project submitted along with the project entitled **High-rise Residential Building** has been carried out by **Dhruv Ajaykumar Patel** under the guidance in partial fulfillment for the degree of Bachelor of Engineering in Civil Engineering, 8th Semester of Gujarat Technological University, Ahmedabad during the academic year 2022-2023.

Prof. B. G. Buddhdev — Internal Guide

Prof. N. P. Singh — Head of the Department

CERTIFICATE



Safal BLISS

Date: 30/04/2023

To Whom It May Concern

This is to certify that **DHRUV AJAYKUMAR PATEL** a student of **VISHWAKARMA GOVERNMENT ENGINEERING COLLEGE, CHANDKHEDA** has successfully completed his internship construction of a high-rise residential building from **1st February 2023 to 30th April 2023** (Total number of weeks:12 weeks) under the guidance of **BHUPENDRABHAI PATEL.**

His internship activity includes Site Engineer.

During the period of his internship program with us, he had been exposed to different processes and was found diligent, hardworking and inquisitive.

We wish him every success in his life and career.

FOR, GANESHA INFRACON

PARTNER

FOR GANESHA INFRACON

GANESHA INFRACON
We Build Fortune

SAFAL BLISS, F.P. No. 120, Opp. Darsh Pavitram, Besides Shivansh 108, K Raheja Road, Koba, Gandhinagar, 382007.
CONTACT : 63 5858 1515 | 63 5858 1717 | Email : safalbliss@gmail.com

Vishwakarma Government Engineering College

Nr. Visat Three Road Sabarmati-Koba Highway,

Chandkheda Ahmedabad-382424

DECLARATION

I hereby declare that the Internship report submitted along with the Internship entitled **High-rise Residential Building"** submitted in partial fulfillment for the degree of Bachelor of Engineering in Civil Engineering to Gujarat Technological University, Ahmedabad, is a bonafide record of original project work carried out by me at **Ganesha Infracon** under the supervision of **Er. Bhupendrabhai Patel** (External Guide) and **Prof. B. G. Buddhdev** (Internal Guide) and that no part of this report has been directly copied from any students' reports or taken from any other source, without providing due reference.

Name of the Student	Sign of Student
1 Dhruv Ajaykumar Patel	_____

ACKNOWLEDGEMENT

I would want to thank the Civil Engineering Department of Vishwakarma Government Engineering College for enabling me with the opportunity to pursue such training while keeping in the mind the importance of practical knowledge in a career as an acting engineer. I would like to thank our department's head, prof. N. P. Singh, for this incredible privilege.

I had done 12 weeks of training at Ganesha Infracon Contractor base Construction Company in Gandhinagar. I would like to thank Mr. Shaileshbhai Patel for giving me permission to work on their site and for accompanying me with every aspect.

I would like to thank my external guide, Mr. Bhupendrabhai Patel, for accompanying me in every circumstance during the internship and guiding me with detailed information of Construction Buisness and real-life scenarios.

I would like to thank Mr. Mitulbhai Prajapati (site engineer) for providing all practical knowledge for manage different work carried out on site, and supporting throughout out my internship period.

I would like to thank my internal guide, Prof. B.G.Buddhdev, who has always been very accommodating and helped me a lot throughout the internship, including preparing our detailed comprehensive report.

Dhruv .A .Patel

Enrollment no: 190170106039

ABSTRACT

This internship helped me to apply my theoretical knowledge gained during the college academic programme into site and experience professional construction process. It helped me to enhance my skill and to enrich my site knowledge by keeping me update with latest technologies. This opportunity is helped to stay in environment where could think as a civil engineer. It also teaches us the sense of responsibility, taking initiatives, projecting the innovative ideas and most important management.

This report provides a detailed account of the internship experience in a high rise residential building, focusing on the civil engineering aspects of the project. The internship involved working with a team of professionals in the construction industry, including architects, structural engineers, project managers, and contractors. The report covers various aspects of the project, including the site layout, foundation design, structural system, and construction techniques used in the building. The report also highlights the challenges faced during the construction process and the solutions devised to overcome them. The report concludes with a summary of the overall experience gained during the internship and the lessons learned.

This report document contains the knowledge and experience which was gained through internship at 'GANESHA INFRACON'.

List of Figure

List of Tables

Abbreviations

BHK	Bedroom Hall Kitchen
Sq.ft	Square feet
mm	Millimeter
cm	Centimeter
PCC	Plain cement concrete
RCC	Reinforcement cement concrete
RMC	Ready mixed concrete
TMT	Thermo mechanically treated
Kg	Kilogram
G.F	Ground floor
Ø	Diameter
T.M	Transit mixture
WBS	Work breakdown structure
UGWT	Under Ground Water-Tank
MPa	Mega pascal

Table of Contents

Chapter 1 INTRODUCTION

1.1 Company Profile

Ganesha Infracon is located in gandhinagar which is a civil engineer contract-based firm. It was established in 2014. The service provided by construction work of Residential and Commercial Building. Uniqueness of the company is to give the value added concept and quality of work.

The firm is made-up of a dynamic group of forward-thinking professionals which one objective in mind, to give the best and most efficient service to the demanding construction sector, which is concerned with cost containment and service levels.
Project done by company,

- Safal Parisar, new vavol
- Pratistha Heritage, new vavol
- Panjuri Palace, new vavol

1.2 Project Information

Safal bliss is a project worth of thirty-five crore by Ganesha Infracon located at Koba, Gandhinagar in 20,400 sq.ft. It is 4 BHK luxurious G+9 floor residential building with two floor basement parking. Each floor has 4 units.

Figure 1.1 Overview of construction site

Figure 1.2 Site elevation

Certain features of Safal Bliss as follows:

- It is 4BHK, G+9 Residential building project with two basement parking facility.
- Each floor high is 11ft.
- There is one servant room is also provided in each unit.

- Leisure Amenities
  - Rooftop terrace garden with seating
  - AC gym at ground floor
  - Terrace jogging track
  - Children play area
  - Indoor game zone
- As Ganesha Infracon is known for its value added concept, Safal Bliss also has certain unique concept like:
  - Elegant entry lounge
  - 3 car allotted parking space to each unit
  - Rooftop solar system for common areas
  - Fire equipped system
  - Rainwater harvesting system
  - 2 smart automatic lifts

1.3 Site Location

Address:

Safal Bliss near Shivansh 108, K Raheja road, Koba, Gandhinagar, Gujarat-382421

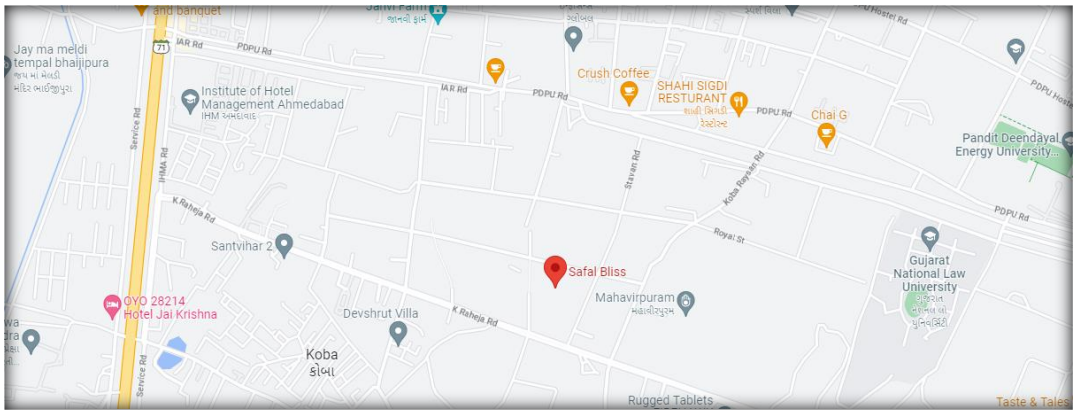


Figure 1.3 Site location

1.4 General Plans

1.4.1 Ground floor plan

- Provided spacious toddlers play zone

- Box cricket for children
- Ac gym
- Home theater
- Multipurpose hall

Figure 1.4 Layout plan of G.F

1.4.2 Unit plan

- Four different types of unit. (A1, A2, A3, A4)
- Four bedrooms, hall, kitchen, two balconies, servant room, puja room, attached toilet.

Table 1.1 Area of unit

Type of unit	Area of unit (sq.ft)
A1	4599
A2	4248
A3	4185
A4	4122

Figure 1.5 Layout plan of unit A1

Figure 1.6 Layout plan of unit A2

Figure 1.7 Layout plan of unit A3

Figure 1.8 Layout plan of unit A4

1.4.3 Terrace plan

- Terrace was planned very unique style and spacious on this site
- Utilities provided on terrace
  - Rooftop Café
  - Yoga deck
  - Acupressure walkway
  - Play court

Figure 1.9 Terrace plan

1.4.4 Key plan

- The overall project is first shown in one or more overall views in drawn in large scale showing the region or vicinity which project is built.

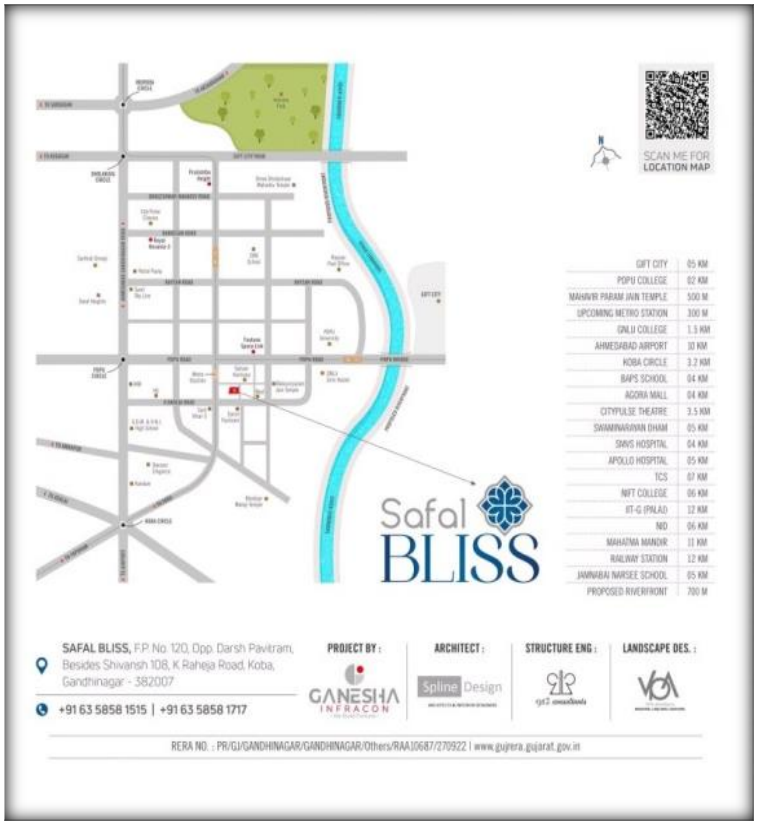


Figure1.10 Key plan

1.5 Internship Summary

Starting as a fresher from day one and learning all the things from the engineers as well as labours to ending the 12 weeks internship with different site responsibilities, this internship concept has helped me to get more clarity in understanding the civil engineering. I have done my internship where foundation work was going on.

1.6 Objective

- To become competent professional for industry ready.
- To get exposure of the current practices of the practical world.
- To learn the application of theoretical knowledge.
- To learn the communication skills with labours, engineers and industrial executives.
- To understand the working pattern of construction industry.
- To get the experience of working under pressure and maintaining work ethics.

1.7 Scope

- Internship has made me industry ready.
- Internship helped me to gain managerial and communication skills.
- Internship will help me to work under the pressurised situations.
- Internship has made me disciplined and responsible for my work.
- Internship has given me helped me to develop problem solving skills which boosted my confidence.
- At last, internship has made me different from the crowd.

1.8 Roles and Responsibilities

- To do the checking.
- To guide the labours in case of problems.
- To analyse certain critical drawings.

Chapter 2 SITE LAYOUT

2.1 General

Site layout in construction is the plan of the construction site that show area and position of various resources and facilities. It involves identifying, sizing and placing temporary facilities such as offices, labour colony, storage areas, etc.

2.2 Site layout

Here is the site layout of Safal Bliss attached where provision of storage area, labour quarters, engineer's office, marketing office, bar-bending area.

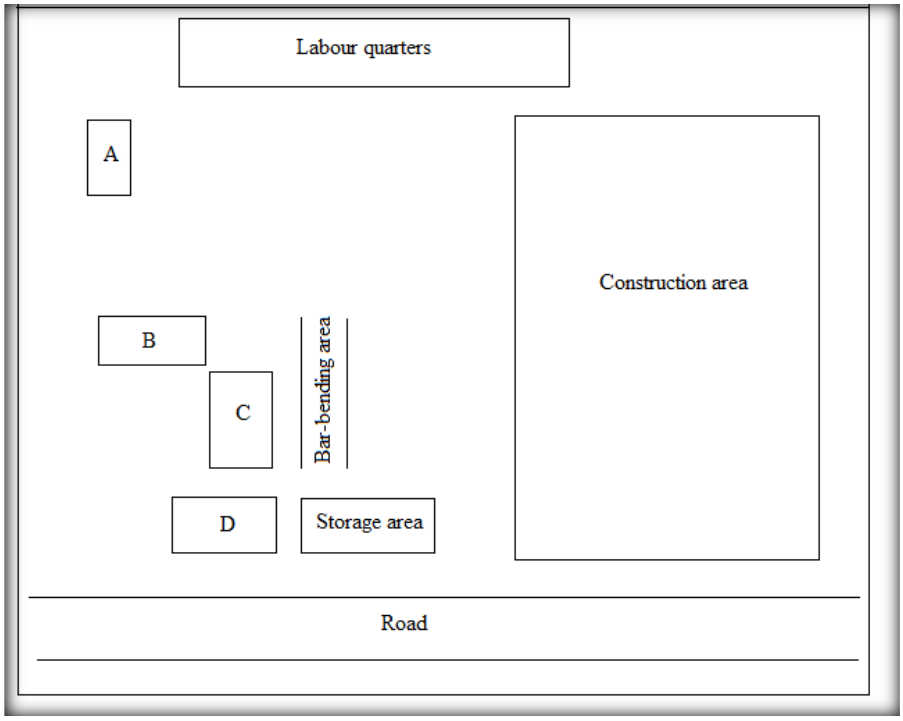


Figure 2.1 Site layout

A= Wash area

B= Builder's office

C= Engineer's office

D= Marketing office

2.2.1 Labour quarter

Labour Quarter is a place where labours working on the site reside. As labours reside far away, it is necessary to give them certain living space, water supply, wash rooms, etc. Hence at Safal Bliss, facility of labour quarter is provided.

2.2.2 Engineer office

It is a temporary cabin made for the daily works on the site. It is used for following purpose:

- To store certain drawing and documents.
- To decide the further plans of working on the site.
- For routine meeting.

2.2.3 Marketing office

Marketing office was constructed for the arranging meeting with client. It is used for making marketing strategy.

2.2.4 Storage area

It is temporary room constructed at the site to store the material like cement, binding wires, cover blocks, electric equipment, safety helmet, etc. so the moisture cannot affect the cement or equipment.

Figure 2.2 Storage area

2.2.5 Bar-bending area

There is some space provided for the cutting and bending of bar at the site is known as Bar-bending area. Threading machine and cutting machine are fixed at bar-bending area.

Figure 2.3 Bar-bending area

2.3 Work breakdown structure

The Project Management Body of Knowledge defines the work breakdown structure as a “deliverable oriented hierarchical decomposition of the work to be executed by the project team”. Division of the main work into smaller works depending upon the importance or level of work.

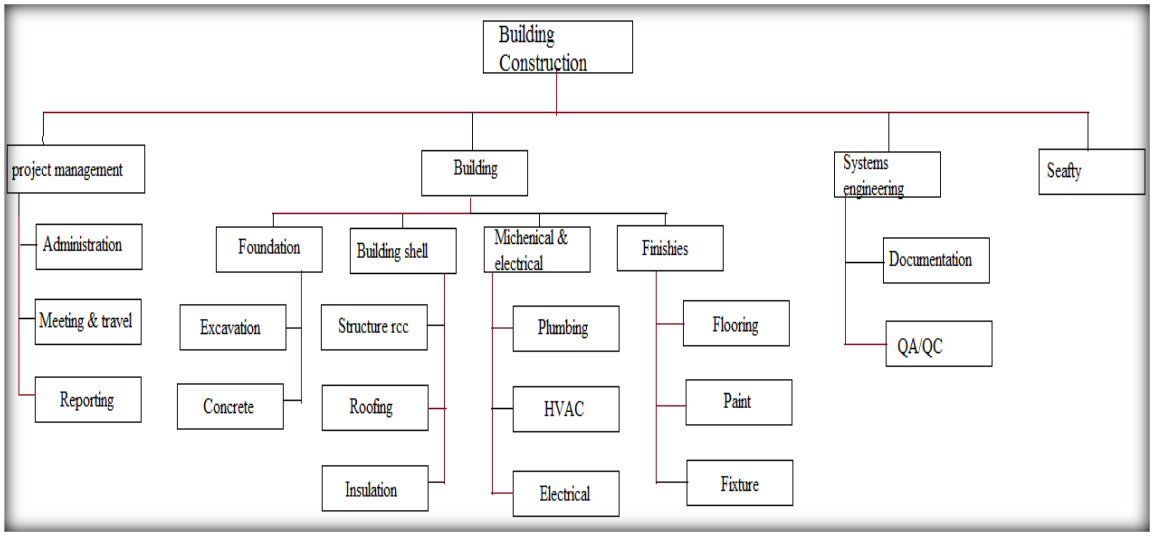


Figure 2.4 Work Breakdown Structure

Chapter 3 CONSTRUCTION MATERIAL

3.1 Shuttering plywood

Shuttering ply is a special type of plywood, designed specifically for concrete formwork. This is the process of building a supported frame which concrete can be poured into.
The formwork structure is temporary. It is created to hold the concrete in the correct dimensions, whilst it sets to hard concrete. Once the concrete has fully gone off, the supports and shuttering ply can be removed.

Figure 3.1 Shuttering plywood

3.2 TMT bars

- Thermo-mechanically Treated (TMT) reinforcement bars were used of Fe-500 grade was used.
- Bar diameter was ranging from 8 mm to 25 mm.
- Reinforcement bar 8mm, 10mm & 12mm are used in slab.
- Reinforcement bar 16mm, 20mm & 25mm are used in beam.
- Reinforcement bar 16mm, 20mm & 25mm are used in column.
- Reinforcement bar 8mm, 10mm and 12mm used in footing.

Figure 3.2 TMT Bars

3.3 Ready Mixed Concrete

Ready mixed concrete was casting material used for casting of structural members like foundation, column, slab, beam, etc.

Table 3.1 Concrete gread

Grade of concrete	Uses location
M10	In PCC
M25	In slab and beam
M30	In column above G.F
M35	In column up to G.F

3.4 Cover block

To avoid the direct contact between reinforcement bars and atmosphere, cover is provided in the structural members. This cover is provided using cover blocks.

Cover size at our site,

- For footing: 50 mm
- For column: 30mm
- For slab: 20 mm

- For retaining wall: 30mm
- For beam: 25mm

Figure3.3 Cover blocks

3.5 Chair for slab

Chair reinforcement or simply chair bars are small structural elements used to properly place reinforcement bars in position and maintain the proper space between the top and bottom reinforcements.

Chair bars are mainly used in slab and footing. It is one of the most important parts of the raft foundations. The diameter of chair bar should not be less than 10 mm.

Advantages of chair bar,

- To hold the reinforcement properly in position.
- To provide strong supports to the bars.
- To provide vertical support to the upper cage reinforcement and lower cage reinforcement in footing and slab.

Figure 3.4 Chair for slab

3.6 Binding wire

Binding Wire is used for tying applications in the field of construction. It is used extensively in the construction sector to tie the re-bars at the joints to keep the structure intact. Binding wire is also called annealed wire and is made of mild steel.

3.7 U head jack

It was used for staging of formwork of slab. To support the formwork of structure from failure during concreting.

Figure 3.5 U head jack

3.8 Boilers

Boilers play the role of *wales* which are attached behind the wooden battens in the horizontal direction to resist the plywood from buckling, in the formwork of vertical members.

Figure 3.6 Boilers

3.9 Clip

It was used to clip the vertical form work in beam, column, etc.

Figure 3.7 Clip

3.10 Wooden batten

Wooden battens were used for studs in the formwork of vertical members. Also, in the formwork of beam and slab, wooden battens play the role of stringer and joists.

Figure 3.8 Wooden battens

3.11 Tie-rods

When concrete is poured, tie rods must be used to keep the formwork in position, that is to say to prevent the distance between two opposite sections of formwork.

Figure 3.9 Tie-rods

3.12 Coupler

Rebar couplers are used for joining rebars with full tension capacity. The ends of bars to be joined are provided with thread, and the bars are joined using a coupler sleeve that transfer the force on the rebar across the connection. Rebar couplers are components which connect two reinforcing bars in longitudinal direction, forming a mechanical splice.

Figure 3.10 Coupler

3.13 Pump slurry

It was mixed in concrete pump before supply concrete from pump to location. It was work as oil for concrete conveyer pipes for easy transportation of concrete. For making frictionless surface in pumping line, pump slurry is passed through it. One packet of 200gm mixed in 50 to 60 liter of water. It was reduce the waste of around 80 kg of cement from one packet.

Chapter 4 CONSTRUCTION EQUIPMENTS

4.1 Bending machine

Bending machines are commonly used at construction sites for bending high diameter bars, such as steel reinforcement bars. These machines come in different types and sizes, depending on the specific application and the diameter of the bar to be bent.

Type of bending machine used for high diameter bars is the rebar bender. Rebar benders are suitable for bending bars up to 32mm in diameter and are commonly used for on-site bending tasks. They are manually operated and easy to use, making them ideal for small to medium-sized construction projects.

Figure 4.1 Rebar bender

4.2 Cutting machine

At construction sites, cutting machines are used to cut high diameter bars, such as steel reinforcement bars, to the required length. These machines come in different types and sizes, depending on the specific application and the diameter of the bar to be cut.

One common type of cutting machine used at construction sites is the hydraulic bar cutter. Hydraulic bar cutters are typically used for cutting high diameter bars ranging from 16mm to 60mm. These machines are powered by hydraulic systems, which provide high cutting forces and precise cutting control. They are also designed with safety features, such as protective covers and emergency stops, to ensure safe operation.

Figure 4.2 Cutting machine

4.3 Threading machine

Threading machine is used for threading in TMT bars, where lapping was done with coupler. Type of threading machine used at construction sites is the portable electric threader. Portable electric threaders are typically used for threading bars up to 32mm in diameter and are commonly used for on-site threading tasks. They are easy to use and lightweight, making them ideal for small to medium-sized construction projects.

Figure 4.3 Threading machine

4.4 Breaker machine

Breaking machine is used for break un-wanted concrete or if some part of concrete want to remove.

Company name: Dong Cheng

Impacting frequency: 900-1890/min

Power: 1500W

Figure 4.4 Breaker machine

4.5 Needle vibrator

Needle vibrator is used for reducing air bubble from concrete, while concreting work was running. The needle vibrator consists of a steel tube, known as a poker, with one end being closed and rounded. There is an eccentric vibrating element inside it. The poker is connected to an electric motor (or a diesel motor) through a flex tube.

Size of needle was selected according to structure.

- 25 mm needle size was used for slab & beam.
- 40 mm needle size was used for column.
- 60 mm needle size was used for footing.

Figure 4.5 Needle vibrator

4.6 Total station

Total station was used at construction site for measuring angles accurately, for giving the starter points of column, for foundation surveying, etc.

It is used to calculation distance from 3 to 5 km.

Company: SOKKIA

Figure 4.6 Total station

Figure 4.7 Points given by Surveyor

4.7 Concrete pump

A Concrete Pump is used in conveying freshly mixed concrete from the containers to where it needs to be filled at the construction site. There are three types of concrete pump.

- Boom or Truck mounted pump
- Trailer, line, or stationary pump
- Specialized usage pump

At our site stationary type concrete pump was used for conveying concrete.

Figure 4.8 Concrete pump

4.8 Backhoe loader

Backhoe is widely used equipment which is suitable for multiple purposes. This is well useful for excavating trenches below the machine level and using front bucket loading, unloading and lifting of materials can be done.

Company: JCB

Capacity: 8000 kg

Backhoe Bucket Capacity: 0.26 CM

Figure 4.9 Backhoe loader

4.9 Transit mixture

Transit mixers, also known as concrete mixers or ready-mix concrete trucks, are commonly used on construction sites for transporting and mixing concrete. Transit mixers come in various sizes, ranging from small portable mixers to large trucks that can carry up to 10 cubic meters of concrete.

The transit mixer consists of a rotating drum mounted on a truck chassis. The drum is made of steel and has blades inside that rotate in one direction to mix the concrete during transportation. The truck is equipped with a hydraulic system that allows the drum to rotate continuously during transit.

Figure 4.10 Transit mixture

4.10 Wooden cutter

It is cutting machine using for cutting plywood sheets for making formwork of beams and columns.

Company: Inditrust

Item Weight: 3kg 150g

Rpm: 13000

Figure 4.11 Wooden cutter

4.11 Auto level

An auto level is an optical instrument that can be used to establish or verify points on the same horizontal plane, and it has an internal mechanism that eliminates variation and inaccuracy from measurements.

Company name: Topcon

Minimum focus: 20cm

Objective Aperture: 36mm

Figure 4.12 Auto level

Chapter 5 FOUNDATION

5.1 General

The structural element connected to the soil (directly/on PCC) which plays the major role for the uniform load distribution of the building is called foundation. Deformation in the foundation means fall down of whole structure.

5.2 Types of footings

- Strip footing
- Spread footing
- Trapezoidal footing
- Isolated footing
- Combined footing
- Stepped footing
- Raft footing
- Strap footing

5.3 Types of footing used at site

There is trapezoidal footing was used for foundation work at Safal Bliss. Two type of footing was done.

5.3.1 Isolated footing

An isolated footing is used to support a single column's load. Its plan is usually square or rectangular. It is the simplest, most cost-effective, and most widely used type of footing. Square footings are used to reduce bending moments and shearing forces at critical sections. There are 35 number of isolated footing was provided at our site.

5.3.2 Combined footing

When two or three columns are located very near to each other, we provide single sub-structure for them and this footing is known as combined footing. There are 4 number of footing was provided at our site.

Figure 5.1 Isolated and Combined footing

Table 5.1 Dimension of footing

Type of footing	Name of footing	Dimension of footing (mm x mm)	Number of footing
Isolated footing	F1	4145 x 2700	4
	F2	4445 x 3000	3
	F3	4745 x 3000	1
	F4	5095 x 2950	1
	F5	4895 x 3300	2
	F6	4895 x 3300	4
	F7	5345 x 3450	1
	F8	5395 x 3100	1
	F9	3680 x 1950	1
	F10	3600 x 2750	5
	F11	4050 x 3200	3
	F12	4200 x 3350	1
	F13	4350 x 3500	2
	F14	2400 x 2400	4
	F15	2250 x 2250	1
Combined footing	CF1	6892 x 3372	2
	CF2	8900 x 10,590	2

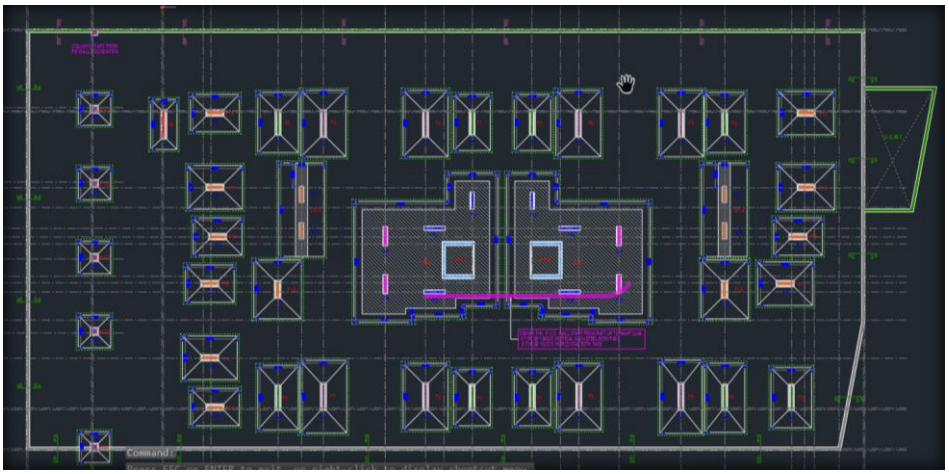


Figure 5.2 Footing layout

5.4 Steps of foundation at site

- Marking on PCC
  - Points are marked using total station.
  - Line out for the columns, lift and shear wall are made using the color.

- Reinforcement
  - Reinforcement bars of required cutting length are made.
  - Reinforcement bars of foundation are fixed with cover blocks of 50 mm.
  - Reinforcement bars of columns are inserted at the line out places leaving the cover of 40 mm and then pedestals are made to maintain the position of column. (Shown in fig 5.3)

- Formwork
  - After providing the cover block of 50 mm formwork was done using the 18 mm waterproof plywood on the periphery of foundation. (Shown in fig 3.4)

- Concreting, curing and de-shuttering
  - Concreting of the foundation was done with M30 grade Ready Mixed Concrete by pumping method. Curing was done for 14 days and de-shuttering after 14 days.(Shown in fig 5.5)

Figure 5.3 Reinforcement of footing

Figure 5.4 Formwork of footing

Figure 5.5 Curing of footing

Chapter 6 PEDESTAL & TIE BEAMS

6.1 Pedestal

6.1.1 General

Pedestals are provided as structural member between column and footing to transfer the load from column to footing.

Figure 6.1 Pedestal

6.1.2 Step of construction

- Reinforcement of pedestals were done before casting of footing and after fixing the main reinforcement of columns.
- During the concreting of raft, shear keys were provided in the pedestal area for batter strength.
- Formwork was done after the raft was casted.
- Concreting of pedestals was done using pumping as well as dumping method and with M30 grade concrete.
- De-shuttering after 24 hours and curing for 7 days.

6.1.3 Advantages

- Pedestals support the structure where load of columns is very high.
- Pedestals help to reduce the size of columns.
- Pedestals reduce the chances of buckling in columns.
- Pedestals reduce the dead load of the structure.

6.2 Tie beam

6.2.1 General

A tie beam is a horizontal structural member that is used to connect two or more columns in a building, typically at the top of the columns. It is also sometimes referred to as a bond beam, lintel beam, or simply a tie. The purpose of a tie beam is to provide lateral stability to the columns and to prevent them from buckling or toppling over, especially in seismic or wind-prone areas.

In foundation construction, tie beams are often provided to join the footings of adjacent columns or piers. This helps to distribute the load of the building evenly and prevent differential settlement, which can cause the building to tilt or crack. Tie beams are usually made of reinforced concrete, which is strong and durable, and can be cast in place or precast off-site and installed later.

Tie beams can also be used in roof construction to tie the walls together and provide additional lateral support. In this application, tie beams are sometimes called collar ties or ceiling joists. Overall, tie beams are an important structural element in many types of construction, and they play a critical role in ensuring the stability and safety of buildings.

Figure 6.2 Tie beams

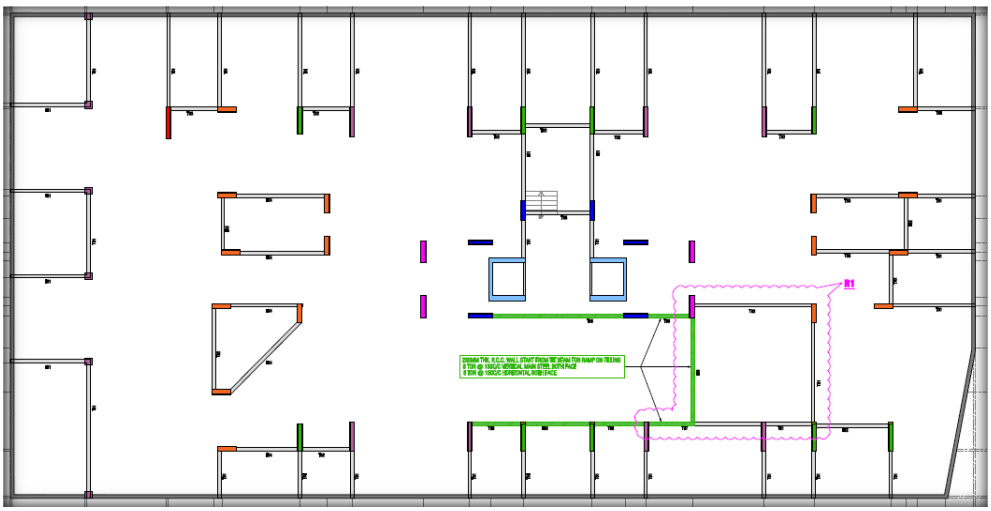


Figure 6.3 Layout of tie beams

Chapter 7 COLUMNS, LIFT AND RETAINING WALL

7.1 General

In the framed structure, columns are the vertical load bearing structure which uniformly distributes the load through compression to the earth. Also, it plays the role of aesthetics. They are designed with the heavy reinforcement bars of minimum 16 mm diameter.

7.2 Detailing of columns, lift and Retaining wall

- Columns at Safal Bliss had a cover of 40 mm.
- Lap in the columns were provided at the center of the length. Also, lap was not provided at the same location in side-by-side main bars.
- Lap was done with the couplers.
- After certain height size of the columns was reducing. So, it was done by bending the reinforcement bars in the beam and also reducing couplers were used for lapping .To provide the anchorage of the ending beam in columns, certain columns below the slab level.
- For casting the columns, firstly starters of 75 mm height were casted.
- Stirrups used for the columns were of 8 mm and 10 mm diameter. Also, stirrups were closely spaced (115mm c/c) in the area L/4 from bottom and top of the column in order to resist the shear failure.
- Minimum hook length of stirrups was kept 75 mm and bent was kept of 45°.
- Formwork was of 18 mm plywood whose de-shuttering was done after 24 hours.

7.3 Starter

To maintain the position and dimensions of column throughout the building, firstly columns were casted only up to 75 mm height taking the points from total station as references. This 75 mm casted column is called starter.

Figure 7.1 Formwork of starter

Figure 7.2 Casting of starter

7.4 Construction of Column From foundation

- After the reinforcement of footing, main bars of column with development length were inserted in the footing. Direction of development length was kept towards column. Stirrups of the column that come in the footing were kept during the reinforcement of footing.
- After fixing main bars and casting of foundation, stirrups were tied.

- Marking starter points and casting of starters.
- Formwork and casting with M30 grade concrete.
- De-shuttering after 24 hours and curing for 7 days.

7.5 Construction of Column From slab

- Marking starter points using total station.
- Casting of starters.
- Fixing main bars and stirrups.
- Formwork and casting with M30 grade concrete.
- De-shuttering after 24 hours and curing for 7 days.

7.5.1 Steps for reinforcement in columns

Following are the steps followed for reinforcing of columns.

- Main bars are fixed as shown in Fig7.3.
- Master ring is fixed which covers the whole span of a member.
- Stirrups are fixed and cover blocks are tied.
- Lap in the main bars were given at the center and in side-by-side main bars, laps were not provided at same position. Here, couplers were used for the lapping in column.

Figure 7.3 Reinforcement in lift wall

7.5.2 Formwork of column, lift and Retaining wall

Following are the steps followed for the formwork of column.

- Keeping the cover, Shuttering is done along with studs.
- Battens are fixed and tie rods are attached.
- For more support, shuttering clamp is used.
- Also, cleats are provided.

Figure 7.4 Formwork of column

Figure 7.5 formwork of retaining wall

7.5.3 Concreting of column, lift and Retaining wall

- Concreting is done with manual process.
- Proper scaffolding should be provided to support the masons.
- Needle vibrator of 30 mm needle was used.
- Due to the fall from height, segregation also takes place so it is very important to use shuttering vibrators for casting of vertical members like columns, shear wall, etc.

Figure 7.6 Concreting of column

Chapter 8 BEAM

8.1 General

A beam is a horizontal structural member in a building to resist the lateral loads applied to the beam's axis. The structural member which resists the forces laterally or transversely applied to the (beam) axis is called a beam.

The loads act transversely to the longitudinal axis, which produces the shear forces and bending moment. The lateral load acting on beams is the main cause of the bending of the beam. They are responsible for transferring a load from the slab to the column.

8.2 Detailing of beam at site

- Beam was casted with M25 grade concrete.
- Beam was having the depth varying from 300 mm to 750 mm and width was varying from 115 mm to 300 mm.
- Beam had the cover of 25 mm.
- Beam had reinforcement bars varying from 12 mm to 25 mm.
- Stirrups in the beam were of 8 mm and 10 mm with hook length of minimum 75 mm and hook bend of 45°.
- Generally, stirrups were closely spaced near the columns and also extra bars were given at some locations. Also, there should be no gap between the bents of stirrup and main bars of beam.
- Centering of beam was done with 12 mm plywood.
- Near the ramp, inverted beam was there.
- In the longitudinal direction of ramp, sloped beam was there.

8.2.1 Size of beam at site

There was different size of beams provided on our site. The size of beams was given below.

Table 8.1 Details of beams

No	Width of beam (mm)	Depth of beam (mm)
1	230	600
2	300	600
3	230	725
4	230	625
5	230	550
6	300	450
7	115	300

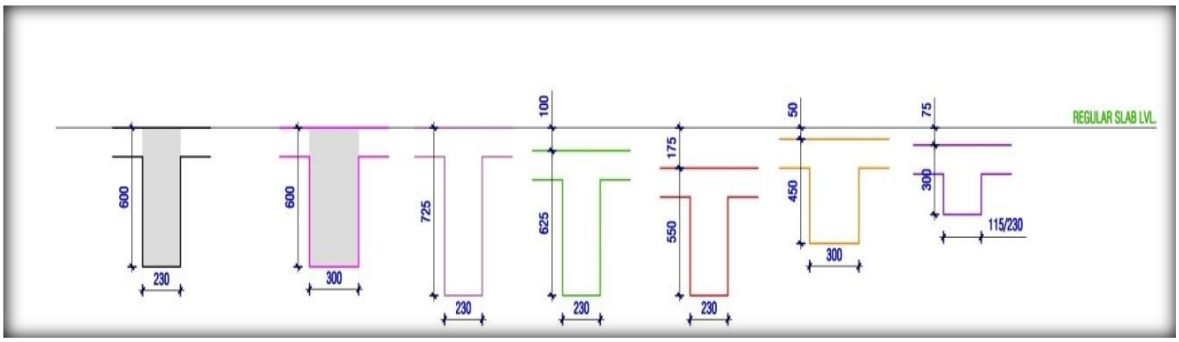


Figure 8.1 Details of beam

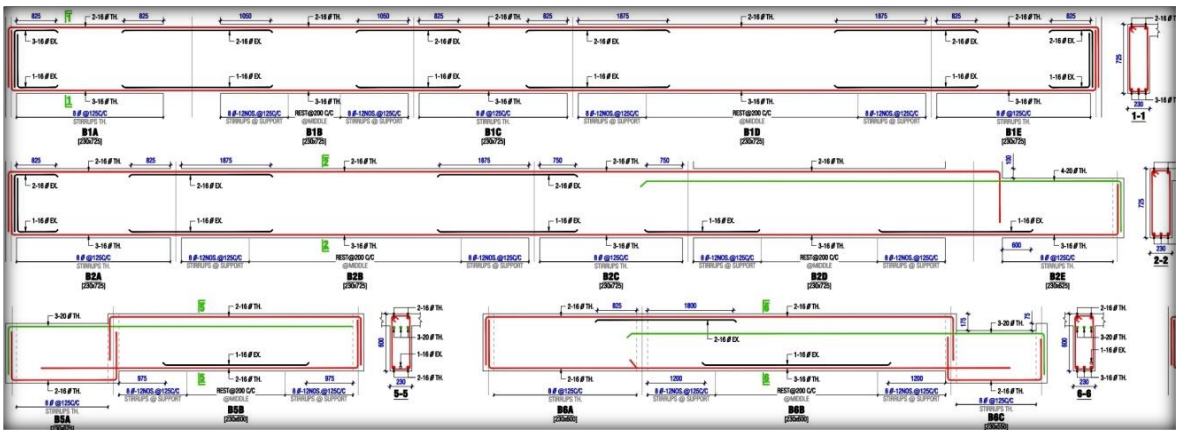


Figure 8.2 Reinforcement Details of beam B1,B2 and B3

8.2.2 Inverted beam

Inverted beam is same like regular beam. When the slab is placed so that the bottom surface of the beam and the slab are the same level, it gives an inverted T shape junction. Hence, it is called inverted beam.

Figure 8.3 Inverted beam

8.3 Steps of construction

- Level of beam bottom was marked on column.
- Formwork of beam bottom was done.
- Formwork of side of beam was done.
- Measuring distance between different beams according to drawing.
- Check level of formwork with water tube.
- Reinforcement provided to the beams.
- Casting of beam with M25 Grade concrete with the help of concrete pump.
- Curing of beam for 10 days and de-shuttering of side of beam in 24 hours and bottom of beam in 14 days.

8.3.1 Formwork of beam

Following are the steps followed for the formwork of beam and slab.

- Level of beam is transferred from the known level.
- Level of beams is marked on the column.
- Staging is done for beam taking this marked levels as reference.
- Joists and stringer are attached on the U-jack of staging.
- Centering and shuttering of the beam is done.

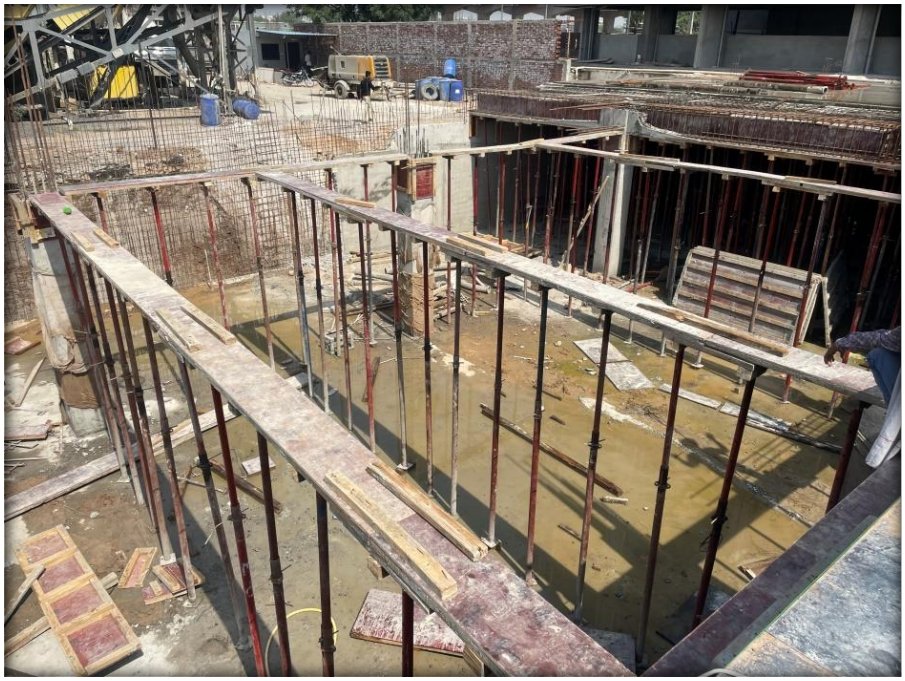


Figure 8.4 Formwork of beam bottom

Figure 8.5 Formwork of beam sides

8.3.2 Reinforcement of beam

Following are the steps followed for reinforcing of beam.

- Main bars and stirrups are reinforced keeping the cover of 30 mm hanging at a certain height. The two sides of beam are anchored in the column and lapping is not provided in the region near to L/4 of beam column junction.
- After the reinforcement is done, beams are loosened to its original position.
- In the beam column junction, beam reinforcement bars are passed from inside the columns and at that place if gap remains between stirrup bent and main bar, extra bar of 12 mm is kept in that portion.
- If there are two layers of reinforcement bars in tension zone or compression zone, then pin of 25 mm is kept between the two layers so that maximum size of aggregate can pass through it.

Figure 8.6 Beam in hanging position

Figure 8.7 Beam in final position

Chapter 9 SLAB

9.1 General

A concrete slab is a horizontal structural element that is poured or placed in construction to provide flat surfaces. It can be used for roofing, flooring or covering.

9.2 Detailing of slab at site

- Slab was casted with M25 grade concrete.
- Generally, thickness of slab was 150 mm and at certain positions slab was kept up to 175 mm.
- Centering was done with 18 mm plywood.
- Alternate bent ups were given and also alternate extra bars were provided.
- Bent ups and extra bars were there near the beams.
- In the areas like washroom, chhaja, etc. sunk slab was provided.

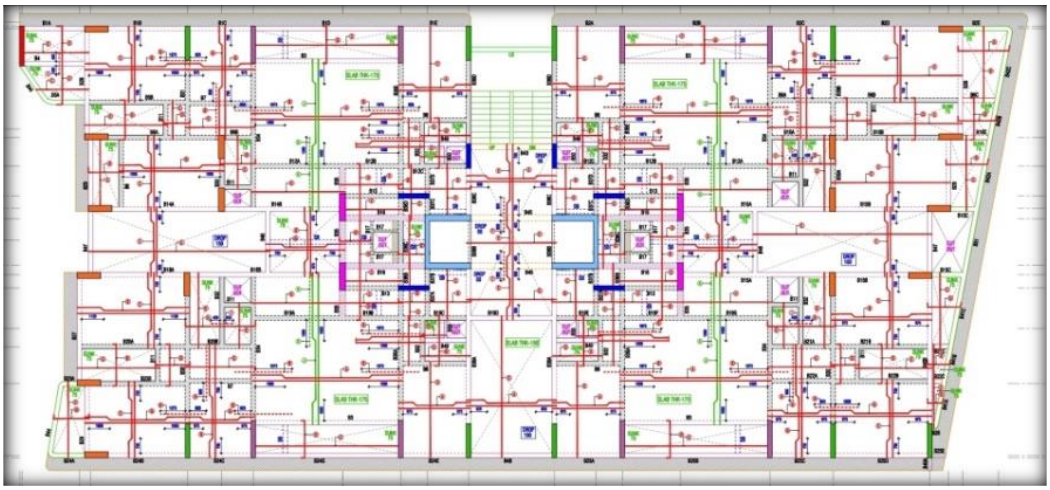


Figure 9.1 Details of G.F slab

Figure 9.2 Reinforcement details of G.F slab

9.3 Construction steps of slab

- Formwork of slab was done
- Leveling of formwork was done with water tube.
- Marking for distribution bar on formwork of slab.
- Electric pipe was provided.
- Reinforcement was done.
- Casting of slab was done with M25 Grade concrete.
- Curing of slab and de-shuttering after 7 days.

9.3.1 Formwork of slab

- After the formwork of beam is completed, formwork of slab is done with the same procedure.

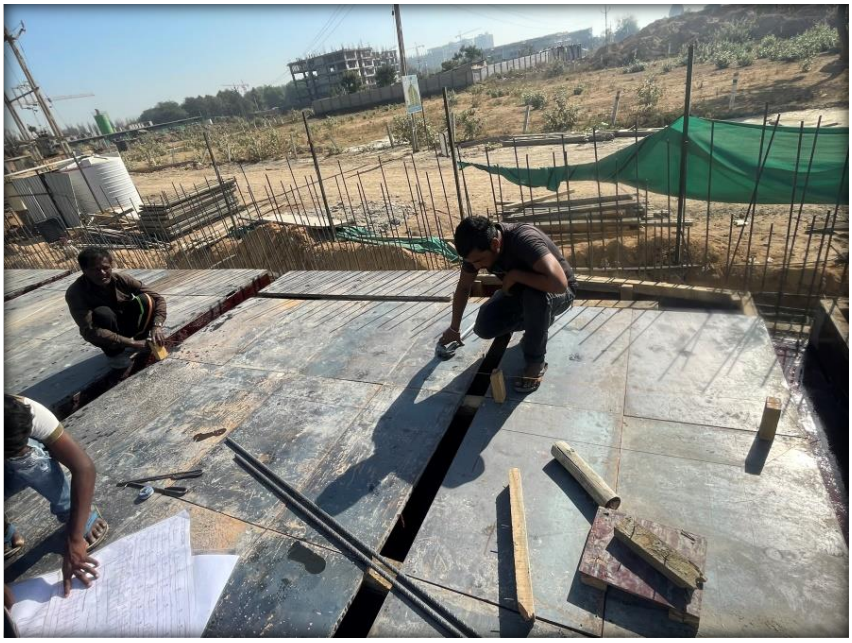


Figure 9.3 Formwork of slab

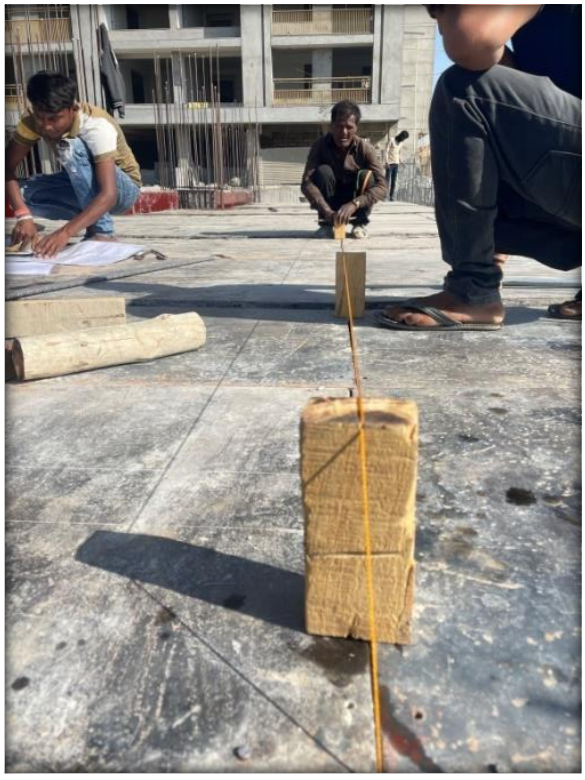


Figure 9.4 level of slab with rope

Figure 9.5 Level of slab with water tube

9.3.2 Reinforcement of slab

At site, two type of slab was provided,

- One way and two way slab for normal areas.
- Sunk slab was provided in the washroom and balcony.
- Sunken slab is a type of slab provided to maintain architectural design in areas where drainage system or pipes are installed below the floor or tiles such as in the washroom, as well as laundry areas.

Following are the steps for reinforcing of slab,

- After fixing the beam at its original position, position of the reinforcement bars is marked.
- On the marked positions, reinforcement bars are placed.
- The placed reinforcement bars on marked positions are fixed after providing the cover of 25 mm.
- Lapping is done
- Alternate bent ups are provided..
- Extra bars are fixed.

- Then in the same procedure, reinforcement of sunk in the slab is done.

Figure 9.6 Marking on slab

Figure 9.7 Reinforcement on slab

9.3.3 Concreting of slab

- Concreting of foundation and slab was done with the pumping method.
- Care should be taken that cold joints are not formed near the beams or columns.
- Concreting should be started from the farthest point.
- For concreting of foundation and slab slightly higher slump is recommended (150-160 mm).
- While concreting of foundation and slab, presence of supervisor, fitter and carpenter is must.
- Thickness of concreting should be done.
- Level of the foundation and slab should be checked during concreting using dumpy level.
- Before starting the concreting, whole formwork should be checked in order to know the force it can resist.

Figure 9.8 Concreting of slab and beam

9.3.4 Curing of slab

- Curing is the process of maintaining the temperature of concrete by avoiding the moisture loss.

- To get the proper strength of concrete, hydration of cement should occur properly. This hydration process leads to generation of heat which in turn results to loss of moisture from the concrete.
- Due to this loss of moisture, concrete shrinks and shrinkage cracks are developed in the concrete.

Figure 9.9 Curing of slab

Chapter 10 STAIRCASE

10.1 General

Staircase is an important component of a building providing access to different floors and roof of the building. It consists of a flight of steps and one or more intermediate landing slabs between the floor levels. In our site U shaped staircase provided.

10.2 Stair case details

Size of staircase is give below,

Table 10.1 Details of Staircase

Location	Size of riser	Size of tread	Size of landing mm x mm
2nd basement to 1st basement	167 mm	300 mm	4150 x 2000
1st basement to Ground floor	167 mm	300 mm	4150 x 2000
Ground floor to 1st floor	150 mm	300 mm	4150 x 2000
Above the first floor	165 mm	300 mm	4150 x 2000

10.3 Steps for construction

Following steps are followed for construction of staircase,

- Firstly, shear wall was constructed to support the
- Centering of slope was done.
- Reinforcement bars were fixed in the landing and staircase.
- Shuttering for risers in the staircase.
- Casting of staircase using M25 grade concrete.
  - For casting the staircase slump was kept higher.
  - Casting of staircase was started from the lower level of slope.
- De shuttering after 7 days and curing for 14 days.

10.3.1 Steps for formwork

Following are the steps followed for the formwork of staircase,

- Staging was done firstly.
- Provide main plywood sheet on bottom of staircase.
- Distributed Reinforcement bar was provided.
- Shuttering work done side by side.
- Formwork of riser was done.

Figure 10.1 Reinforcement of staircase

Figure 10.2 Formwork of staircase

10.3.2 Concreting of staircase

- Casting of staircase should be started from the lower level.
- Slightly higher slump is kept (160 mm).
- Casting of staircase is done by pumping method.
- In staircase, needle vibrator of 30 mm needle was used.

Chapter 11 RAMP

11.1 General

Ramp is a slope provide during construction of building for the entry and exit of vehicles to basement parking. Ramp has a beam in its longitudinal direction as well as in the transverse direction at certain distances.

11.2 Steps of construction of ramp

- Points of the slope are marked.
- Formwork.
- Fixing of reinforcement bars.
- Casting starts from the bottom level and is done with pumping.
- De-shuttering was done after 14 days and curing was done for 14 days.

11.2.1 Steps for formwork of ramp

Following are the steps followed for the formwork of ramp.

- Starting and ending level of the ramp is marked and accordingly whole slope of the ramp is marked.
- Staging for beam is done taking the reference of marked levels.
- Centering and shuttering of beam that are coming in the ramp are done. Here, critical care should be taken while setting the level of beam in order to attain proper slope.
- Staging of ramp slab is done after the reinforcement of beam.
- Centering of ramp slab is done taking the beam levels as reference to attain the proper slope.

Figure 11.1 Level of ramp shuttering

Figure 11.2 Formwork of ramp

11.2.2 Section plan of lower basement ramp

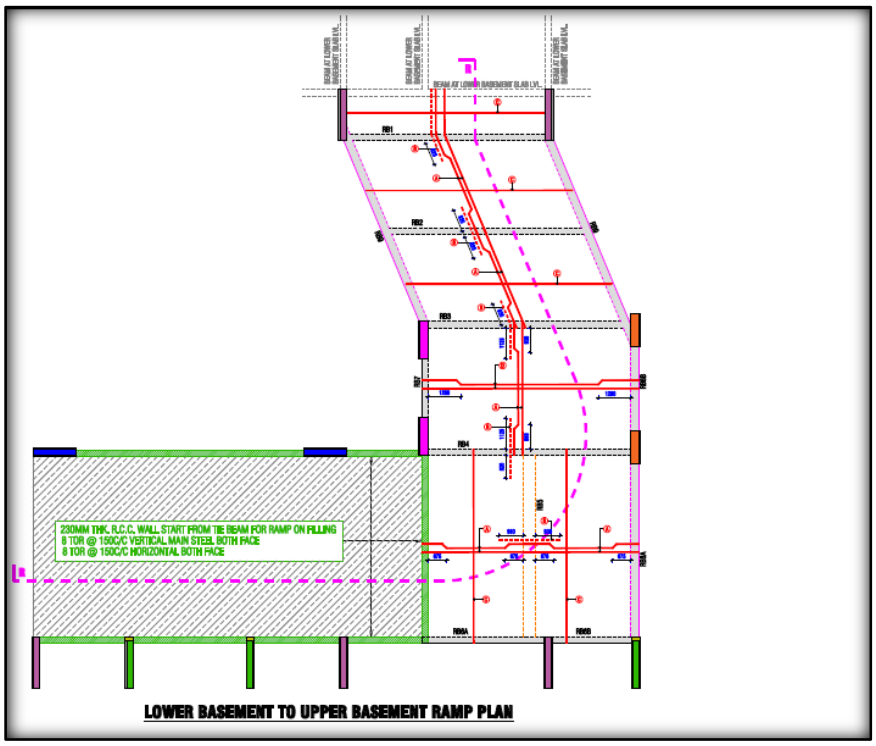


Figure 11.3 Lower basement ramp plan

11.2.3 Section plan of upper basement ramp

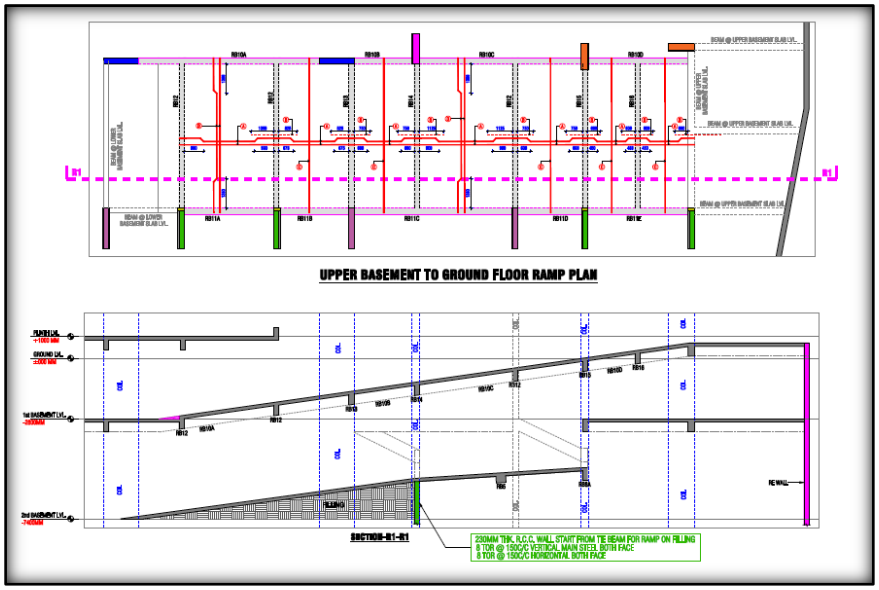


Figure 11.4 Upper basement ramp plan

11.2.4 Concreting of ramp

- Casting of ramp and staircase should be started from the lower level.
- Slightly higher slump is kept (180 mm).
- Casting of staircase is done by dumping method.
- Casting of ramp is done by pumping method.
- In staircase, needle vibrator of 30 mm needle was used

Figure 11.5 Concreting of ramp

Chapter 12 UNDER GROUNG WATER TANK

12.1 General

Under Ground Water Tank was constructed in residential building for purpose of store the water. The water stored in water tank is used for fire safety system, for domestic purpose and to collect water coming from rain-water harvesting system.

12.2 Details of water tank

- Size : 8.9m x 4.2m x 3.3m
- Grade of concrete : M25
- Free board : 300mm
- Capacity : 1,00,000 liter
- Slab thickness : 150mm
- Location : Below upper basement slab
- Sump size : 500mm x 900mm x 300mm
- Manhole size : 600mm x 600mm

12.2.1 Section plan of UGWT

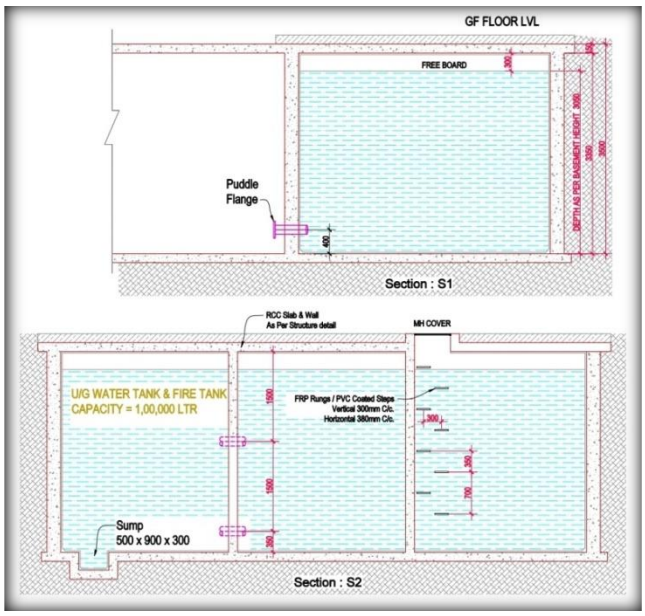


Figure 12.1 section plan of UGWT

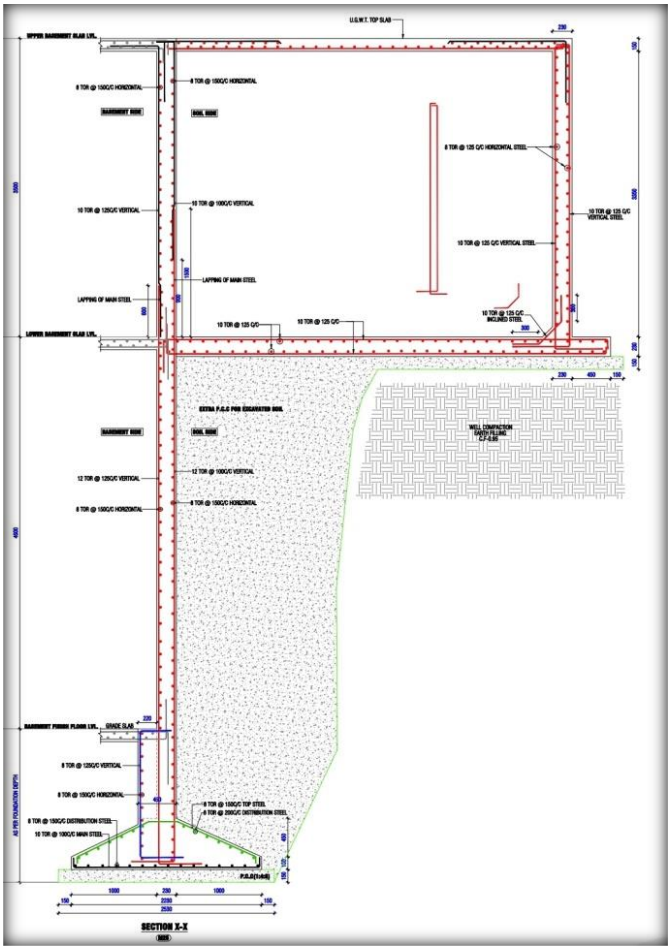


Figure 12.2 steel details of UGWT

12.2.2 Sump

Sump was lower part of water tank provide for the removal of unwanted water from tank.

The water pump was fixed in sump. Size of sump at our site was 500mm x 300mm x 900mm.

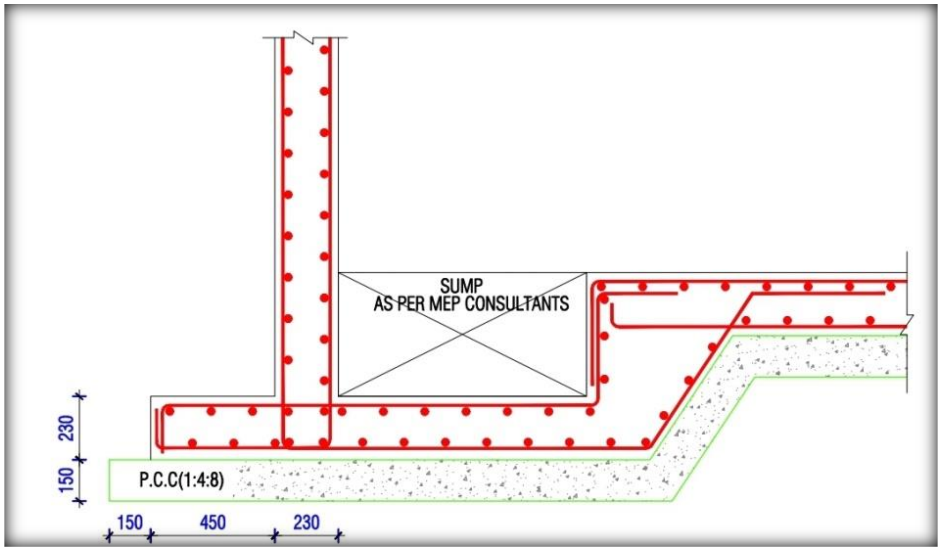


Figure 12.3 Typical section of sump

12.2.3 Manhole

The main purpose of the construction of a manhole is trenchless rehabilitation for the sewer system, an inspection of a drainage system, cleaning the clogged line, and maintenance purpose, also it an initial step for entering the inside sewer line and finding out a problem with it and it also helps to replace the damaged pipe without need of digging work.

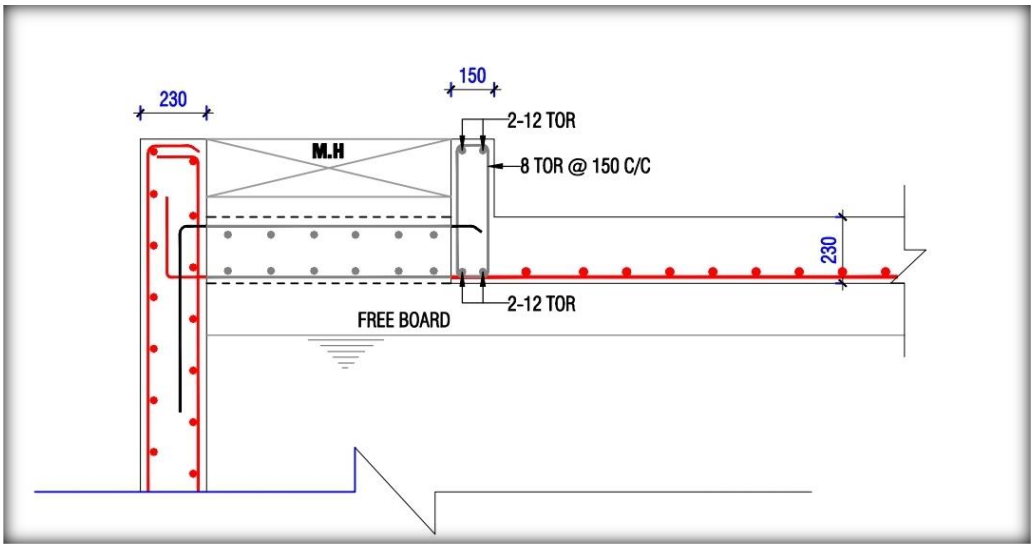


Figure 12.4 Typical section of manhole

Chapter 13 TEST ON SITE

13.1 Concrete Cube test

The concrete cube test is a standard test conducted on-site to determine the strength of the concrete. The test involves casting and curing concrete samples in the shape of cubes of specific dimensions, typically 150mm x 150mm x 150mm.

Here are the steps involved in conducting a cube test on concrete on-site:

- Sampling: The concrete sample is collected from the construction site and transported to the laboratory for testing.
- Cube Mould Preparation: Clean and lubricate the inner surfaces of the cube mould to ensure that the concrete can be easily removed after curing.
- Casting: The fresh concrete is poured into the cube moulds in three layers, and each layer is compacted with a vibration hammer or a rod to ensure that the concrete is evenly distributed in the mould.
- Curing: After casting, the cube moulds are covered with a plastic sheet to prevent moisture loss and kept in a curing tank with a temperature of 27 ± 2 °C for 28 days.
- Testing: After 7 & 28 days of curing, the cubes are removed from the moulds and placed on a compression testing machine. The maximum load at failure is recorded, and the compressive strength of the cube is calculated by dividing the maximum load by the cross-sectional area of the cube.

The cube test is an essential test to ensure the quality of concrete used in construction. It helps to determine the strength of the concrete and whether it is suitable for the intended application.

Result of test,

- After 7 days of curing, the expected compressive strength of good concrete should be about 60-70% of the 28-day strength.
- After 28 days of curing, the expected compressive strength of good concrete should be at least 30 MPa.

Figure 13.1 Concrete cube testing machine

Figure 13.2 Cube moulds

Chapter 14 CONCLUSION

It was a wonderful learning experience at GANESHA INFRACON. During the internship improve a lot of insight regarding almost every aspect of practical work. Working exposure is given in almost all the departments at the site. In order to integrate and work closely in each section is a challenging task to one person especially when he is fresh or beginner. During trainee period realized that observation, recording, analysis and timely decision making are the main element of effective functioning.

From Internship learned that besides the knowledge the good engineer must have the management technique, planning of the construction work. Also learn the way of work in an organization, the importance of being punctual, the importance of maximum commitment and the importance of team spirit. Various things which could not have been possible theoretically were possible to be learnt.

This internship is an excellent opportunity to learn from ground level and experience the things that never giving through going straight into a job.

Personal experience that simultaneously of the practical knowledge and also studying of college is best to implement and develop the mind and personality as civil engineer.

Interaction with workers and local public was also a great experience, during internship.

REFERENCES

- BIS Indian Standard:456 (2000) 'Plain and Reinforced Concrete Code of Practice[CED 2: Cement and Concrete]'.
- IS : 9556 (1980): Design and Construction of Diaphragm Wall.
- https://en.wikipedia.org/wiki/Construction
- https://www.basiccivilengineering.com
- https://theconstructor.org
- Book of building construction technology by R. P. Rethaliya
- Book of RCC structure by B.C. Punmia.
- BIS Indian Standard:516 (1959) 'Method of Tests for Strength of Concrete [CED 2:Cement and Concrete]'.
- Building Construction by B.C. Punmia, Ashokkumar jain; Arunkumar jain.1.
- National Building Code of India (NBC), 2016.