A Study on Super Structural Construction Work Process of Ten Storied Residential Building

Practicum Report

by

Md. Samim Alam

ID#14206071

Program: BSCE

IUBAT—International University of Business Agriculture and Technology

Dhaka

August 20, 2019

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Examination Committee

Position	Name	Signature
Chair, Dept. of Civil Eng.	Professor Dr. Md. Monirul Islam	
Supervisor	Md. Anisuzzaman Khan	

Department of Civil Engineering
College of Engineering and Technology (CEAT)

IUBAT—International University of Business Agriculture and Technology

This practicum report is done for the partial fulfillment of requirements for the Bachelor of Science degree at the

IUBAT−International University of Business Agriculture and Technology, Dhaka, Bangladesh.

Dhaka

August 20, 2019

Letter of Transmittal

August 20, 2019

Prof. Dr. Md. Monirul Islam

Chair and Course Coordinate, Department of Civil Engineering

IUBAT— International University of Business Agriculture and Technology

4 Embankment Drive Road, Sector 10, Uttara Model Town,

Dhaka 1230, Bangladesh

Subject: Submission of Practicum Report

Dear Sir,

This is a great opportunity and immense pleasure for me to submit our internship report on **"A Study on Super Structural Construction Work Process of Ten Storied Residential Building".** I have got the opportunity to work in **B H Builders Limited** for my internship program, which is an essential part of my academic program.

I have tried my level best to prepare this report to the required standard. It was certainly a great opportunity for me to work on this report to actualize my theoretical knowledge in the practical field.

I express my heart full gratitude to you to go through this report and make your valuable comments. It would be very kind of you, if you please evaluate my performance regarding this report.

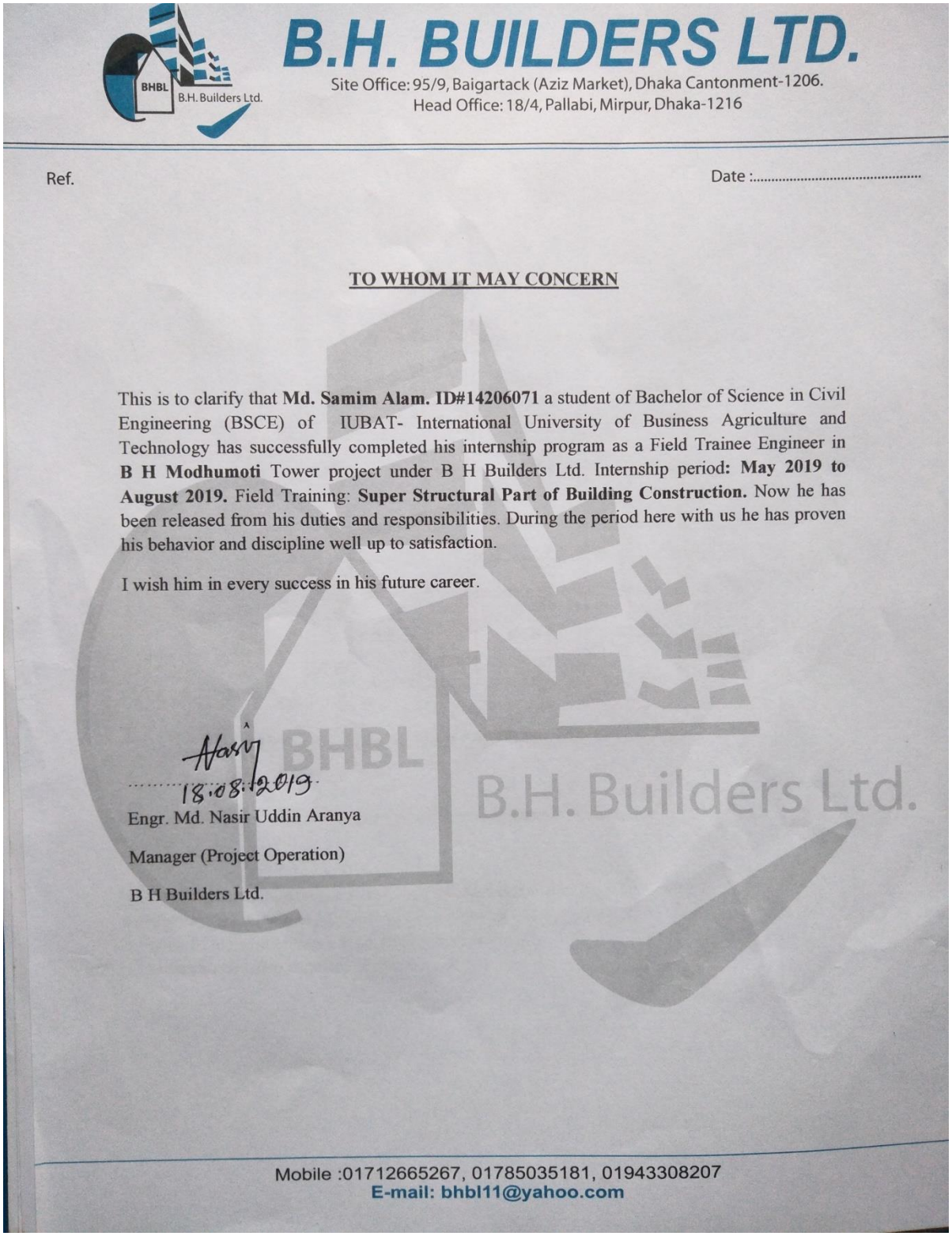
Thank You,

Sincerely Yours,

…….

Md. Samim Alam

Recommendation Letter



B.H. BUILDERS LTD.

Site Office: 95/9, Baigartack (Aziz Market), Dhaka Cantonment-1206.
Head Office: 18/4, Pallabi, Mirpur, Dhaka-1216

Ref.

Date :.....

TO WHOM IT MAY CONCERN

This is to clarify that **Md. Samim Alam. ID#14206071** a student of Bachelor of Science in Civil Engineering (BSCE) of IUBAT- International University of Business Agriculture and Technology has successfully completed his internship program as a Field Trainee Engineer in **B H Modhumoti** Tower project under B H Builders Ltd. Internship period**: May 2019 to August 2019.** Field Training: **Super Structural Part of Building Construction.** Now he has been released from his duties and responsibilities. During the period here with us he has proven his behavior and discipline well up to satisfaction.

I wish him in every success in his future career.

18.08.2019

Engr. Md. Nasir Uddin Aranya

Manager (Project Operation)

B H Builders Ltd.

Mobile :01712665267, 01785035181, 01943308207
E-mail: bhbl11@yahoo.com

Student Declaration

I am Md. Samim Alam, ID: 14206071, declaring that this internship report on **"A Study on Super Structural Construction Work Process of Ten Storied Residential building"** has only been prepared for the partial fulfillment of the degree Bachelor of Science in Civil Engineering (BSCE).

It has not been prepared for any other purpose, reward, or presentation and has not been submitted by us for any Degree, Diploma, Title or Recognition before.

……..

Md. Samim Alam

Program: BSCE

ID # 14206071

Executive Summary

“A Study on Super Structural Construction Work Process of Ten Storied Residential building” is the title of this report which is based on four months internship working experience as a trainee engineer in **B. H. Builders Limited**. It is quite difficult for me to cover every single details of a construction project within four months but I tried my best to explain important parts of construction work. During the practicum period I have learned about some construction process and estimation. In this report, construction procedures of beam, column, slab and stair have been discussed in details and also the construction materials that have been used during construction work. For this report I have done some field test and lab test of materials. At construction time I have observed some problems and tried to find out corrective measures of those problems. The main part of my observation was comparing the theoretical knowledge with practical work. It was not possible for me to cover everything of a construction project. I have tried my level best to cover important parts of a construction project.

Acknowledgment

In the process of preparation of my practicum report, I am very thankful to the almighty Allah who made me able to complete my practicum report.

In this connection I would further like to pay my gratitude and respect to certain personalities for their immense help and enormous co-operation herein.

First of all, I would like to pay my gratitude to our respected Prof. Dr. Engr. Md. Monirul Islam, Chair, Department of Civil Engineering, IUBAT, who gave me the opportunity to do the report on **"A Study on Super Structural Construction Work Process of Ten Storied Residential Building".**

Then I would like to thank my honorable supervisor Md. Anisuzzaman Khan, Senior Lecturer, Dept. of Civil Engineering, IUBAT, for guiding me entirely, making me able to be precise about the report work and be presentable with the required knowledge I have gained throughout this practicum period.

After that I would like to pay my gratitude to Engr. Md. Nasir Uddin (Project Engineer) who allowed me to conduct my practical work under his company, and to guide me through my internship period and made me able to understand different aspects of construction works and prepare this report successfully.

Finally, I would like to thanks again to the respected Vice-Chancellor of IUBAT, Prof. Dr. AbdurRab, because he showing his great wisdom has arranged such kind of educational activity through which a student can have a slight taste of the actuality, brutality and also beauty of professional life.

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Chapter 1: Introduction

1.1 General

I had completed my practicum from **B.H. Builders Limited**. During my practicum period I had learned some practical knowledge of a residential building project. My project name was **B.H.Modhumoti Tower**. It was ten storied residential building. It was necessary to learn practical knowledge to compare theoretical knowledge. In this report based on to compare theoretical knowledge and practical knowledge. During my practicum period I got some structural construction process as column, beam, slab and stair. Also I had done some field test of materials. In this chapter described about objectives, scope of the study, limitations, responsibilities and organization of report.

1.2 Objectives of the practicum work

The main objective of the practicum report is to gather practical knowledge from practical work of a civil engineering fields. Others objectives are:

- To understand drawings and design specifications.
- To acquire practical knowledge based on theoretical knowledge.

1.3 Scope of the study

During this practicum period I worked as a trainee engineer in a developer company. It was a great opportunity for me to work in the practical field as a trainee engineer. In my project I worked with project engineer and he shared me his practical knowledge. I have learned the drawing and design specification of the structure. During this period I got some important procedure of super structural construction work and got some experience that how to work with different persons like client, contractor, labors etc. I also learned about official discipline and punctuality. I have done some field test and laboratory test of some materials in our university lab.

1.4 Responsibilities at the project

- To be present in the construction site regularly.
- To ensure that construction works are according to structural drawing.
- To ensure the mix ratio are according to design.
- To monitor the constructions works at site.
- To gather practical knowledge of construction works.
- To find out the problem and try to inform the project engineer.
- To check all the necessary things before casting.

1.5 Limitations of the study

I have faced some limitations in the construction site during my practicum period. Because of practicum period was four months, I could not observe all the construction work. During my practicum period, I got a chance to supervise some of the super structural components but some other constructional works like piling, foundation work, share wall, brick work, sanitary, plumbing work, electrical work, plastering and painting, tiles, septic tank, water reservoir etc were totally unknown to me because at this short time it is not possible. There were no work schedule and bar chart in our construction site. Sometimes works were stopped for the lacking of materials and mismanagement of authorities.

1.6 Organization of the report

I have divided my report into six chapters. The first chapter is an introductory part. In the second chapter I have discussed about the company profile and my project details. The third chapter contains design specifications. In the fourth chapter, I have discussed about the construction materials and equipment. The fifth chapter contains the construction work of column, beam, slab and stair. And last chapter is about knowledge development and conclusion.

Chapter 2: Company Profile and Project Details

2.1 General

In my practicum period, I got an opportunity to work with a developer company named ″**B.H. Builders Limited**″. Which has become one of the most renowned company in our country in recent years through their quality of work. In this chapter I will described about the company.

2.2 Company profile

Name: B.H. Builders Limited.

Address: 547/2 ECB Chottor, Cantonment, Dhaka.

Contact No: +8801712665267

Phone: +8801933954944

E-mail: bhbl11@yahoo.com

Website: http://bhblbd.com

Site Office: 179/22 Alabodirtek, Pollobi, Dhaka-1216

2.3 Company logo

Figure 2.1 Company logo

2.4 Company background

B.H. Builders Limited has been emerged from the feeling of engaging ourselves in construction of apartment building in order to contribute to overcoming the residential crisis of urban people to some extent and to ensure a better quality of life. Our projects are characterized by innovative & modern design and implementation process. We provide our clients with the opportunity to

customize their homes with a great degree of freedom and always keep environmental & social responsibility in mind when undertaking our projects.

2.5 Mission and vision

Our mission is to present iconic real estate development and construction projects to lead Bangladesh market to the world.

Our Vision is to become a finest lifestyle developer of Bangladesh.

2.6 Company organogram

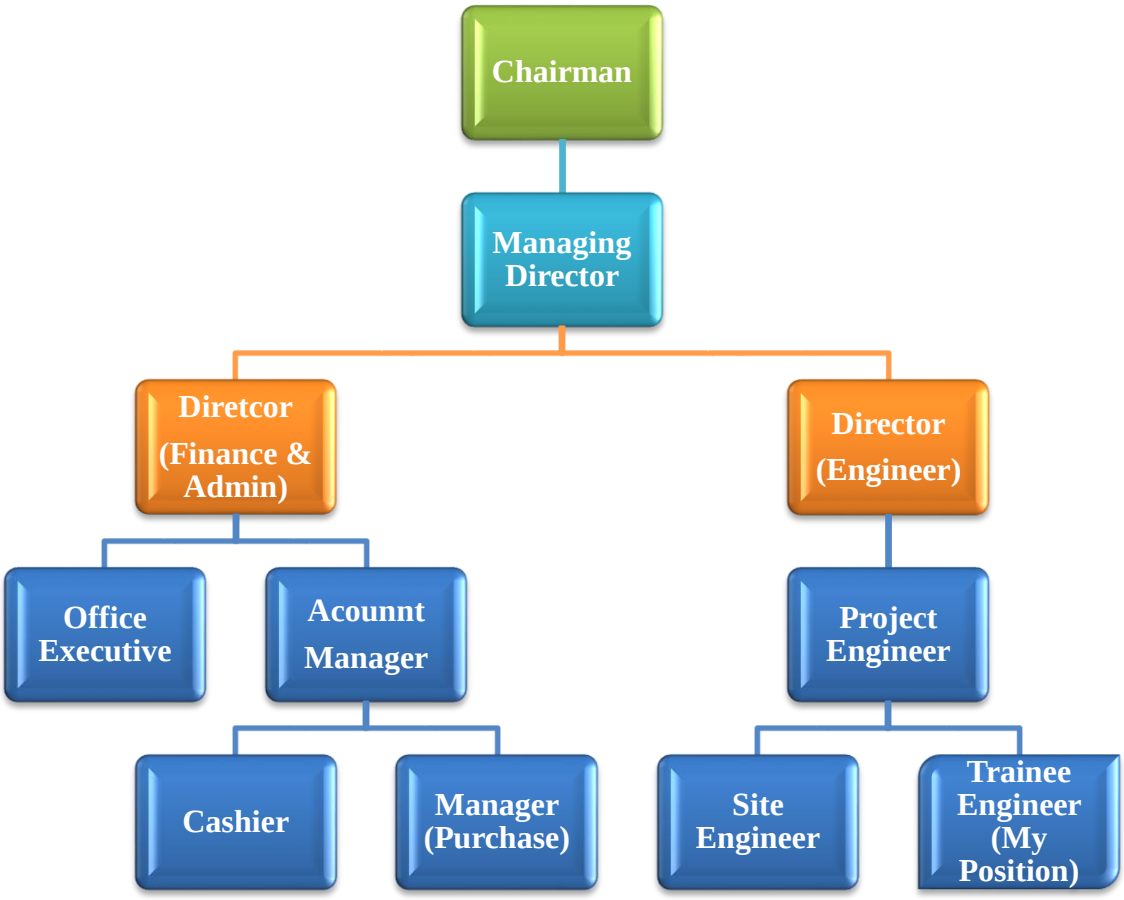


Figure 2.2 Company organogram

2.7 Project information

During the internship period, I got a chance to observe the super structural construction work of a residential building. It was a 10 storied building with a basement situated at Alabodirtek, East Pallabi, Dhaka-1216. The project name was **B. H. Modhumati Tower.** I have observed the construction process from 8th floor to 9th floor. In this chapter, I will describe the location of the project, typical floor plan and the existing condition of the project.

2.7.1 Project profile

Project Name: B.H. Modhumoti Tower
Project Address: Alabodirtek, Dhaka Cantonment, Dhaka-1216
Height: Basement + 10 Stored
Project Type: Residential Land Area
Area: 10Katha.
Apartment Size: 1270sft.
Facilities:

- ✓ Car parking
- ✓ Lift
- ✓ 24 hours Security System
- ✓ Generator
- ✓ Substation
- ✓ Solar paneletc.

Unit Per Floor: 04
Starting time: 01/06/2017
Completion Date: 30/12/2019

Figure 2.3 Project View

2.7.2 Project location on map

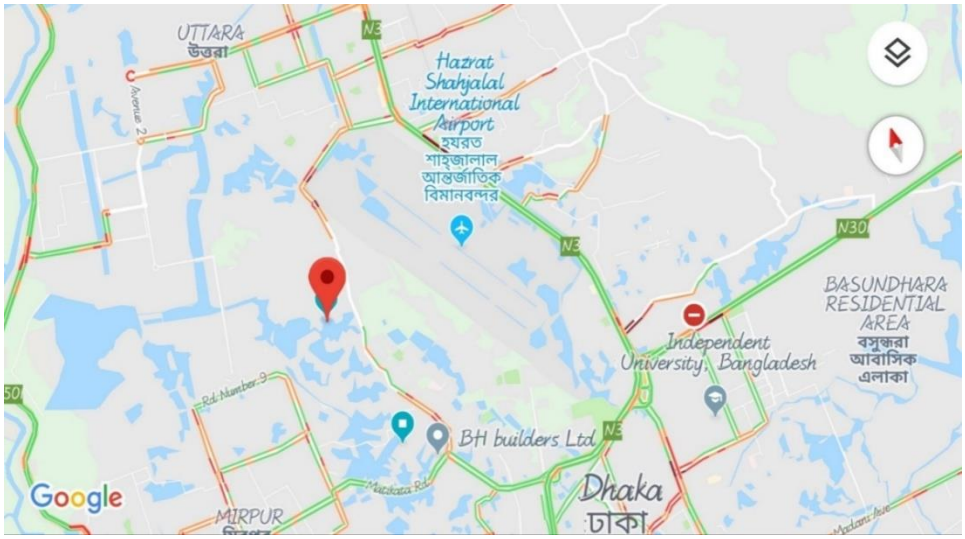


Figure 2.4 Project location on map

2.7.3 Ground floor plan

The ground floor contains electro mechanical room driver's waiting room, guard room, substation room, and common toilet one of each. At a time 15 cars can be placed on this ground floor.

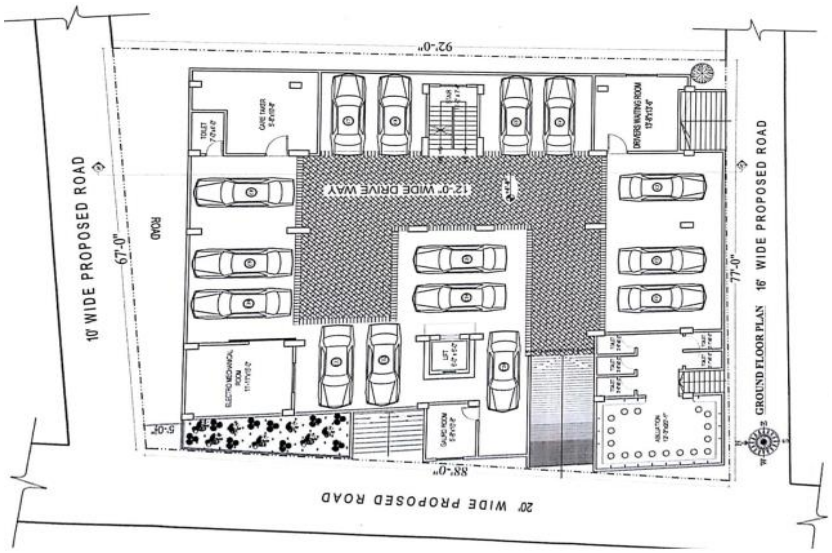


Figure 2.5 Ground floor plan

2.7.4 Typical floor plan

In this typical plan, there were four units. Every unit has three bed rooms, one dining, one kitchen, one common toilet& two attached toilet and one drawing room.

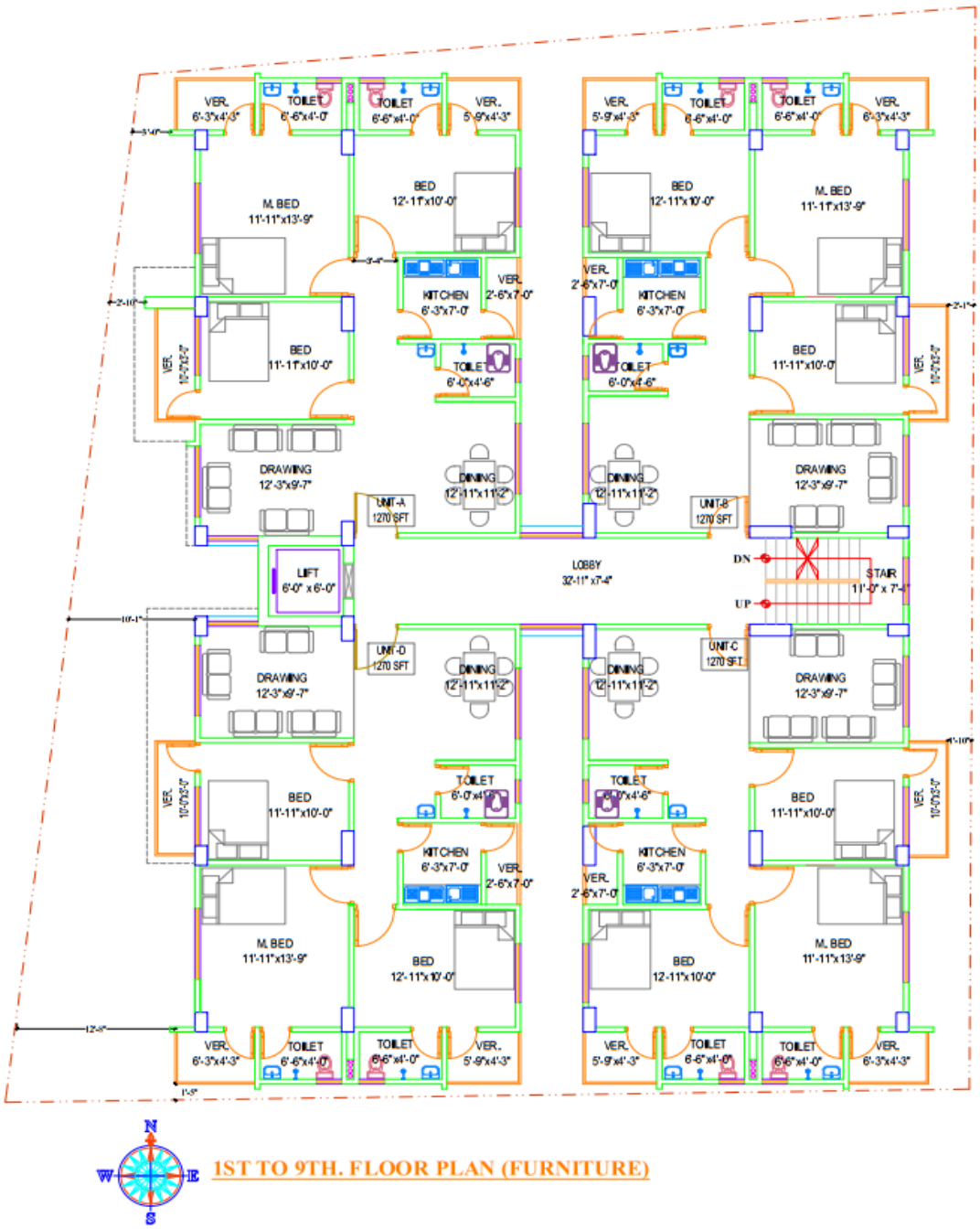


Figure 2.6 Typical floor plan

2.8 Design specifications

2.8.1 General

a) Design method used is USD according to Bangladesh National Building Code (BNBC) 2015, ACI Code 1999.
b) All this structural drawing shall be read in conjunction with relevant architectural drawings.
c) Follow BNBC/15 for specifications/ structural requirements not mentioned in the drawings or in this note sheet.
d) Any details not shown in the drawings should be done according to ACI Detailing Manual -1999.
e) Basic wind speed = 245 km/hr.
f) Seismic zone - 2.
g) Other loads as per BNBC 2015.
h) Detailing is done in accordance to intermediate moment resisting frame.

2.8.2 Foundation

a) The building has been designed for 10- storied residential building.
b) Foundation type is as soil report and factor of safety is taken as 3.0.
c) Any loose pocket found in foundation bed is to be filled up with compacted sand of FM 2.5 min. In case of soft clay soil, water should not be ponded in the foundation trench.
d) Filling should be 6″ lift and compact properly with soil compactor at optimum moisture content.

2.8.3 Concrete

a) Concrete design compressive strength considered as follows:
    1) For pile and pile caps f'_c = 4000 psi.
    2) Grade beam, lift core, column etc. f'_c = 3000 psi.
    3) For roof beam, slab, lintel and stair f'_c = 3000 psi.
b) Minimum cylinder strength: based on cylinder test of diameter D= 150mm, height H= 300mm.
    1) 28 days strength= as specified in 3(a)
    2) 7 days strength= 75% of 28 days strength.

c) Curing of R.C.C work:

1) Curing time minimum 28 days.
2) Method of curing-
   - Horizontal surface- by ponding of water.
   - Other surface- by wrapping moist jute fabric and sprinkling water by hose pipe frequently.

2.8.4 Lap length

Unless otherwise mentioned in the drawings, lap length of bar shall be:

Table: 1 Lap length

Bar dia (mm)	Tension (mm)		Compression (mm)
	Top bars	Bottom bars	
6 Ø	325	325	325
10 Ø	400	325	325
12 Ø	525	425	350
16 Ø	650	525	425
20 Ø	725	600	500
22 Ø	900	700	575
25 Ø	1500	1150	650
28 Ø	1900	1450	725
32 Ø	2400	2000	1000

- Columns Laps shall be Tension Lap.

2.8.5 Cement

Ordinary Portland cement type-1 or composite cement conforming to BDS 232: 1974/ASTM C150

2.8.6 Concrete aggregate

a)Fine aggregates: Sand F.M 2.5 (min)

b) Coarse aggregates: 20 mm downgraded crushed stone chips to be used as coarse aggregate in all R.C.C work of 4000 psi concrete and 20 mm downgraded picket (brick) chips to be used as coarse aggregate in all R.C.C work of 4000 psi concrete

2.8.7 Water

Potable water to be used in concrete mix.

2.8.8 Steel reinforcement

1) All reinforcements for lift core base, column, slab, edge beam, underground water reservoir and stair are 60 grade high strength deformed bar made from billet steel.
2) Steel of column, beam, slab, railing, drop wall and parapet are 60 grades.
3) Yield strength of steel fy= 415 Mpc (60000 psi) conformed to one of the following specifications:
    a) BDS 1313: 1991:
    b) ASTM A615M
4) 1313:1991 and test result shall be submitted to engineer for checking and record:
    a) Tensile strength test
    b) Percentage of elongation test
    c) Bend/ rebend test

2.8.9 Hooks of rebar

For all Re-bar : Provide 90° standard hooks(L-Bent) if not shown in the drawings.

2.8.10 Spacer bars

To support second layer bars in beams/ slabs use 25ϕ spacer bars @750 c/c where required.

2.8.11 Formwork and scaffolding

All formwork and shuttering shall be water tight and sufficiently rigid. The forms shall not be removed before the expiry of the period specified as:

a) Bottom of slab – 21 days
b) Bottom of beams, stair – 21 days
c) Side of beam – 7 days
d) Side of columns – 3 days
e) Side of pile caps – 2 days
f) Vertical R.C.C walls of underground water tank/ lift core – 5 days

2.8.12 Lap location

For beam bottom bar, lap not to be provided at middle third zone of the span.For beam top bar, lap may be provided at middle third zone of the span. Not more than 50% of the bars shall be

spliced at one place. Lap splices are to be confined by hooks with maximum spacing or pitch of d/4 or 100mm, where d is the effective depth of the beam.

2.8.13 Development length

All beams and slab rebar should be extended into the support up to development length.

2.8.14 Admixture

Water proofing admixture, plasticizer and jointing admixture shall be used as mentioned in the respective drawings and in the specification after approval by the engineer.

2.8.15 Water stopper

250mm wide PVC water stopper to be used at all construction joints below ground in Base slab, shear wall, water tank wall etc.

2.8.16 Minimum bar spacing of column longitudinal bar

Clear distance between longitudinal bar shall not be less than 1.5 times bar diameter, 1.5 times of the maximum size of coarse aggregate nor 1.5″.

Chapter 3 : Construction Materials and Equipment

3.1 General

The world of civil engineering deals with a lot of materials that we are encounter on daily basis. The importance of the material stem from its availability, ease of use, strength, durability, and sustainability. Reinforcement, Cement, Sand, Bricks, Brick Chips, Stone Chips, Block, Wire, Coarse and Fine Aggregates and Water are the main constructions materials in any construction building project. In my project, I have seen that these types of materials were used. The main objective is to ensure the strength and durability which depends on materials. We need to ensure good quality of material for constructing any structure. There are some supporting materials are used in the project like bamboo, steel frame wooden plank, water etc. I will describe the materials that were used in the project and also their quality test in field.

3.2 Construction materials

It is necessary to ensure good quality of raw materials for a durable structure. Sand, cement, reinforcement bar, bricks, brick chips, stone chips, water, admixture are the main construction materials in every building project.

3.2.1 Cement

Cement is the most important construction material. It is required almost every construction work. There are many types of cement out there based on their specific application. Ordinary Portland Cement (OPC) and Portland Composite Cement (PCC) are the most used cement in Bangladesh. In my project, I have observed Portland Composite Cement (PCC) named ANWAR CEMENT. The cement contains clinker, slag, fly ash, lime stone and gypsum. Net weight of one bag cement is 50 kg. Manufacturing Date was July/August2019.

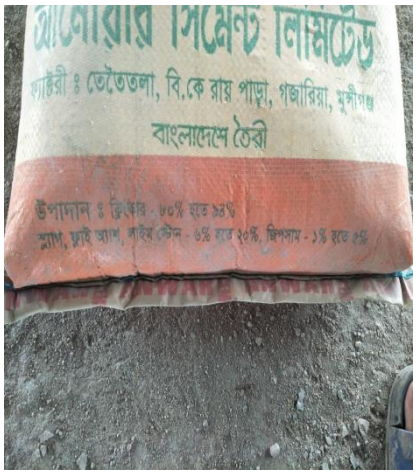


Figure 3.1 Anwar cement and ingredients of cement

3.2.1.1 Date of manufacture

I also checked randomly the manufacturing date of the cement that is written in the bag which is shown in Figure and I marked the date. The cement was used within 90 days of its manufacturing date. So, this was satisfactory for construction.

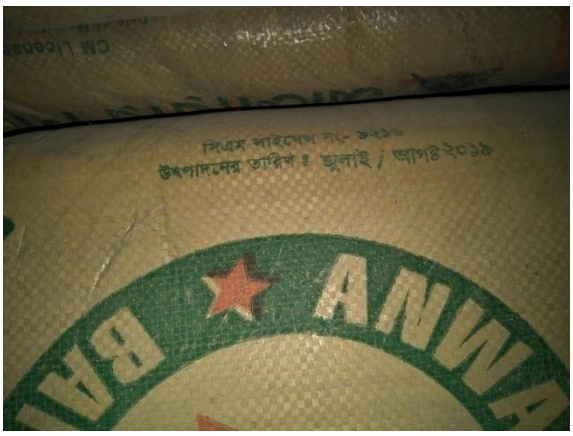


Figure 3.2 Manufacturing date of cement

3.2.1.2 Field test on cement

The field test of cement is done to check its physical properties like color test, adulteration test and floating test etc.

1.Color test

The color of the Portland cement should be gray and it should be uniform. I observed the color of the cement by taking some of the cement in my hand and the cement was light gray, and the color is uniform. So, the test result was satisfactory.

Figure 3.3 Color test of cement

2. Adulteration test

I took some cement in between my fingers and rubbed it. The cement felt a smooth in between my fingers. There were no lumps in cement and the cement was good. So the adulteration test of cement was satisfactory.

Figure 3.4 Adulteration test of cement

3. Temperature test

The temperature of a good cement should be cool. When I put my hand into cement it felt cool. That means the quality of the cement was good. After testing the temperature test of the cement, the result was satisfactory.

Figure 3.5 Temperature test of cement

4. Float test

I have thrown a small amount of cement into a bucket of water, I observed that after some seconds the cement did not float on the surface. The cement sink at all. That's means that the cement passed the float test.

Figure 3.6 Floating test of cement

3.2.2 Sand

Sand is defined as the materials, which can pass through the NO. 4 sieve. It is usually called as fine aggregate. Generally in our country, Local sand and Sylhet sand are used as fine aggregates. In my site, this both sand were used.

Figure 3.7 Sylhet sand and Local sand

3.2.2.1 Field test of sand

Field test of fine aggregate was done to know the physical properties of sand such as clay test, silt test etc.

1. Clay test

At first I took a glass and some sand, after that I put water into the glass then I put some sand in the glass and mix with spoon. After few minutes, sand settles first and clay settle on the sand and some organic matter float on the water. So, the sand quality was not satisfactory.

Figure 3.8 Clay test of sand

2. Silt test

Field test can be performed by rubbing a small amount of sand between finger tips. If clay are left on finger tips, it indicates the existence of clay in the sand sample. For this test I had taken some amount of sand and rubbed it. After rubbed there was very few amount clays remaining. So, the test result was good for sand.

Figure 3.9 Rubbing sand in between finger tips and left clay in finger tips

3.2.3 Brick

Brick is an important element for construction of wall. I took some field test of brick. There are different number of bricks like no.1, no.2 etc. The bricks were regular in shape and uniform in size and their edges was square, straight and sharp.

Figure 3.10 Brick

3.2.3.1 Field test of brick

Field test of brick were done to check the physical properties of bricks. Tee test, skin test, sound test and absorption test have been described below.

1.Sound test

After hitting two bricks together, it was not created metallic sound. So, It was not the sign of good brick.

Figure 3.11 Sound test of brick

2. Hardness test

From the brick stuck I have taken a brick randomly and tried to scratch on the surface of the brick by nail. After scratching by finger nail, there was scratched on the surface of the brick. So, it was a not good quality of brick.

Figure 3.12 Hardness test of brick

3. T-test

At first I took two brick, then I made like T-shape. After that, it was fall down above 6 ft as per idea. Then one brick was broken in corner side and another was brokenin the middle. So the brick was not good.

Figure 3.13 Making T shape and after T test

4. Size checking of brick

In Bangladesh, the standard size of bricks is 9.5"×4.5"×2.75" without mortar. At first, I measured the bricks length, width and height. It was well size, sharp and straight and uniform in shape.

Figure 3.14 Size of brick

3.2.4 Reinforcement

Reinforcing bars are made in different grades. It is the main tensile In my project 10mm, 12mm, 16mm, 20mm, 22mm reinforcement bars were used. The grade of this bars was TMT 500W (RRM) which is 60-grade steel. TMT means Thermo Mechanically Treated. This is a new generation high strength steel having superior properties.

Figure 3.15 Reinforcement bar

3.2.4.1 Field test of reinforcement

The field test of was done to check its physical properties like color test, bending and rebending test of reinforcement.

1.Rust test

I observed the reinforcement color. It was not free from rust.

Figure 3.16 Rust test of reinforcement

2. Bending and re-bending test

I took a 12 mm steel bent it 90 degrees and re-bent it 10 times. After completing the process the steel was remains unbroken .Since the bar was not broken so it was good quality of reinforcement.

Figure 3.17 Bend and Re-bend test of reinforcement

3. Smoothness test

For good steel the cutting surface of steel should be smooth. In my project I have observed the smoothness of steel bar and it was good enough.

Figure 3.18 Smoothness test of reinforcement

3.2.5 Water

Water is called the binding material. It is one of the most important materials for construction work. For mixing the concrete potable water is recommended. Water should be free from organic or chemical substances and also free from any visible impurities. In my project water plays a vital role for preparing the concrete or mortar paste.

3.2.6 Bamboo

Bamboo was used with timber for supporting the construction work such as column, beam, slab and stair formwork. It was different diameter and different height.

Figure 3.19 Bamboo props

3.2.7 Wooden plank

Wooden Plank was used for shuttering of beam, slab, column, footing, kicker etc. It was also used for supporting the foundation. Thicknesses of plank was 0.75″ and width 5″ and 6″.

Figure 3.20 Wooden plank

3.2.8 Plain sheet

Plain sheet was used in my project for shuttering work. The size of sheet was 3ft x 6ft. It was used for slab and stair. In my project the cross section of the plain sheet was 3ft×6ft.

Figure 3.21 Plain sheet

3.2.9 Steel shutter

In my project steel shutter has been used for shuttering of column.

Figure 3.22 Steel shutter

3.2.10 Runner

Runner was used to support slab, beam, column, stair etc. Runner height was 2.75″and width 1.75″.

Figure 3.23 Runner

3.3 Construction equipments

In every construction project, different types of equipment are used for construction work. These types of equipment help to make construction work easier and more suitable. In this part, I will discuss the construction equipment which was used in my project.

3.3.1 Concrete mixer machine

In my project, Mixture machine is used for proper mixing of sand, cement, and stone chips or brick chips with water.

Figure 3.24 Concrete mixer machine

3.3.2 Steel cutter machine

Steel cutter used for cutting steel according to desired length. The worker cut 3 to 4 rebar at a time.

Figure 3.25 Steel cutter machine

3.3.3 Vibrator machine

Concrete vibrator is used for the compaction of freshly poured concrete so that trapped air and excess water are released and the concrete settles firmly in place in the formwork. Compaction is required to fill up the voids with concrete paste uniformly.

Figure 3.26 Vibrator machine

3.3.4 Crane

Crane was used to pull concrete mixture, reinforcement or any other heavy materials from the ground to required place.

Figure 3.27 Crane

Chapter 4: Construction Work Process

4.1 General

I observed 8th to 9th floor construction process in my project. In this chapter, I will discuss about the construction process of the components which I have observed during my practicum period. Here I will also show the calculations of the materials required for the construction work. I will discuss the construction works of the followings:

- Column
- Beam and Slab
- Stair

4.2 Construction work of column

Columns are defined as the member that carry loads chiefly in compression. In his part contains the column types and construction procedure of column. Generally, the load of the slab is transferred to the columns through the beams. In my project, eight types of column were used. In my practicum period, I observed casting of columns from 8th to 9thfloor level. Hare I had discussed about C5 column construction procedure.

4.2.1 Column layout plan

In my project there are total of 30 columns. In layout, grid line is A, B, C, D, and E was east to west face and 1, 2, 3, 4, 5 and 6 was north to south face. There were eight types of column was layout plan. Those were C1, C2, C3, C4, C5, C6, C7 and C8. There are four C1 columns, four C2 column, six C3 column, two C4 columns, four C5 columns, four C6 column, four C7 column and two C8 columns. Column layout plan of my project is given below-

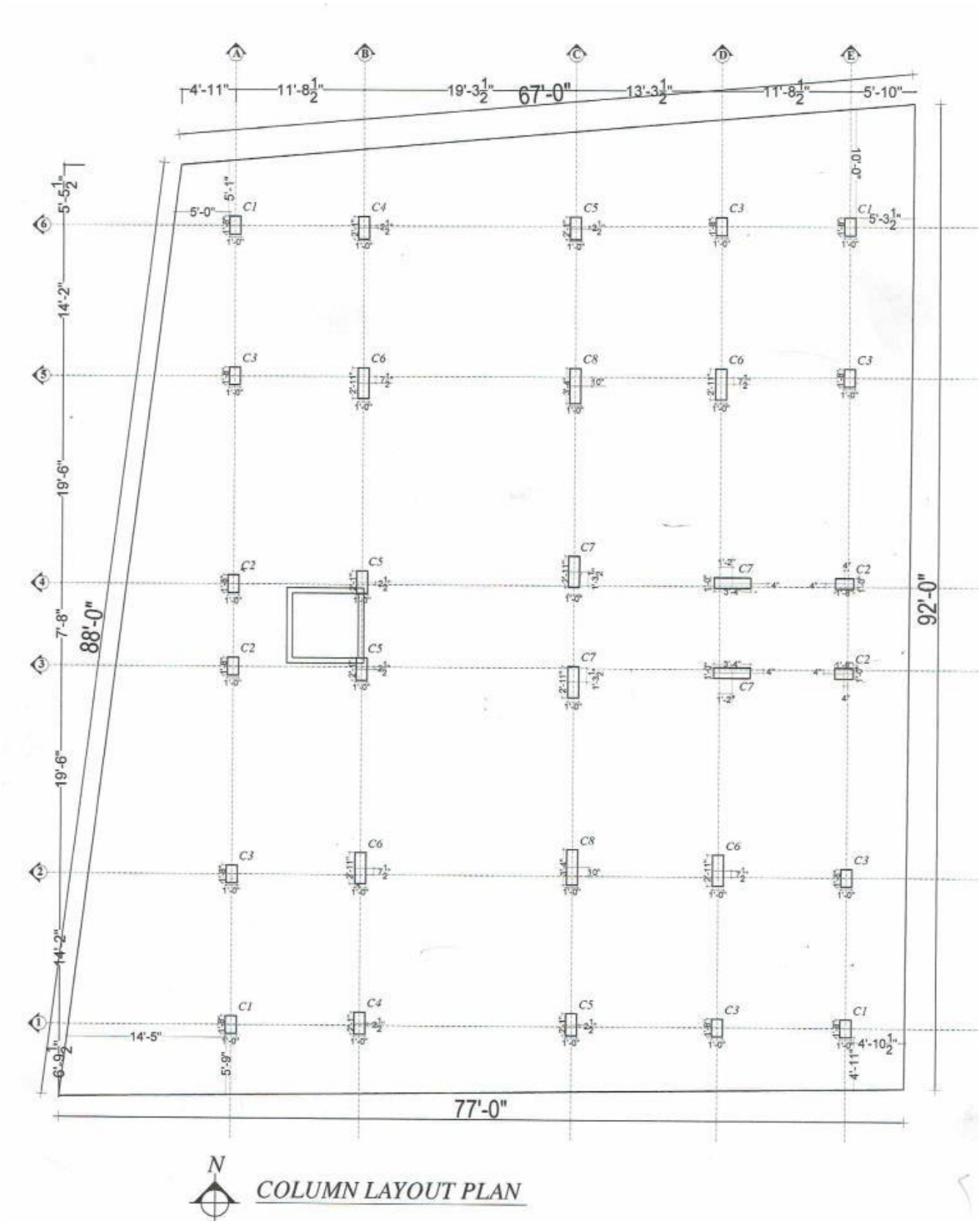


Figure 4.1 Column layout plan

4.2.2 Column schedule

In column schedule there was eight types of column. Those are C1, C2, C3, C4, C5, C6 C7 and C8. Column schedule was shown the section of the columns, reinforcement details, and their placement. From the column schedule, I observed that in different floor levels column size remains constant but reinforcement details are different. Column schedule of my project is given below:

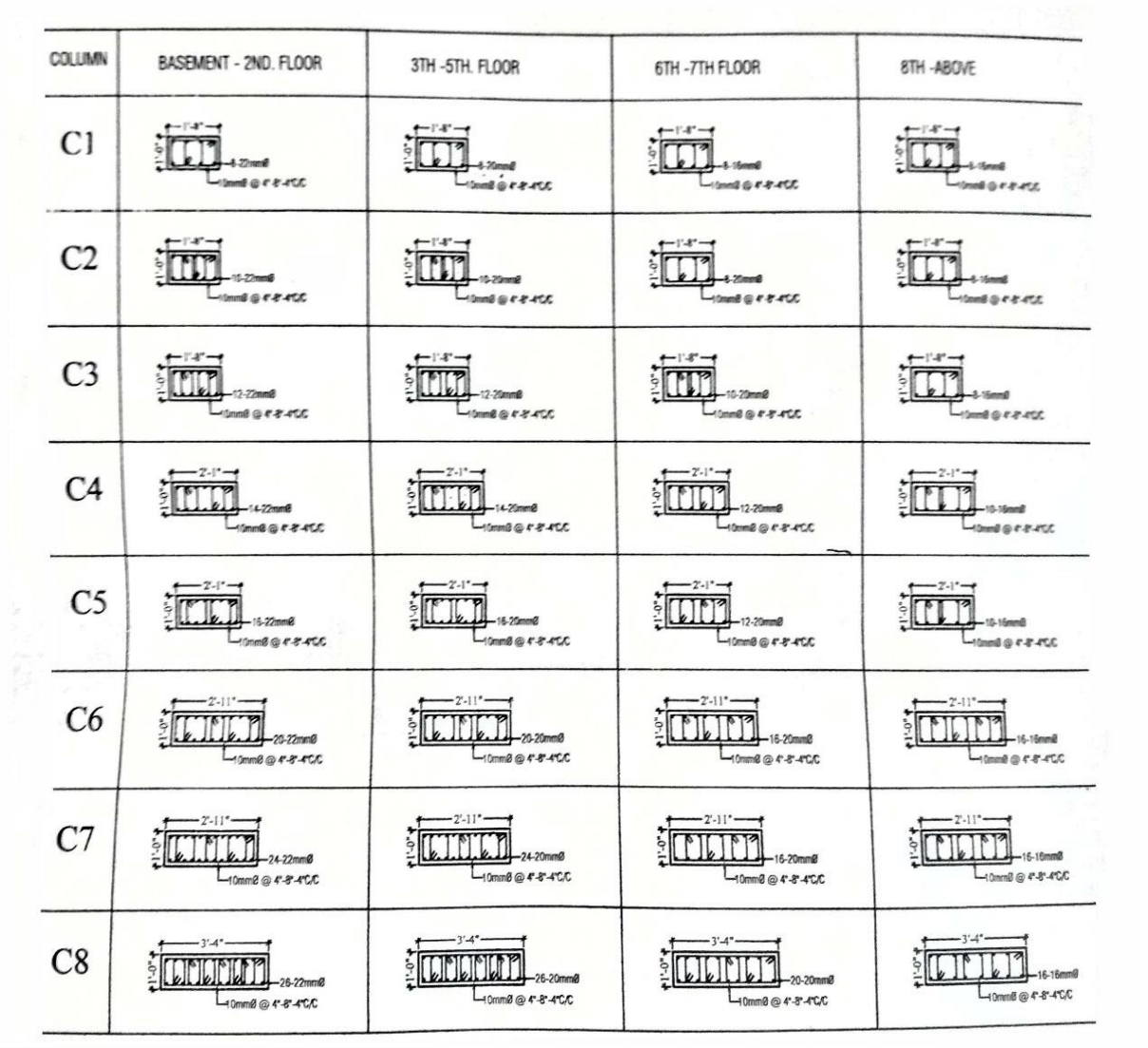


Figure 4.2 Column schedule

4.2.3 Kicker formwork

For column construction work kicker was the first step to construct column.Before preparing kicker shuttering, they had cleaned the column surface. At first marked column position according to grid line, the workers were prepared for shuttering. In my construction site they used wooden shutter for the kicker. They fixed the three sites and after that placing it on the column then they fixed the remaining part.

(a) (b)

Figure 4.3 (a) Making kicker shutter (b) Kicker shuttering

4.2.4 Kicker casting

After preparing the formwork of kicker, casting of kicker was progressed. Mixing ratio of casting was 1:1.5:3. Before casting column surface was cleaned by water. I also checked the height of the kicker. The height of the kicker was five inches.

(a) (b)

Figure 4.4 (a) Kicker casting (b) Kicker height checking

I also checked the length and width of the kicker. Length and width depends on the column size. I found that it was okay.

(a) (b)

Figure 4.5 Checking of kicker (a) Length (b) Width

4.2.5 Reinforcement work of column

After completing the column kicker, they had started the placing of column reinforcement. According to 8th floor column layout plan C5 column main bar was 16 numbers 20 mmØ and column size was 12″x25″.10 mm dia bar used for tie bar as per as design. Tie spacing for bottom one fourth lengths is 2'-1″ at 4″ c/c, for middle half is 4'-2″ at 8″c/c and for top one fourth length is 2'-1″at 4″c/c.

4.2.6 Preparing reinforcement

For the reinforcement work of the column at first they cut the reinforcement by grinding machine for main bar lapping of column. They also prepared different types of tie bar for column according to the drawing.

(a) (b)

Figure 4.6 (a) Making tie bar for column (b) Different sizes tie bars

4.2.7 Column reinforcement placing

20 mm bar paced for main bar and 10mm bar for tie bar. Tie spacing for bottom one fourth lengths is 2'-1″ at 4″ c/c, for middle half is 4'-2″ at 8″c/c and for top one fourth length is 2'-1″at 4″c/c. They did not put two consecutive tie bar hook in the same side of the column.

Figure 4.7 Tie bar placing

4.2.8 Measuring tie bar spacing and lap length

I have measured the tie bar length and counted the number of tie bar used in column. Also checked the spacing of tie bar and lap length of main bar. Tie spacing for bottom one fourth lengths is 2'-1″ at 4″ c/c, for middle half is 4'-2″ at 8″c/c and for top one fourth length is 2'-1″at 4″c/c. I have also measured the lap length of column. The lap length was 29″.

(a) (b) (c)

Figure 4.8 Tie bar spacing check (a) 4″ c/c (b) 8″ c/c and (c) Lap length

4.2.9 Shuttering of column

After completing all reinforcement binding the work is shuttering of column. Steel and wood shutter was used in my project. Corner side of steel shutter was joined by jute. Before set up column shuttering, shutter was cleaned and paper fitted on wood shutter. After completed shutter preparation column shutter was setup. There were two parts of steel shutter and wood shutter has four parts. One part of shutter was attached with another part and joints them together by using nuts and bolts. Screw, nut, bolt, hammer, and pin were used to fixed shutter tightly. For vertically alignment they used bamboo and turn bolt.

(a) (b)

Figure 4.9 Column shuttering (a) Steel shutter (b) Wood shutter

4.2.10 Vertical alignment checking of column

Checking vertical alignment of column is very important for column construction. For checking vertical alignment of column, a piece of brick was hanged by the ware from the top of the column shutter. Before hanged brick four piece of reinforcement was attached at the four corners of shutter. Then four pieces of brick was hanged by ware. After that I observed the checking of the vertical alignment of that column.

Figure 4.10 Vertical alignment checking

4.2.11 Column casting

After completing the shuttering, next day worker were going to start casting of column. The materials were cement, sand and stone chips with the water. For mixing the concrete they used mixer machine. They gave the stone chips, sand cement and water then mixed it. The mixing ratio was 1:1.5:3 (cement: sand: stone). They used vibrator during the casting of column. Over vibrate may cause the segregation. During the column casting I have checked the mixing ratio and the mixing were proper way or not.

(a) (b)

Figure 4.11 (a) Concrete mixing (b) Column Casting and Using Vibrator Machine

4.2.12 Column curing

Curing of the column is very important after casting. After casting of column, the shutter has been removed 48 hours later. Then they used water for curing. They sprayed water twice in a day.

Figure 4.12 Column curing

4.2.13 Work schedule of column

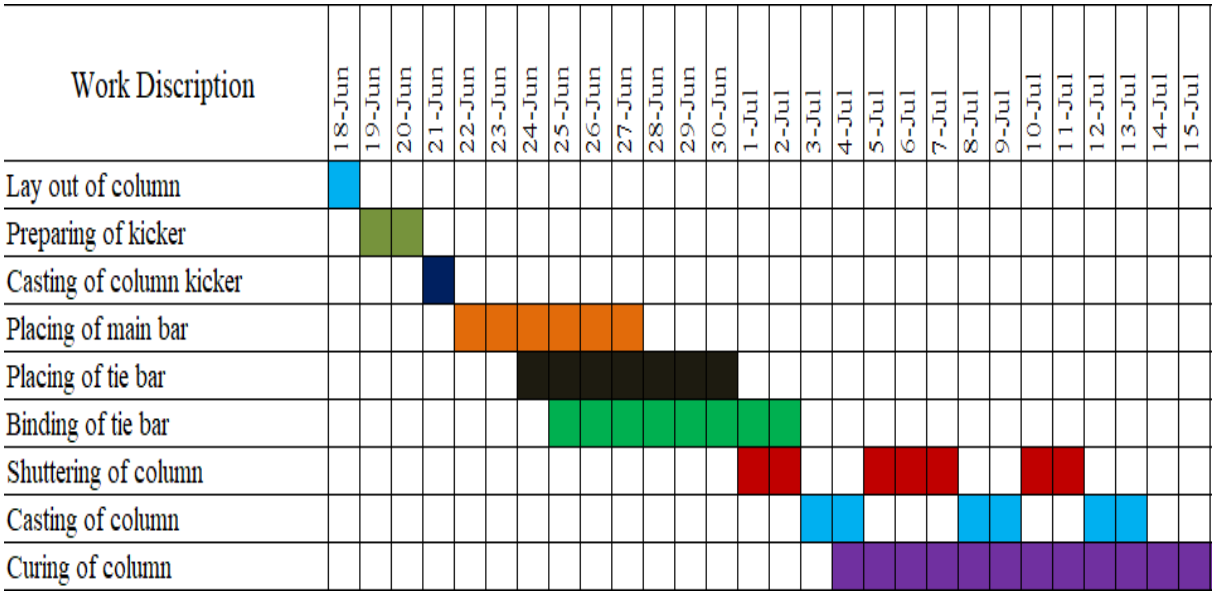


Figure 4.13 Work schedule of column

4.3 Beam and slab construction

Beam and slab both is horizontal member in structure. Beam and slab were constructed together in my project. I observed 8th floor beam and slab construction process of my project. In this chapter I will describe about the construction procedure of beam and slab.

4.3.1 Beam and slab layout

In my project, there was six categories of beam as RB-1, RB-2, RB-3, RB-4, RB-5, and RB-6. The size of the beam was 10×20 inches. And slab contained 8 panels. In this chapter I will described about RB-3 and slab panel-4. Layout of beam and slab is given below:

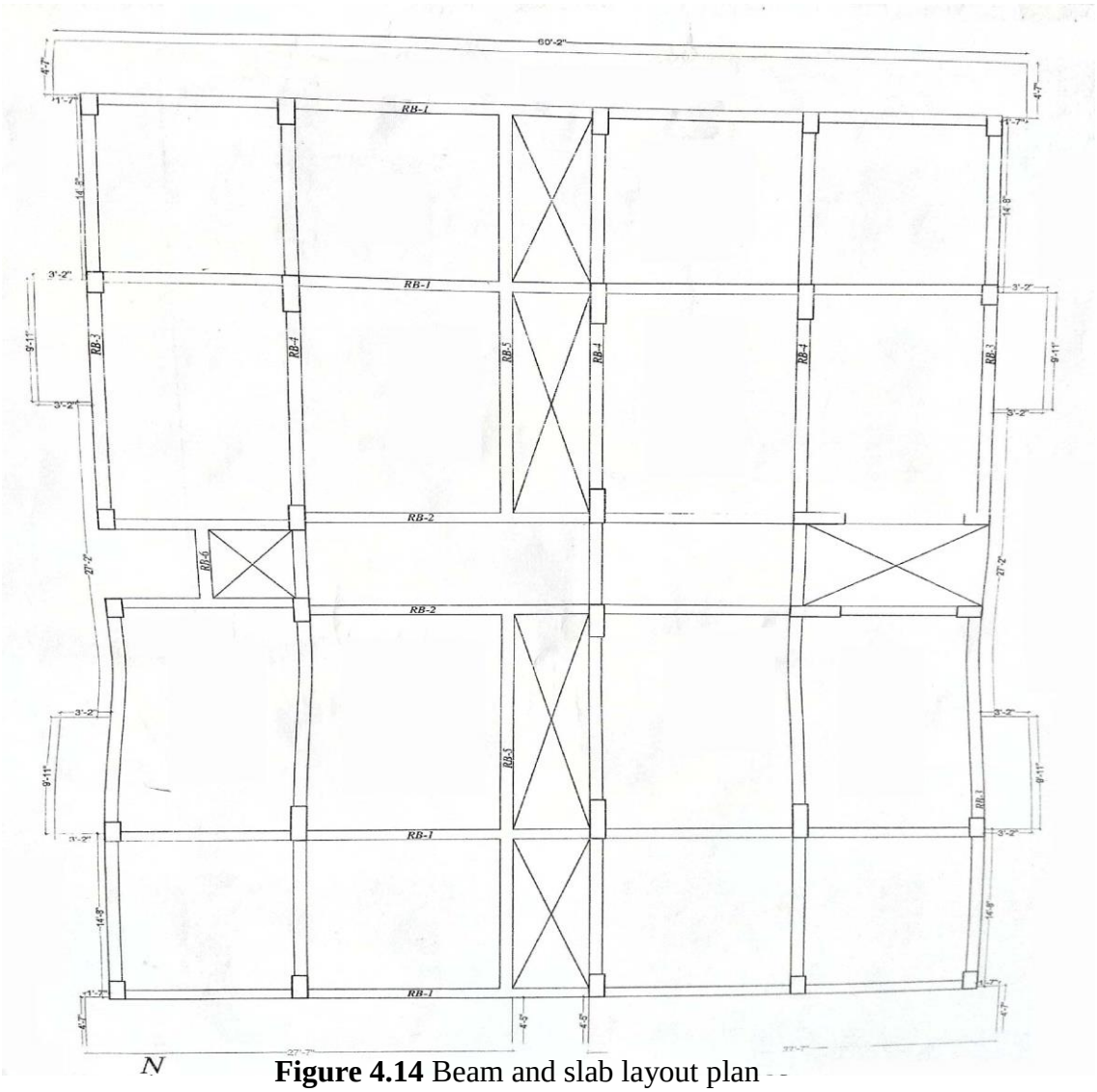
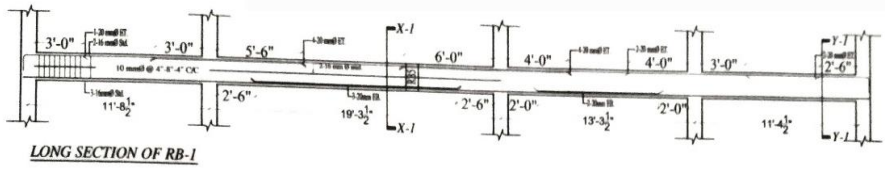


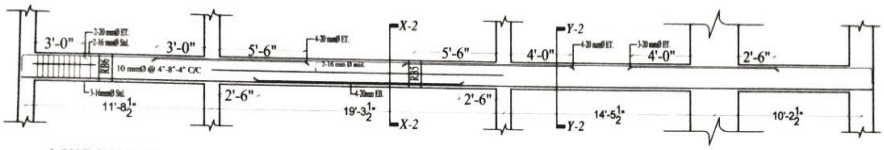
Figure 4.14 Beam and slab layout plan

4.3.2 Reinforcement details of beam

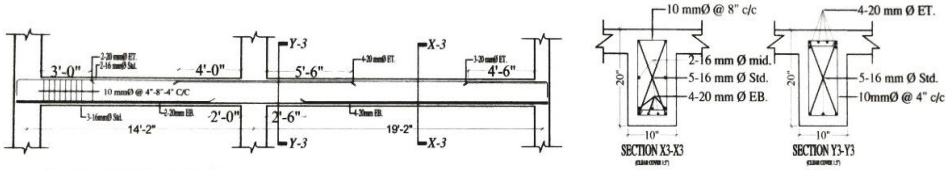
In my project they used 16mm dia bar as main bar of beam. 20 mm bar use for extra top and bottom bar. 10 mm bar use for stirrup. Here is the long section and cross section reinforcement details of all beam.



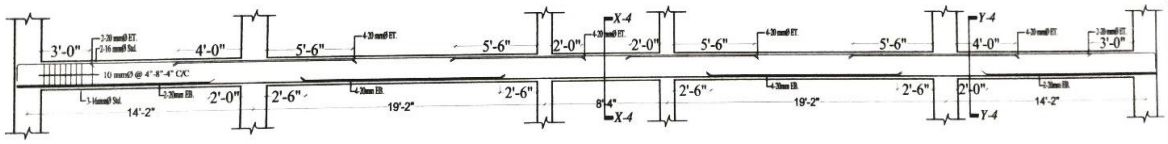
LONG SECTION OF RB-1



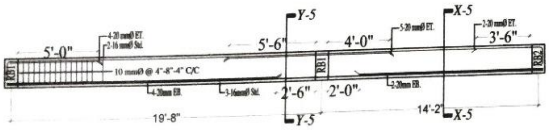
LONG SECTION OF RB-2



LONG SECTION OF RB-3



LONG SECTION OF RB-4



LONG SECTION OF RB-5

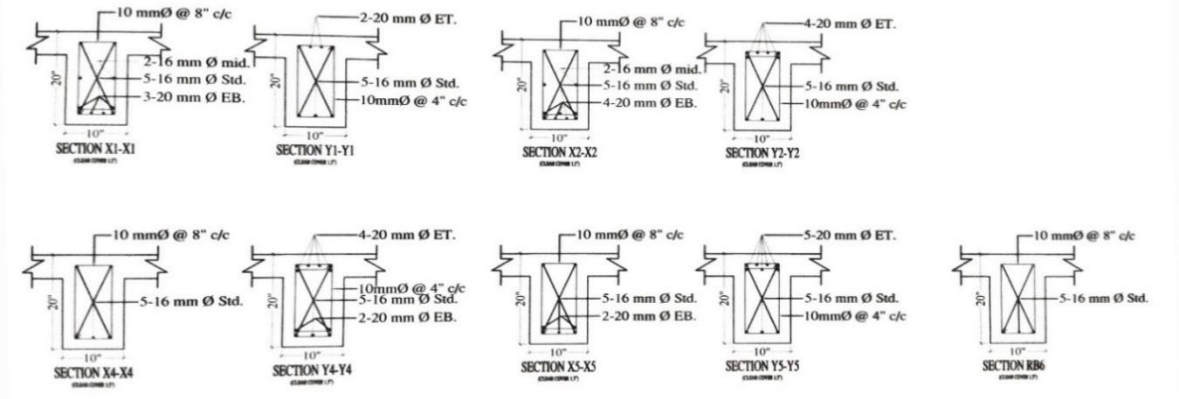


Figure 4.15 Reinforcement details of beam

4.3.3 Formwork preparation of beam

For beam shuttering wooden plank used. Bamboo props used for supporting beam shutter. For shuttering preparation at first, they joined woodto column top surface. After that they prepared for bottom and side shutter of beam. Then they joined bottom shutter to kobla by supporting bamboo props.

(a) (b)

Figure 4.16 (a) Bamboo props preparation (b) Shuttering of beam preparation

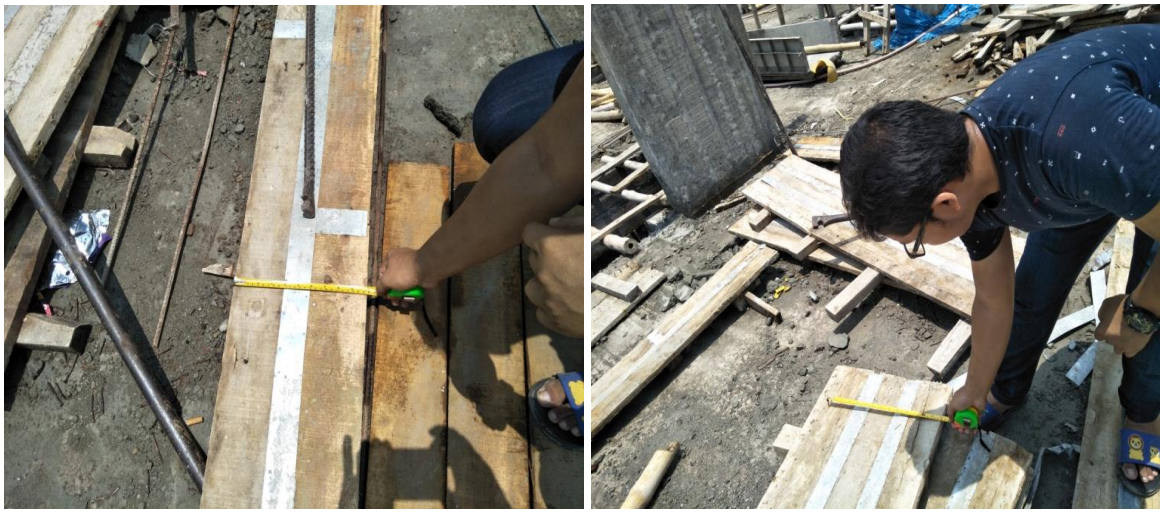
4.3.4 Beam shutter setup

After preparing beam shutter workers were prepared for shutter setup. At first they joined bottom shutter with kobla by supporting bamboo props. Then they joined side shutter with bottom shutter.

(a) (b)

Figure 4.17 Beam shutter setup (a) Bottom shutter (b) Side shutter

Before setup the beam shutter I have measured the size of beam. Size of bottom shutter was 10 inch and side shutter were 15 inch.



(a) (b)

Figure 4.18 Size of beam shutter (a) Bottom (b) Side

4.3.5 Runner and props placement for slab shutter

After finishing the beam shutter workers are prepared for runner placing. Size of runner was 2.75 in x 1.75 in. Length of runner was varied for slab panel size. Runner was placed in short direction to the panel at 24 inch distance. I have measured the spacing of runner. It was 24 inch.

(a) (b)

Figure 4.19 (a) Runner placement and setup (b) Measuring the spacing of runner

4.3.6 Wooden plank placement for slab shutter

After finishing runner placement work workers were prepared for placing wooden plank on runner. Width of plank was 5 inches. They were placed plank with 5-inch gap. All the plank fixed with runner by nails.

Figure 4.20 Wooden plank placement

4.3.7 Beam cross section checking

Slab and beam shutter were done when whole shuttering process was completed. Before reinforcement placing of beam project engineer was come to check slab and beam shuttering. Then he checked the cross section of the beam. In my project beam cross section was 10 inch x 18 inch.

Figure 4.21 Beam cross section check

4.3.8 Plain sheet placement

When beam reinforcement placement was done then plain sheet was placed in slab shutter. There was three size of shutters. Those was 3́x6́, 1́x6́ and 1.5́x6́.

Figure 4.22 Plain sheet placement

4.3.9 Reinforcement details of beam

In my project total 6 category beam used. Here I will discuss about RB-3. The span length of this beam was 31 ft 2 inch and height of this was 15 inch and width 10 inch. Reinforcement of this beam was 5-16 mm dia bar used as a main bar, 4-20 mm dia bar used for extra top bar at section X-3 and 4-20 mm dia bar used for extra bottom bar at section X-3 , 10 mm dia bar used for stirrup binding. Stirrup spacing was 4″c/c at section X-3 and 8″c/c at section Y-3.

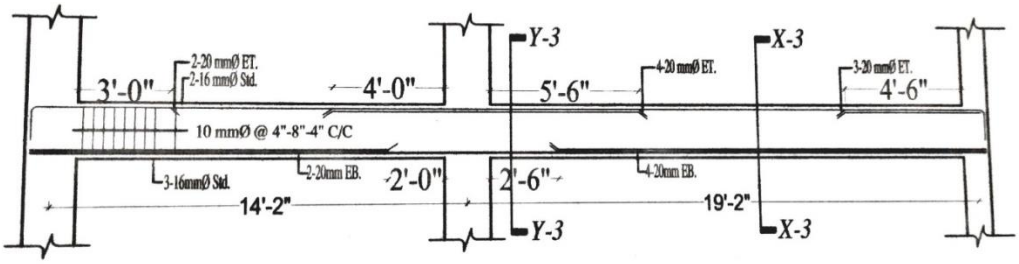


Figure 4.23 Long section of RB-3

4.3.10 Reinforcement placement work of beam

For beam reinforcement placement, at first workers cut the reinforcement as per as drawing. Before placement of reinforcement 10 mm bar bind with column to hang whole beam. After then they placed beam rebar. After placement of main bar stirrup was placed as per as drawing spacing. Then they bound stirrup with main bar.

(a)

(b)

Figure 4.24 (a) Stirrup placing (b) Stirrup binding

4.3.11 Measuring the spacing of stirrup and lap length

After placing stirrup I have measured the spacing of stirrup.The spacing was 4 inch and 8 inch. I also measured the lap length of main bar. The lap length was 30 inch.

(a)

(b)

(c)

Figure 4.25 (a) & (b) Measuring stirrup spacing (c) Measuring lap length

4.3.12 Clear cover block placement

At the end of whole work of reinforcement binding of beam, beam reinforcement was placed in beam shutter. After then clear cover block was placed. Size of clear cover block was 1.5 inch. I have measured the size of clear cover block.

(a) (b)

Figure 4.26 (a) Clear cover block placing (b) Size of block (1.5”)

4.3.13 Reinforcement details of slab

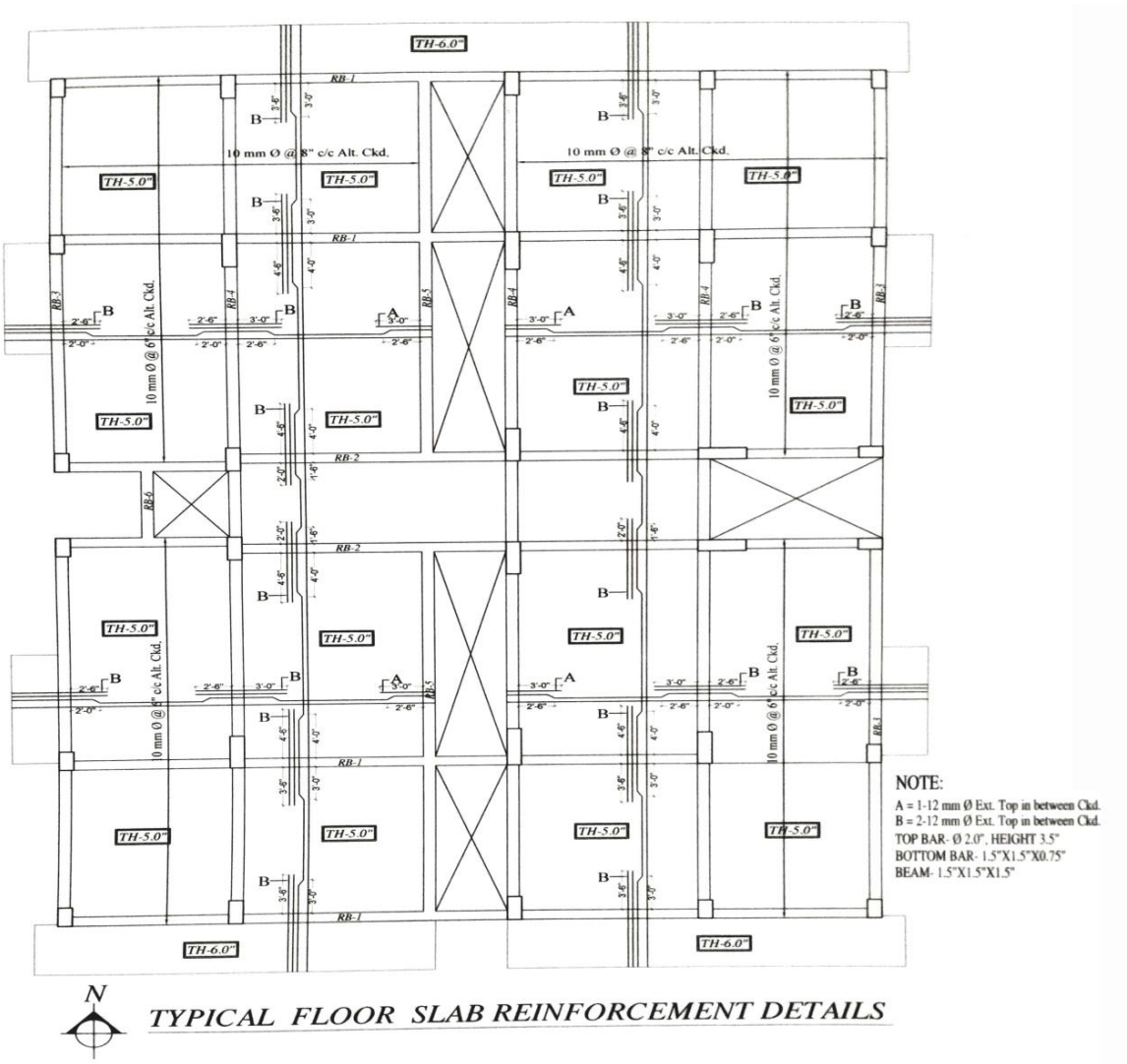


Figure 4.27 Reinforcement details of slab

As per design slab thickness was 5 inches. In short direction 10mm bars used @ 6″ c/c at alternative cranked which has been given in drawing. After that placed 10 mm dia used as a long direction 8″ c/c at alternative cranked. Then used extra top 12mm dia bar in between top bar as per as design and also cantilever portion. In this part I will discuss about panel-4. Here the reinforcement details of panel-4.

4.3.14 Slab reinforcement placement

In my project slab thickness was 5 inch that was two-way slabs. The ratio between short and long span is less than two. The slab reinforcement was 60 grades used. In this slab have 8 panels. At first, they placed short direction rebar @12″ c/c after that they placed long direction rebar @16″ c/c in the bottom layer of slab bellows the beam top layer.

(a) (b)

Figure 4.28 Slab reinforcement placement (a) Long direction (b) Both direction

After that they placed long and short direction rebar, then they started to binding rebar. Then they placed clear cover block. Size of block was 0.75“ for top layer and 3.2“ for cranked bar.

(a) (b)

Figure 4.29 (a) Reinforcement binding (b) Block placement

After binding bottom and top layer reinforcement, then they made cranked bar. I have measured the spacing of the cranked bar. The spacing is 12 inch.

(a) (b)

Figure 4.30 (a) Making cranked bar (b) Spacing of cranked bar

I have measured the spacing between long way and short way bar. It was 8 inch and 6 inch. And also measured the cranked bar. After binding rebar they placed extra top bar of slab.

(a) (b)

Figure 4.31 (a) Spacing of bottom bar (b) Spacing of top bar

After completing the binding of slab top and bottom reinforcement then they placing extra top for slab.

(a) (b)

Figure 4.32 (a) Reinforcement for extra top (b) extra top bar placement

4.3.15 Electric pipe placement

After the slab reinforcement work completed, electric pipe was placed. Electric pipe was very important for all types of electric supply. They placed PVC pipe for electric work. When they placed PVC pipe, they have maintain 2d gap between two PVC pipes. Where d is dia of used PVC pipe.

Figure 4.33 Electric pipe placement

4.3.16 Beam and slab casting

After placement of all the reinforcement work casting work is started. Before slab and beam casting, They used water spray on the shuttering for clean the slab. Then they were started casting work. For casting materials, they used cement, Sylhet sand, local sand, brick chips, stone chips and drinkable water. Mixing ratio was 1:2:4. Concrete mixing was by mixer machine. Water cement ratio was 0.45 to 0.5.

(a) (b)

Figure 4.34 (a) Spreading water before casting (b) Mixing process of concrete

At first column was casted. Then levelled from column point. At casting time, they used vibrator machine for compacting. In casting time, they used grouting for better joint between mixer and reinforcement.

Figure 4.35 Column casting

After completed the casting of column then they casted slab and beam together. Used patta for leveling beam and slab.

(a)

(b)

Figure 4.36 (a) Beam and slab casting (b) Using patta for leveling

During slab and beam casing they used vibrator machine. Vibrator is used to reduce the volume of concrete. After leveling slab, they placing "U" for column alignment.

(a)

(b)

Figure 4.37 (a) Vibrator using (b) "U" placement

4.3.17 Beam and slab curing

After passing 24 hours they made a temporary boundary for the curing of the slab. They used the hose pipe for the curing work. The curing work continued 14 days after casting.

Figure 4.38 Curing of slab and beam

4.3.18 Work schedule of beam and slab

Work Discription	22-May	23-May	24-May	25-May	26-May	27-May	28-May	29-May	30-May	31-May	1-Jun	2-Jun	3-Jun	4-Jun	5-Jun	6-Jun	7-Jun	8-Jun	9-Jun	10-Jun	11-Jun	12-Jun	13-Jun	14-Jun	15-Jun	16-Jun	17-Jun	18-Jun	19-Jun	20-Jun	21-Jun	22-Jun	23-Jun	24-Jun	25-Jun	26-Jun
Shuttering of beam																																			
Shuttering of slab																																			
Placing of main bar of beam																																			
Placing of stirrup of beam																																			
Placing of extra top of beam																																			
Placing of main bar of slab																																			
Placing of binder bar of slab																																			
Placing of extra top bar of slab																																			
Binding of bar with each other																																			
Casting of beam and slab																																			
Curing of slab and beam																																			

Figure 4.39 Work schedule of beam and slab

4.4 Stair construction

The stair is one of the main components of a multi-storied structure. It is also most crucial part of high raised building. In my project, there were one stair. I observed the construction procedure of stair. The workers made up to half landing of stair at the time of column and with slab they made another half. Formwork, reinforcement placing and casting was done gradually.

4.4.1 Stair plan and construction

Stair total length was 11'-0″ and width was 7'-4″. Stair had two flight; first flight and second flight. Each flight had nine steps. Each step height was 6 inch and wide was 10 inches. Waist Slab and landing thickness was 6 inches. In design, the landing was 3'-11″ and the stair was 7'-6″.

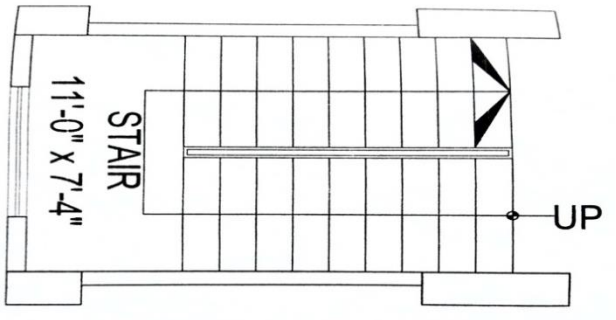


Figure 4.40 Stair plan

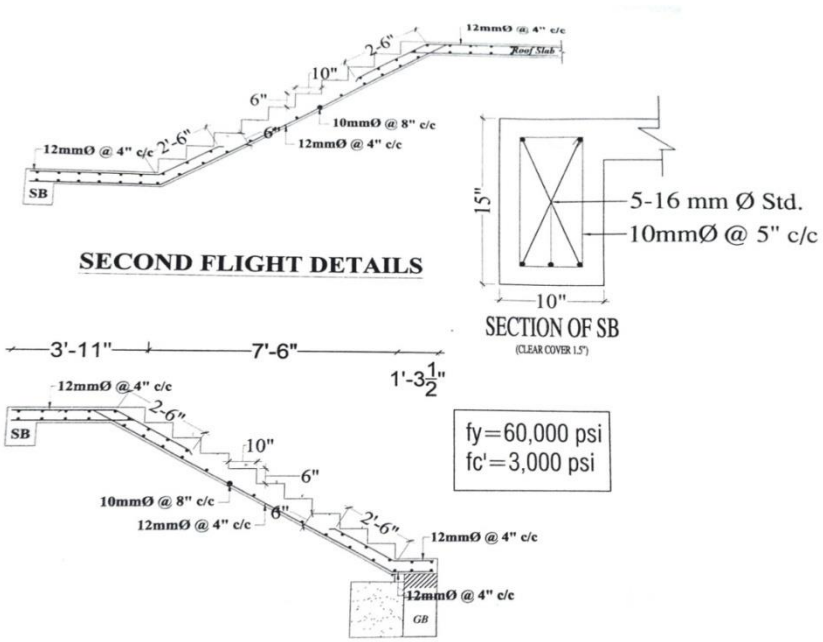


Figure 4.41 Cross section of Stair

4.4.2 Reinforcement details of stair

12 mm and 10 mm reinforcement were used in the slab. At the bottom layer 12 mm bar @ 4″ c/c was placed as the main bar. 10 mm bar @ 8″ c/c was used as bottom binder bar. At the top layer, 12 mm bar was used at 4″ c/c as the main bar and 10 mm bar at 8″ c/c as binder bar.

4.4.3 Formwork preparation of stair

The materials were used to construct the formwork of stair which was bamboo props, runner and wooden plank, nail and plain sheet. The bamboo props were used for supporting the runner and the wooden plank were used to make platform over it. The runner was placed 2 foot away from each other and the supporting bamboo props were placed 2 foot away too. The runners were used 4-foot long and each runner was supported by two bamboo props. After that the steel sheet used over the wooden plank for a smooth and plain surface. The size of each steel sheet was 3́x6́.

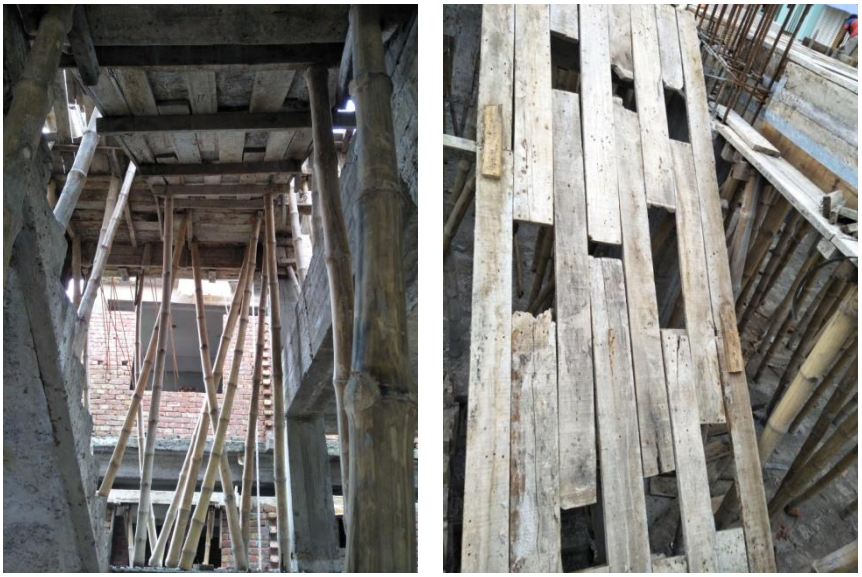


Figure 4.42 Shuttering of stair

4.4.4 Reinforcement placement of stair

After preparing formwork of the stair, they started to place the main reinforcement as per design. At first, they had placed 12 mm bar at 4″ c/c. The main bar extended to the first landing. After that, they placed 10 mm bar at 8″ c/c as binder bar. The clear cover of the waist slab was 0.75″

and concrete blocks were used to maintain it. After that I have measure the spacing of main bar and binding bar. It was 4 inch and 7 inches.

Figure 4.43 Reinforcement placement

(a) (b)

Figure 4.44 (a) Spacing length of main bar (b) Spacing length of binder

4.4.5 Riser and tread placement

After placing the reinforcement properly, wooden planks were used to create tread and riser. First, they placed top and bottom riser and the rest of the riser was placed. Plumb bob was used to check the vertical alignment for setup tread and riser. The top and bottom riser placed by using water leveled pipe. Riser height was 6″ and tread size was 10″. I have measured the length of riser and tread. It was 6 inch and 9.5 inch. After preparing the whole formwork, all the things were cleaned by water before casting.

Figure 4.45 Riser and Tread setup

(a)

(b)

Figure 4.46 (a) Tread length check (b) Riser height check

4.4.6 Stair casting

Stair was casted after completing riser and tread setup. Concrete mixture was made by mixture machine. The ratio was used for casting was 1:2:4 (Cement: Sand: Brick chips). Before casting, casted place was wetted by water and also spread grouting (Cement + Water) in the joint portion. During casting vibrator machine was used to apply avoid void in the concrete mixture.

(a) (b)

Figure 4.47 (a) Stair casting (b) Using vibrator

4.4.7 Stair curing

After passing 24 hours the curing work was started. They used hose pipe for the curing work. They did it almost 14 days to get the height strength of the concrete. Figure 6.7 (a and b) shows the curing work of stair.

Figure 4.48 Curing of stair

4.4.8 Work schedule of stair

Work Discription	15-Jul	16-Jul	17-Jul	18-Jul	19-Jul	20-Jul	21-Jul	22-Jul	23-Jul	24-Jul	25-Jul	26-Jul	27-Jul	28-Jul	29-Jul	30-Jul	31-Jul	1-Aug	2-Aug	3-Aug	4-Aug	5-Aug	6-Aug	7-Aug	8-Aug	9-Aug	10-Aug
Shuttering of staircase																											
Placing of main bar																											
Palcing binder bar																											
Placing of extra bar																											
Placing of side shuttering																											
Casting of staircase																											
Curing of staircase																											

Figure 4.49 Work schedule of stair

Chapter 5: Conclusion

5.1 Knowledge development

Before joining practicum field, I have learned theoretical knowledge. After joining construction site, I have learned some practical knowledge. Also compared with those. I found lots of difference between theoretical and practical. In engineering materials course, we learned about field test of cement, sand, bricks, reinforcement. Here I have done all of those theoretical knowledge for field test. I have learned how to check shuttering of column, beam, slab and stair. In practicum time my project engineer helped me to learn all of those things. In practicum time I have measured all types of clear cover and spacing. It was not actually done by design. More or less difference happened. I have seen what kind of irregularities happed in construction site. On that this I learned how to overcome it.

5.2 Conclusion

During my practicum time I observed the process of building construction. I was following the instruction of engineer what he told the workers. Engineer helps me to give some information about building construction. Worker leader leads the worker team and he instruction them how they worked. I have learned some practical information from worker leader. During my practicum time I have learned how to construct column, beam slab and stair.