Report on

Structural and Foundation Design for G+9-Storied Residential Building at Banasree, Dhaka

Final Year Project (CE498)

TEAM

Khobir Miah	ID: 2018-1-22-051
Sudipto Goon	ID: 2018-2-22-006
Nila Ishrat Priya	ID: 2018-2-22-019
Nishat Tasnim Shama	ID: 2018-2-22-022

ADVISOR

Dr. Md. Naimul Haque

A project report submitted to the Department of Civil Engineering, East West University as requirements of the Final Year Project (CE498)

January 2023

Department of Civil Engineering

ACKNOWLEDGMENTS

We would like to thank everyone who worked on the project and who made it possible for us to turn an idea into a workable application. We are thankful to Dr. Md. Naimul Haque, Head of the Department of Civil Engineering, who has been a wonderful mentor and inspiration for our work.

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Khobir Miah

Nila Iahrat Priya

Sudipto Goon

Nishat Tasnim Shama

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EXECUTIVE SUMMARY

In this project, we will design a structural element of a ten-story residential building in Banasree, Dhaka. The size of the project land is 10 Katha or 7200 sq ft. As structural design engineers, we will plan and design the building's beams, columns, slabs, and foundations as well as draft the structural drawing. Software such as ETABS and AutoCAD is used to analysis and designing structural parts. We are analyzing and designing this project in accordance with the BNBC Code, ACI 318, and Dhaka-Imarat-Nirman-Bidhimala. According to the codes and guidelines, we also design and choose the size and position of the septic, underground, and overhead water tank. A detailed Bill of Quantity (BOQ) for the project building is also provided. The schedule for completing the building project has also been prepared by us.

CHAPTER-1
INTRODUCTION

1.1 PROJECT BACKGROUND

Banasree was the location of the land that was selected for the project. The sum of the land is 10 Katha. The front side road is 100 feet wide. The RAJUK has previously approved the building plan, which the customer has not provided. The architectural plan and the soil reports are provided to us by our client. As structural design engineers, we are asked to plan, design, and draft building structural drawings including foundation design. The construction materials are simple to transport to that location, but the placement of the materials is challenging because the main road is on the front side of the property. Therefore, it was difficult for us to build a structure located near a road. We are taking every effort to fulfill the requirements of our clients.

The project's general information is given below.

Table 1.1 Project general information

Area of land	Approximately 10 Katha
Building type	Residential building
Location	Banasree, Dhaka
No. of story	G+9
Road	100 ft (front side)

In Dhaka, Banasree occupies a distinctive place. Residents of Banasree may easily access any location in the city because Hatirjheel is just on the other side of the street. No place is too far away from Banasree, whether it be Gulshan, Mirpur, Motijheel, or Dhanmondi. It was even easier because of the recent building of flyovers. People can also avoid the usual traffic intersections by using the Staff-Quarter Road to travel to Narayanganj and leave Dhaka. Even though they are so close to Dhaka's core, both are nonetheless feasible. The area's boundaries are well within the reach of hospitals like Al-Raji Islamia, Farazy Hospital Ltd, and American International Hospital. Both of which are within a 20-minute drive of any location in Banasree. Educational institutions like East-West University and Dhaka Imperial College are in Aftabnagar opposite Banasree where many students come from outside Dhaka to study.

So, they want to live near the institution area. Moreover, there is an educational institution like Ideal School and College located near the project area. For those who want to live nearby, this project will present a great opportunity.

1.2 PROJECT REQUIREMENTS

The stockholder listed a few requirements for the project's implementation.

These are mentioned below-

- Both an earthquake and strong winds won't cause any damage to the structure.
- Outside the boundary line, nothing can be constructed, not even a foundation.
- To make the building affordable, the structural design needs to be optimized.
- A rooftop garden will be built on the rooftop space.

As structural engineers, we try to cover all the requirements given by stockholders while designing structural elements. We also make every effort to improve the economic appraisal.

To build up any building in Bangladesh it is mandatory to follow the rules provided by Bangladesh's government. Without following this, approval for the construction of houses cannot be obtained from the Rajdhani Unnayan Kartripakkha (RAJUK) and the concerned authorities. So, before the implementation of the project RAJUK approval must be needed. Except that the Bangladesh government also provides Bangladesh National Building Code which is mandatory to build up a building. The government's detailed instructions on the minimal level of quality control required during building construction are contained in the National Building Code. Before starting work on a project, a builder must have clearance from the relevant authority to proceeds with the construction of the building by the relevant construction regulations. The goal of adhering to these regulations is to guarantee the property and personal safety of every living thing within the structure. In Bangladesh too, some criteria have been set in terms of floor area ratio, maximum ground coverage, setback rule, the distance of road around the building, etc. So, to implement this project, these rules are mandatory to follow.

1.3 OBJECTIVE

Build up a 10-story building that is profitable for the owner, is one of the main objectives. Engineers must follow all rules per the BNBC2020 and ACI-318 code while analysis and designing the structure. So that Rajuk has no hesitation in passing the plan. A significant housing shortage is also present in the project area. A larger amount of demand will be met after the structure is constructed. The original objective of a building is to offer safe, secure, and climate-controlled areas for its residents and their belongings. This is a fundamental component for building up a structure.

Here are some basic objectives -

- To analyze and design a G+9 - storied reinforced concrete building.
- Helping the underprivileged find work.
- To provide a structurally sound and environmentally controlled space for the home and to protect occupants and contents.
- Designing a structure that can bear all applied loads over its planned life without failing.
- The structure needs to be made more cost-effective.

1.4 LITERATURE REVIEW

RCC, steel, and composite structures are the three popular construction materials used nowadays. Here we show the comparison of why we choose RCC structures over steel and composite structures for this project.

Rahul Pandey has submitted his thesis “Comparative seismic analysis of RCC, Steel and Steel-concrete composite frame” in which he had compared the performance of a (G+7) storey RCC, Steel, and Composite building frame situated in earthquake zone 5 using ETABS software. And the results were compared and the conclusion about the storey drift more for steel frame as compared to composite and RCC frame. And RCC frame has the lowest value of storey drift because of its high stiffness, which indicates that as the value of stiffness increases, storey drift values decreases with it. So here RCC frame is better than rest of two frames in case of storey drift.

Under the application of various loads the displacement of nodes can occur. Less nodal displacement indicates safe structure. **Shashikala Koppad and Dr. S.V. Itti** had published

“Comparative study of RCC and Composite Multi Storeyed Buildings” in which they took a 3-D model in seismic zone 3. In this research paper they had concluded that node displacement in composite structure is more as compared to RCC structure. This is because the composite structure is more flexible as compared to RCC structure.

Therefore, we conclude that the RCC structure is preferable than other structures in terms of story drift and displacement from the study article mentioned above. When comparing steel, RCC, and composite structures, price is a key factor. Because costly structures are sometimes ignored during development if a more affordable alternative is offered in front of them. Cost of composite buildings is more than RCC and less than steel. In consideration of everything, we decided to use the RCC structure for the project.

1.5 REVIEW OF SUPPLIED DOCUMENTS

The client has supplied the architectural drawing and the floor plan of the project building. Their floor area is 4275 square feet, and this architectural design shows that it is a two-unit floor. Each unit features three bedrooms, a living room with a dining area, a kitchen, a servant room, five bathrooms, a family room, and two balconies. The stairwell and elevator are in the middle of the building. There is one stair per unit. In the middle of the two stairs, there are two elevators. The ground floor of the project building will be used as parking. The client also provides a subsoil geotechnical report**.** The floor plan is given below. Some rules and regulations according to codes are observed from the architectural drawing.

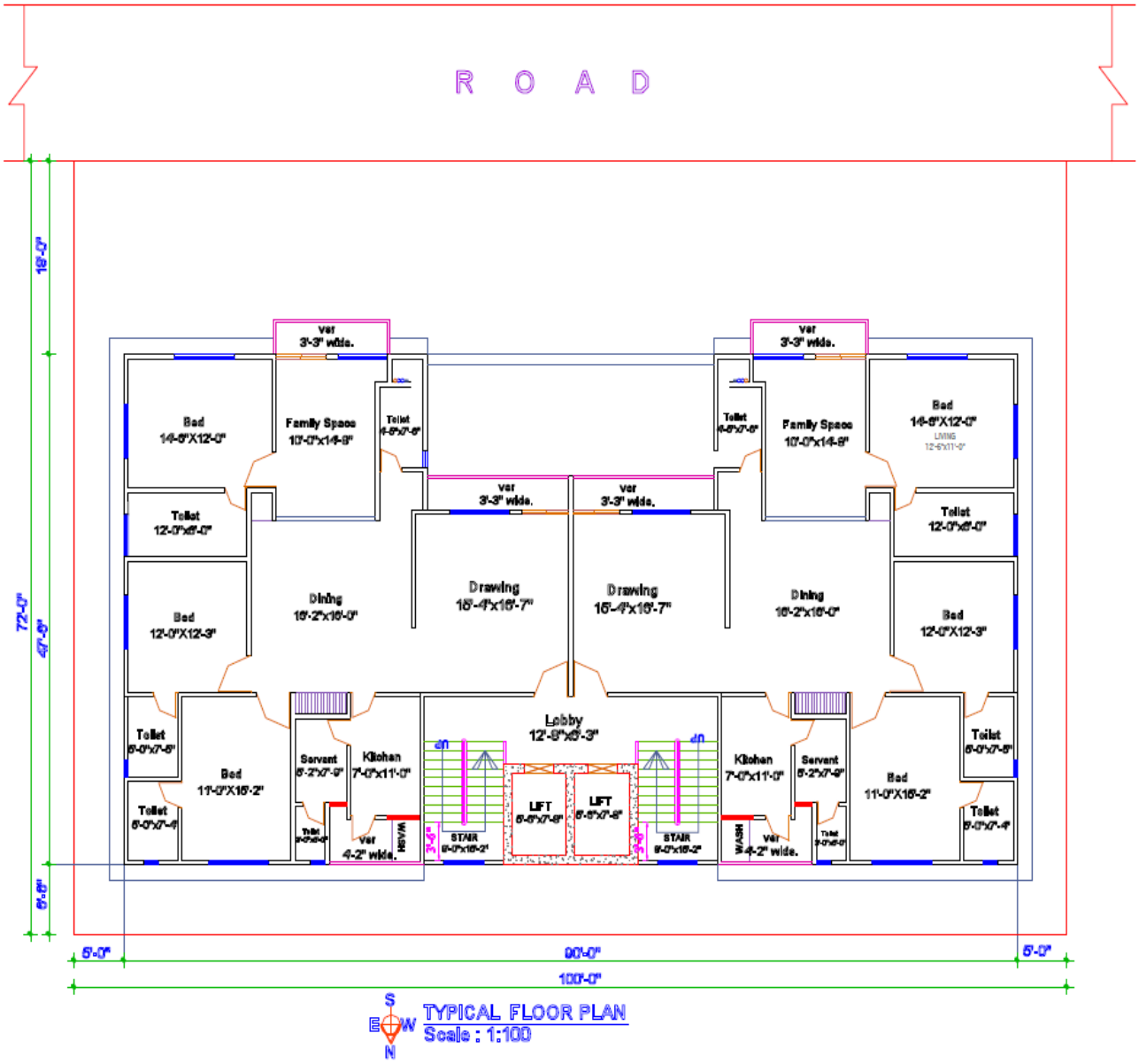


Figure-1.1 Floor Plan

FAR Rules:

The ratio of a building's total floor area (gross floor area) to the size of the piece of land on which it is built is known as the Floor Area Ratio (FAR). The total project land area is 10katha or 7200sq. ft. The project building is a residential building. According to land area and building type Dhaka Imarat, Nirman Bidhimala provided the FAR ratio which is 4.25.

From the setback rule, it observed that the front side is 18ft, the back side is 6.5ft and each side is 5ft. After deducting the areas the total floor area reminds 4275sq ft. The total floor of the building is 9.

$$FAR = \frac{\text{Summation of all floors area}}{\text{Total area of land}}$$

$$= \frac{4275 * 9}{7200}$$

$$= 5.34 > 4.25$$

Here, for the project building obtained FAR is 5.34 which are more than the RAJUK approved FAR.

MGC Rules:

MGC is the Maximum Ground Coverage. It shows the percentage of the ratio of the total covered area of the building and the total land area of the site. The calculation helps determine how much land has been used up in constructing a building.

The total project land area is 10katha or 7200 sq ft and our building is residential.

The total floor area reminds 4275sq ft.

MGC = (Covered area by the building) / (Total site area) ×100%

=4275/7200 ×100%

= 59.4%

Dhaka Imarat Nirman Bidhimala provided some guidelines for MGC. According to the total land area and building type, the MGC must be 57.5%. But the calculated MGC is 59.4%, more than the required MGC.

Setback Rules:

A few set-back guidelines have been provided by RAJUK by the Detailed Area Plan (DAP) to safeguard the city's greening, light ventilation, rainwater absorption, and other facilities. The setback rule establishes the required minimum distance from the building on all sides.

Table 1.2 Projects setback rules

Direction	Project Setback (m)	Minimum Setback (m)	Comment
Front side	5.45	1.50	Satisfied
Back side	2.00	2.00	Satisfied
Both side	1.52	1.25	Satisfied

Minimum Occupancy Requirements:

According to BNBC 2020 minimum area for a drawing room should not be not less than $9.5m^2$ or 100 sqft in our floor plan drawing area is $23.58m^2$. Which is more than the minimum requirement for a drawing or living room. The kitchen room should not be less than $4m^2$ which is around $7m^2$ in our plan. For the washroom, the minimum size is $2.75m^2$ in our all the washroom size is more than the requirement. So, as per the area size of the floor plan drawing room, kitchen, and washroom area are more than the minimum requirement. Again according to BNBC 2021 stair width for a residential building should not be less than 1.15m but the project building stair area is 2.43m which is more than the minimum required area specified in BNBC 2021.

Table 1.3 Minimum occupancy requirements

Occupancy Type	Project Minimum	Minimum Requirement	Comment
Room	$23.58m^2$	$9.5m^2$	Satisfied
Kitchen	$7m^2$	$4m^2$	Satisfied
Toilet	$3.48\ m^2$	$2.75m^2$	Satisfied
Stair	2.43m	1.15m	Satisfied

1.6 SITE VISIT

As a structural engineer, visiting the project allocation is crucial before beginning any work. Accordingly, we went to the project site before we started. The project area was inspected by us on February 6, 2022. The project's location is next to a 100-foot-long road in a residential area. After visiting the site, we evaluated its current state, its surroundings, its accessibility, the usefulness of its services, the placement of its material storage, and its waste management.

Figure-1.2 Site Visit

Site Condition:

Except for a small room, the project site is unoccupied. This area is not entirely level. With little manpower, the room may be quickly destroyed and the area leveled. People have thrown trash on the site because there are numerous residential structures close by. There are also a lot of stone chips and various plants growing there. Also, the project site is surrounded by brick walls before starting the work process the brick walls must be demolished.

Accessibility of the Site:

As the project site is located near the road we can easily use a heavy or light vehicle for as per constructor needs. Therefore, it is simple to bring in construction supplies. Because it is adjacent to the major road, construction trash disposal can be managed as well as the transportation of large vehicles with building materials. It is quite simple to live here because

there are residential structures. Rajuk will find it simple to obtain authorization since the neighborhood is residential.

Utility Services:

There are adequate facilities for utility services because Banasree is a residential and developing area. For electricity, it can be arranged from Desco. Again gas facilities also need for any residential building it can also be easily arranged.

Material Storage Location:

As the project is located on10katha so there is not enough space on the site for construction materials storage. The site is located in the middle of the residential area and there is a road along the site so there is not enough space for construction material storage. Moreover, the road is busy all the time so it is hard to park a loaded truck on the road. Also, there is no open space near the site so the construction materials stored at some distance from the site. Materials can also be brings for 10/15 days.

Waste Management:

The construction waste materials can easily replaced by using dump trucks. Recycle bins can also be placed in certain areas during construction work and arrange for them to be taken away by dumping trucks at the end of the day. Also, it can be use separate bulk for the disposal of organic waste materials. There is no damage to the soil, environment, and surroundings.

1.7 PROJECT IMPACTS

1.7.1 Environmental Impacts

As the project construction procedure takes a long time to complete so it has a large contributor to environmental impacts. We try to minimize the impacts by providing some mitigation measures.

Air Pollution:

To begin any construction of a building there needs some equipment that is not available at the site the pieces of equipment are brought from other places by using many vehicles. These vehicles operate on diesel engines that can cause pollute the air. Also, the earthwork and

pilling work incurred by diesel engine machines pollute the air. Low-sulphur diesel may be used to minimize this pollution. Also, water sprays or sprinklers may be used to control some types of dust and stop it from spreading. Waste materials should never be burned on the project site that causes smoke, releasing poisonous gases such as carbon monoxide into the atmosphere.

Noise Pollution:

Some sources of noise pollution on the project construction sites include loud machinery, raised voices, and physical work such as hammering, drilling, or digging. This can cause residents to experience varying levels of stress, sleep disturbance, or high blood pressure. So the construction work should be scheduled between 8 to 6 pm rather than when residents around the project area are likely to be sleeping. As the employees use particularly loud equipment, they may even experience hearing loss. So it must ensure that employees wear the correct PPE, where needed to reduce the risk of hearing loss due to excessive noise. Metal-to-metal contact should be avoided as much as possible by placing rubber pads between metal contact points such as machinery gates and doors. Barriers can also be placed around the construction site to reduce noise.

Water Pollution:

As the construction procedure may include deep excavation work so the groundwater may be affected. Different types of chemicals can pollute groundwater and human drinking water. The project area is located in a residential area, so proper steps should be adopted regarding water pollution. There is no pool or canal near the project site so there will be no chance to pollute the surface water with the construction works.

Soil Pollution:

Soil work is a must-do in construction work. Soil can be polluted by different liquid waste and wastages of construction work. Also, dust can pollute project site soil.

1.7.2 Societal Impacts

The social environment is negatively impacted by every construction site. It produces a lot of dust and noise, both of which are quite damaging to both people and animals. The social

ecosphere and ecosystem are negatively impacted by construction trash. There are a few societal implications related to the project's construction site.

Health and Safety:

A building site's maintenance is extremely important when it comes to health and safety. They are important elements that affect whether the work will be finished on schedule and to the needed standards. The most crucial safety-related measures are to ensure the attentiveness and collaboration of managers, supervisors, and laborers during the actual building process. Considering the dangers associated with various working procedures is part of being alert. It also involves maintaining temporary physical safety, such as providing hard helmets, eye protection, hearing protection, and safety shoes for workers, as well as first aid supplies and qualified staff on site. Along with the health of the project employees, we must also think about the health of the people who live beside the project construction area.

Impact on Employability:

This project is a ten storied building project so it takes a long period for the construction procedure of the building. The construction process involves a large number of workers. It creates job opportunities for the local workers who work during the construction time. As the project building is a residential building so after construction there is also a need for some workers for various jobs like security guards and housekeepers.

Impact on Traffic Volume:

The project is right next to the main road of Demra-Banasree. Being the main road, the road is quite wide. Therefore, there will not be any traffic affecting the vehicles coming with the materials for the building. So, the people living around the project site will not be affected by any traffic issues. Also, the construction materials can easily bring to the project site at night.

Socio-Economic Environment:

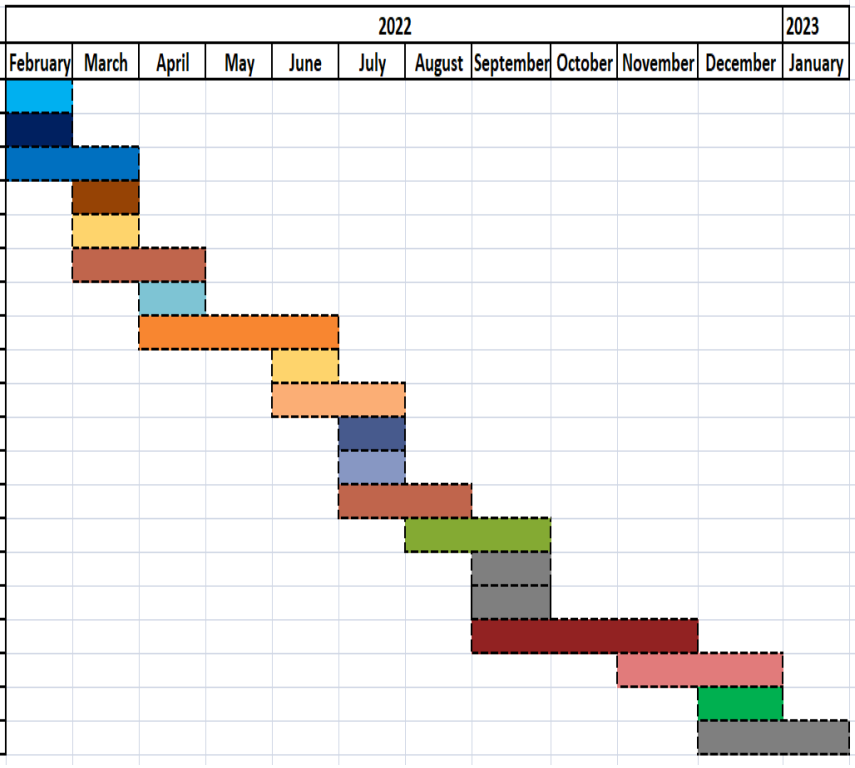
The project is in a residential area. The project land is empty. The project land is surrounded by brick walls, so the site is not being used for any social activities. So, the project will not affect the socioeconomic environment. On the other side, the project land does not benefit the landowner because it is vacant. In that regard, the landowner will benefit if a ten-story building is constructed there. Though it's a costly process to build up a ten-storied building it brings long-term economic benefits to the landowner.

1.8 PROJECT SCHEDULE

A gang chart of the project management plan with an activity list is provided below-

PROJECT SCHEDULE

	Task Name	Start Time	End Time	Days
1	Project Assigned	01-02-22	05-02-22	5
2	Site Visit	06-02-22	15-02-022	10
3	Architectural Drawing Analysis	16-02-22	02-03-22	15
4	BNBC Code study	03-03-22	17-03-22	15
5	FAR, MGC & Setback Rules	18-03-22	27-03-22	10
6	Geotechnical Report	28-03-22	16-04-22	20
7	Environment & Social Impacts	17-04-22	23-04-22	7
8	ETABS Analysis	24-04-22	08-06-22	45
9	Design Of Structural Component.	07-06-22	21-06-22	15
10	Modeling the structure on ETABS	22-06-22	01-07-22	10
11	Validation Study	02-07-22	06-07-22	5
12	Apply load on modeling	07-07-22	21-07-22	15
13	Structural analysis	22-07-22	20-08-22	30
14	Design of over & underground water tank	21-08-22	10-09-22	20
15	Detailed Drawings	11-09-22	22-09-22	12
16	Input all data on report	23-09-22	28-09-22	6
17	Bill of quantities of structural design	29-09-22	13-11-22	45
18	BOQ	13-11-22	02-12-22	20
19	Project Schedule	03-12-22	17-12-22	15
20	Final Repost Submission	18-12-23	12-01-23	26



CHAPTER - 2

ANALYSIS AND DESIGN

2.1 DESIGN CONSIDERATION

The design of concrete structures is generally done within the framework of codes giving specific requirements for materials, structural analysis, member proportioning, etc. Most reinforced concrete buildings constructed in Bangladesh are designed by the current BNBC Code. The project building is located in Bangladesh and for the minimum requirements for the design of vertical structures, and minimum standards and guidelines to protect lives and property, construction, and quality of materials the BNBC 2020 and ACI-318 codes should be followed for the design.

2.1.1 Material Properties

For the building construction, construction materials are considered as follows-

Table 2.1 Strength of materials

Material	Strength (psi)
Concrete	4000
Grade 60-bar	60000

Table 2.2 Unit weight of materials

Material	Unit Weight (pcf)
Brick	120
Concrete	150

2.1.2 Loading and Boundary Condition

Loads are a primary consideration in any building design because they define nature and the level of danger is the external force that a building must resist providing a reasonable functionality (safety and serviceability) throughout the useful life of the structure. Expected loads are affected by the intended use of a building (acquisition and functionality), configuration (size and shape), and location (climate and site conditions). A load causes stress, deformation, and displacement in a structure. The excess load may cause structural failure, so this should be considered and controlled during the design of a structure.

Bangladesh National Building Code (BNBC) serves as a guideline in the design loading condition for a building structure. According to the BNBC, the building project is designed based on the following loads-

- Dead Load.
- Super Imposed Dead Load
- Live Load.
- Earthquake Load.
- Wind Load.

Dead load

Dead Load is the vertical load due to the weight of permanent structural and nonstructural components and attachments of a building such as walls, floors, ceilings, permanent partitions, fixed service equipment, etc. Dead load for a structural member shall be assessed based on the forces due to:

- Weight of the member itself.
- Weight of all materials of construction incorporated into the building to be supported permanently by the member.
- Weight of permanent partition.
- Weight of fixed service equipment.

Super Imposed Dead Load

Superimposed dead load lies as part of the wall load on the slab, and the beam of the building structure. In this project different types of superimposed dead load consider on the ground floor, typical floor, and rooftop. The rooftop of this project building will be used for gardening so that is also considered while designing the building. We consider the super imposed dead load in Etabs analysis as per the following figure.

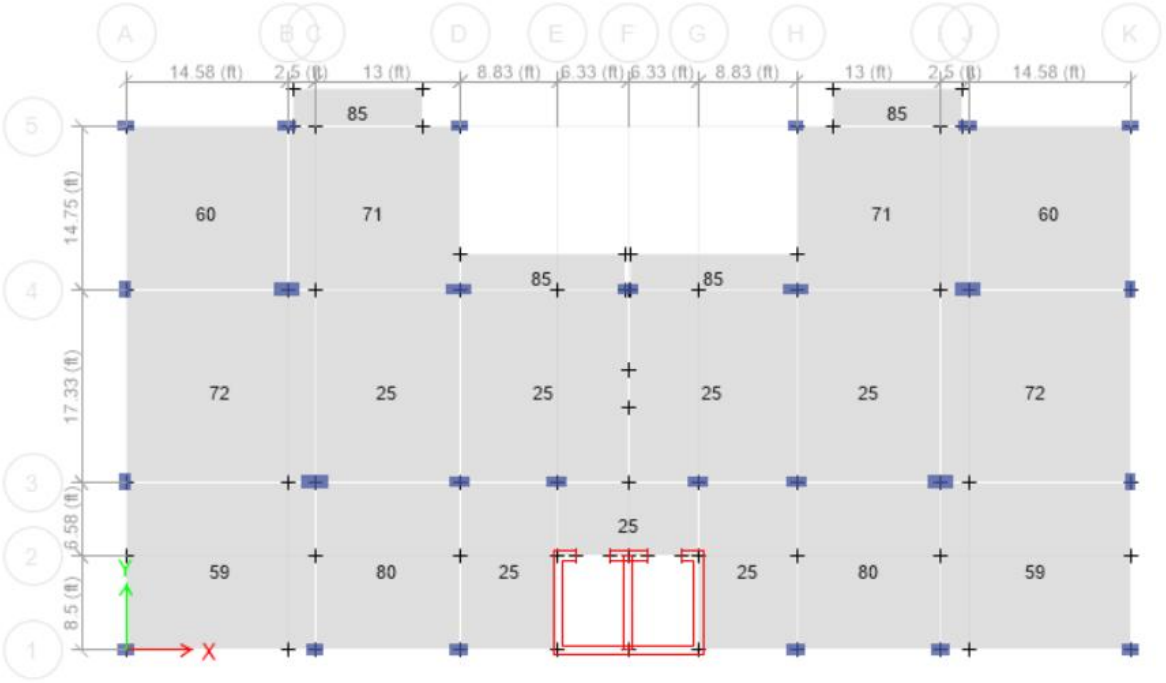


Figure-2.1 SIDL Load on Slab

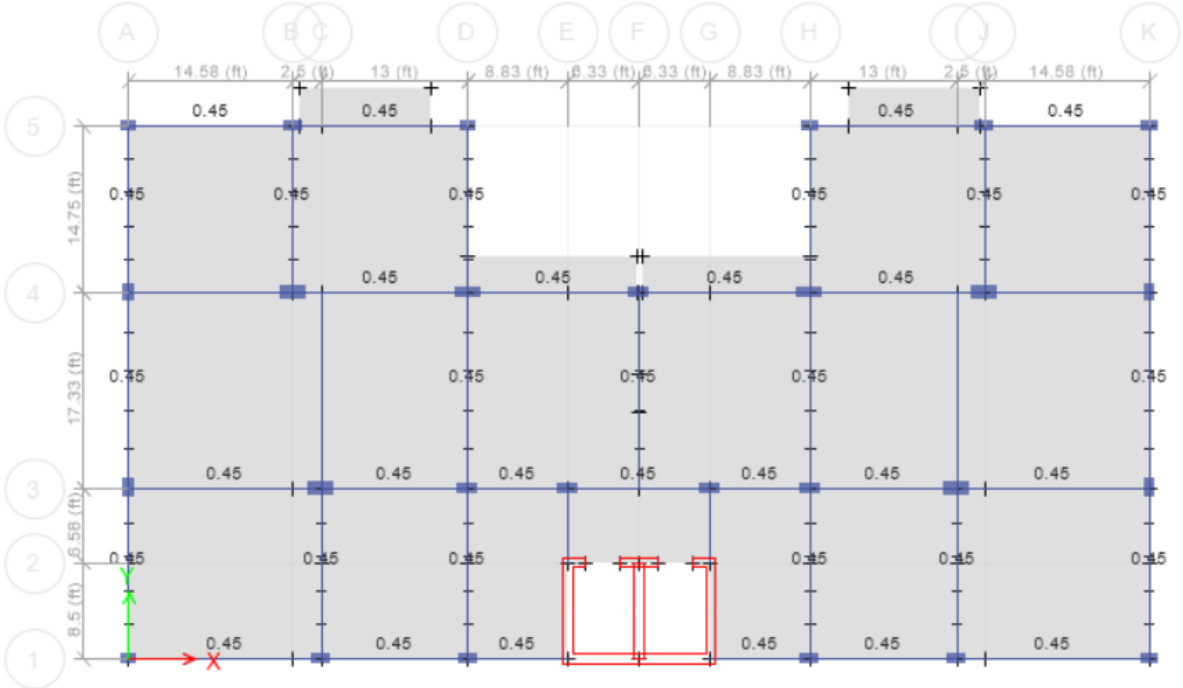


Figure-2.2 SIDL Load on Beam

Live load

Live load is the load superimposed by the use or occupancy of the building not including the environmental loads such as wind load, rain load, earthquake load, or dead load. Loads include those from human occupants, furnishings, no fixed equipment, storage, and constriction and maintenance activities. We consider live loads in Etabs analysis as followings.

Table 2.3 Live loads

Parameters	**Load (lb/ft^2)**
Residential Building	40
Staircase	100
Ground Floor	50
Rooftop	100

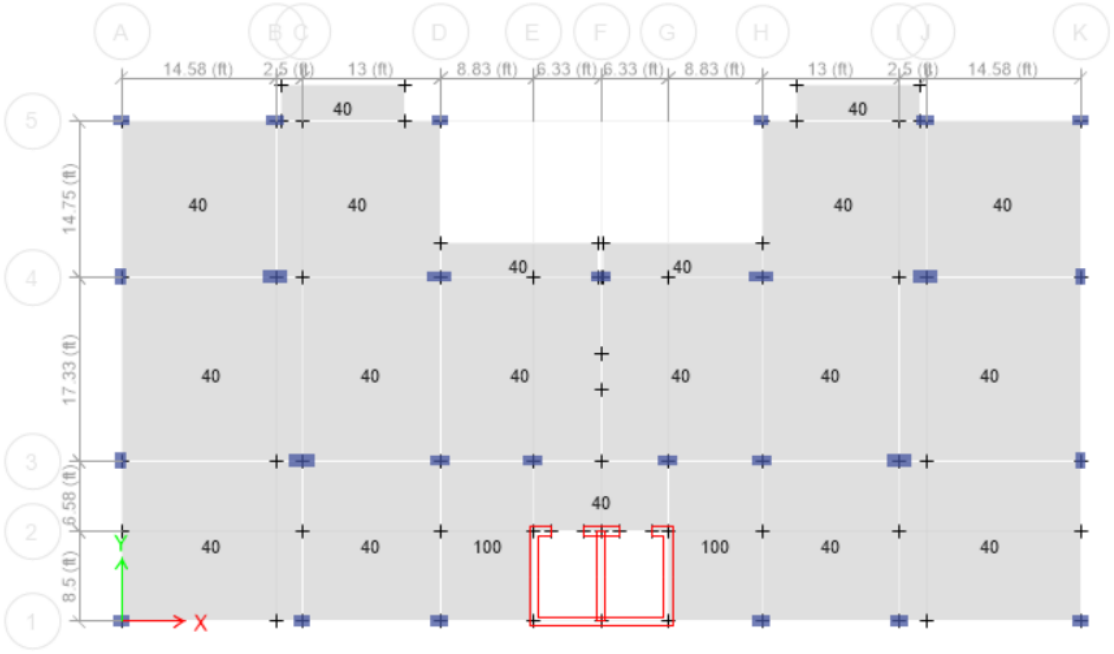


Figure-2.3 Live Load for Typical Floor

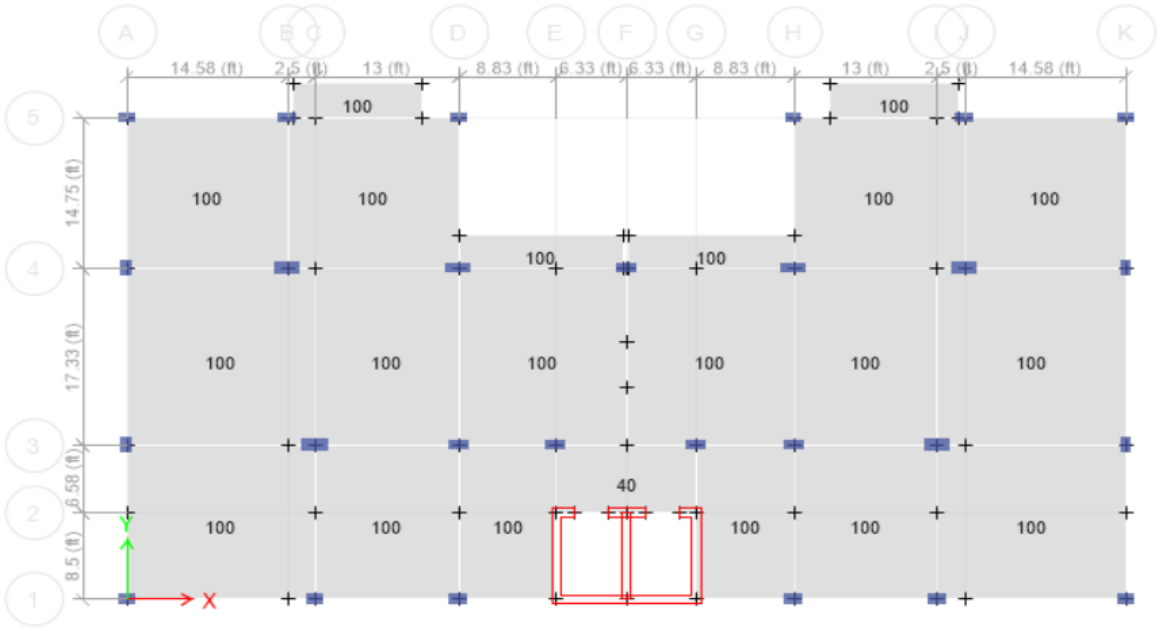


Figure-2.4 Live Load for Roof Top

Wind load:

To determine the appropriate wind load on the structure, loads have been calculated according to the BNBC code with a basic wind speed at the location of the building. We consider the wind load parameters as per the following Table 2.4 and in Etabs analysis we consider those parameters as per ASCE 7-16. Wind load acts on both vertical and horizontal projection of building surfaces.

Table 2.4 Wind load parameters

Parameters	**Value**
Exposure Type	B
Wind Speed, V	147.17mph (Dhaka)
Importance Factor, I	1
Topographic Factor, K_{zt}	1
Gust Factor	0.85
Directional Factor, K_d	0.85

Earthquake Load:

The purpose of the earthquake-resistant design provisions in the BNBC Code is to guide the design and construction of new structures subject to seismic ground motions to reduce the risk to life for all structures by increasing the expected performance of relatively high occupancy structures. The total lateral force at the base of a building is called the seismic base shear. We consider the earthquake load parameters as per the following Table 2.5 and in Etabs analysis we consider those parameters as per ASCE 7-16. We consider the earthquake load both positive and negative.

Table 2.5 Earthquake parameters

Parameter	Value
Response Modification, R	5
System Over-strength, Ω	3
Time Period, C_t	0.0466; m is 9
Deflection Amplification, C_d	4.5
Occupancy Importance, I	1
Site Class	F
Site Coefficient, Fa & Fv	1.15 & 1.765
Seismic Coefficient Ss & S1	0.5 & 0.2
Long-Period Transition Period	5

BOUNDARY CONDITION

The project building is a 10-storied building. We provided a deep foundation as a pile foundation which helps to increase the factor of safety of the heavily loaded structure. Pile foundation has a moment, shear, and lateral loads resisting capacity on itself. Axial loads are resisted by the axial capacity of the piles. Piles are relatively flexible and have a fixed condition. As we provided a pile foundation, our boundary condition is fixed.

2.1.3 Load Combination

The BNBC Code requires that structures must be designed for several load combinations as discussed in section-2.7.3. Factored load combinations include dead load, live load, wind load, and earthquake load for both X and Y directions (Positive + Negative). Structural

members and foundations shall be designed to have a strength not less than that required to resist the most unfavorable effect of the combinations of a factored load combination.

These are:

Com-1: FDL: 1.2 DL+1.2 SIDL+1.6 LL

Com-2: UFDL: 1.0 DL+1.0 SIDL+1.0 LL

Com-3: FEQXpos: 1.2 DL+1.0 LL+1.2 SIDL+1.0 $EQx_{(+)}$

Com-4: FEQXneg: 1.2 DL+1.0 LL+1.2 SIDL+1.0 $EQx_{(-)}$

Com-5: FEQYpos: 1.2 DL+1.0 LL+1.2 SIDL+1.0 $EQy_{(+)}$

Com-6: FEQYneg: 1.2 DL+1.0 LL+1.2 SIDL+1.0 $EQy_{(-)}$

Com-7: FWXpos: 1.2 DL+1.0 LL+1.2 SIDL+1.6 $Wx_{(+)}$

Com-8: FWXneg: 1.2 DL+1.0 LL+1.2 SIDL+1.6 $Wx_{(-)}$

Com-9: FWYpos: 1.2 DL+1.0 LL+1.2 SIDL+1.6 $Wy_{(+)}$

Com-10: FWYneg: 1.2 DL+1.0 LL+1.2 SIDL+1.6 $Wy_{(-)}$

2.2 PRELIMINARY DESIGN

After receiving the architectural drawing, we produce two alternative beam column layouts for the design by considering the stockholder conditions and as per code requirements. The total cross-sectional area of the two alternative beams and columns are remaining the same. All the columns in the first layout measure 12x15 inches, whereas all the columns in the second layout measure 15x18 inches and beams. We try to avoid placing a column in the center of the room to maximize free space and meet customer requirements for good room orientation. We plot 27 columns in layout-1 with dimensions of 12x15 in. Where layout-2 we plot 18 columns with dimensions of 15x18 in. To facilitate car parking on the ground floor, both layouts' columns are placed so that drivers do not find it difficult to park their cars. After analyzing we will select the best beam-column design for the building.

Table 2.6 Preliminary Design Consideration

	Layout -1	**Layout-2**
Column Size	12x15 in	15x18 in
Beam Size	12x15 in	15x18 in
Total Column	27	18

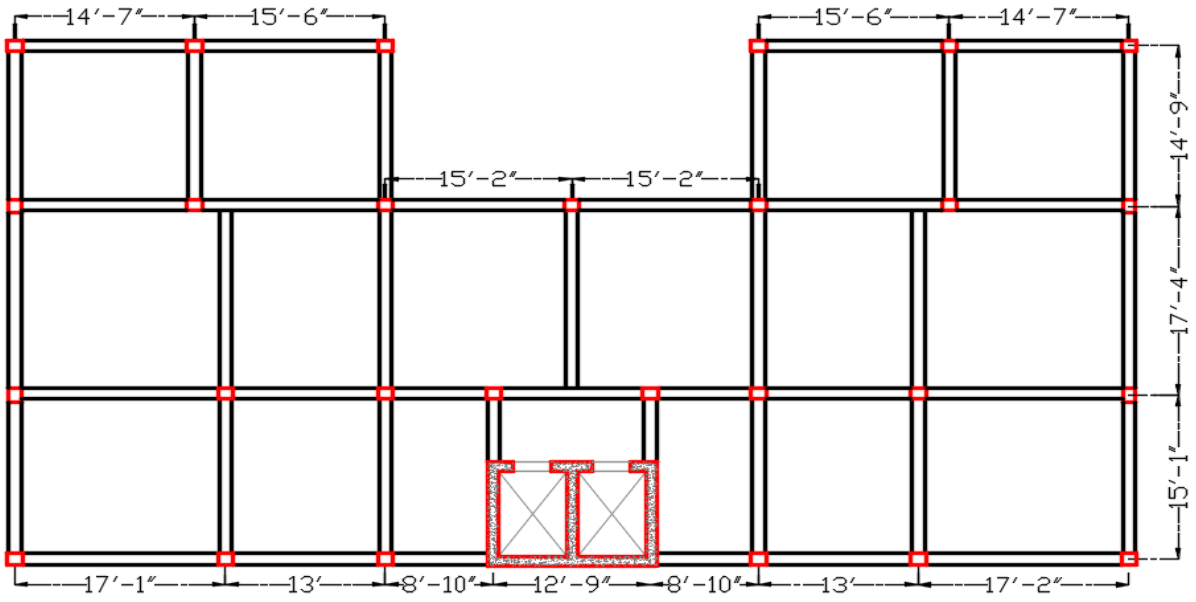


Figure-2.5 Beam-Column Layout-1

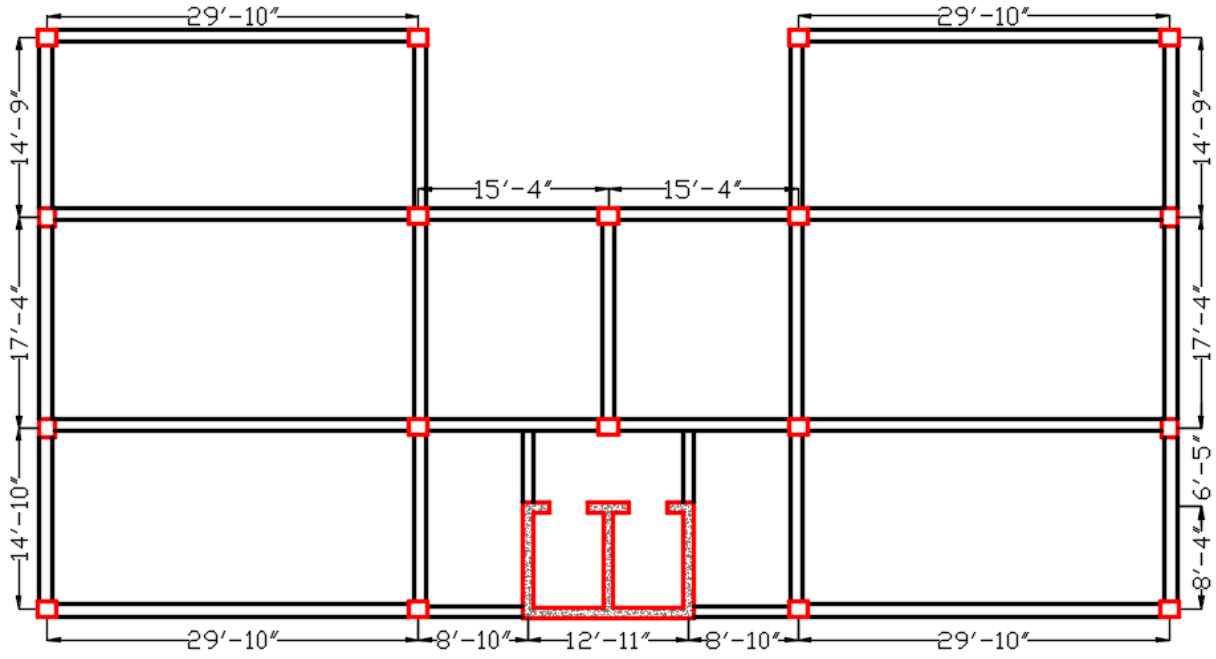


Figure-2.6 Beam-Column Layout-2

2.3 ANALYSIS OF ALTERNATE SOLUTIONS

The performance of beam-column layout 1 is the best, according to the ETABS analysis. Here, the lateral displacements for both layouts are represented collectively along the graph's x-axis and also plotted for y-axis. Layout 2 has a maximum lateral deflection of 2.8 inches, whereas layout 1 has a maximum lateral deflection of 2.3 inches. The highest lateral displacements we obtain for both layouts are on rooftops. Therefore, based on this displacement value, we can choose layout 1 for our major analysis.

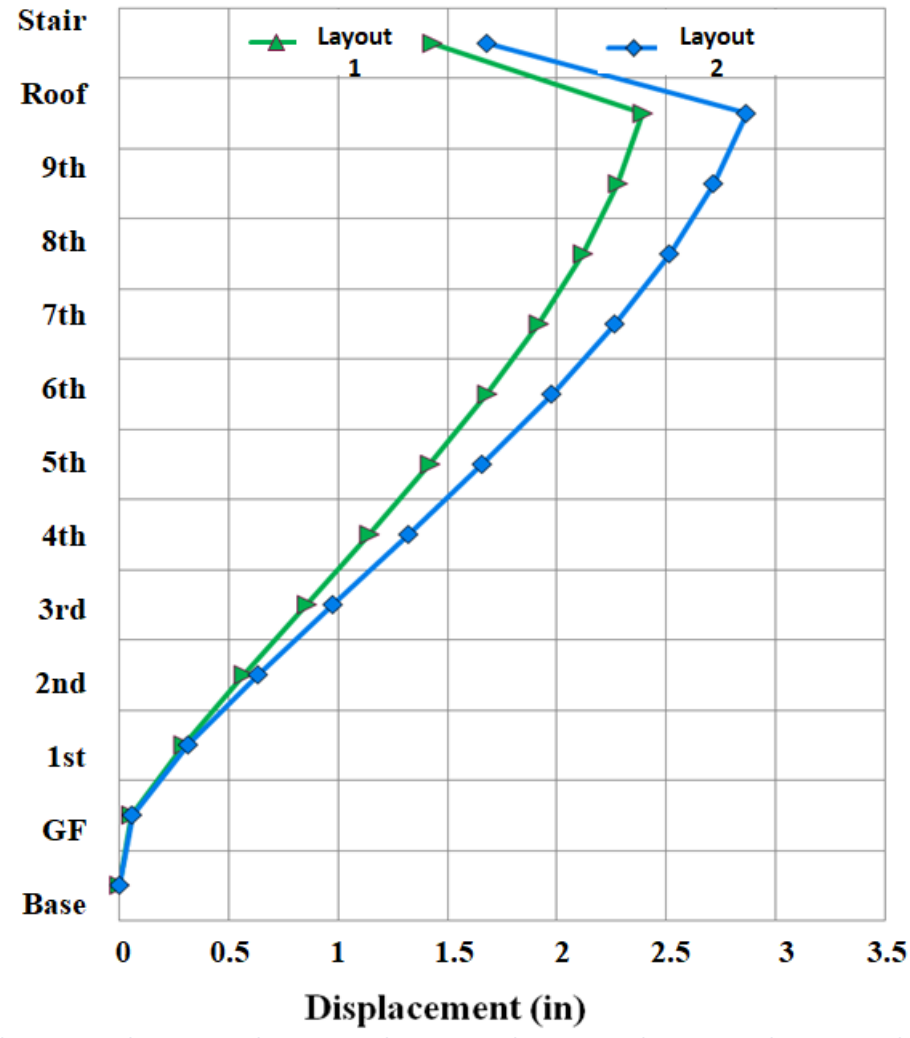


Figure-2.7 X-Axis Displacement

The highest displacements for layout 1 and layout 2 on the y-axis displacement graph are 1.39 in and 1.65 in respectively.

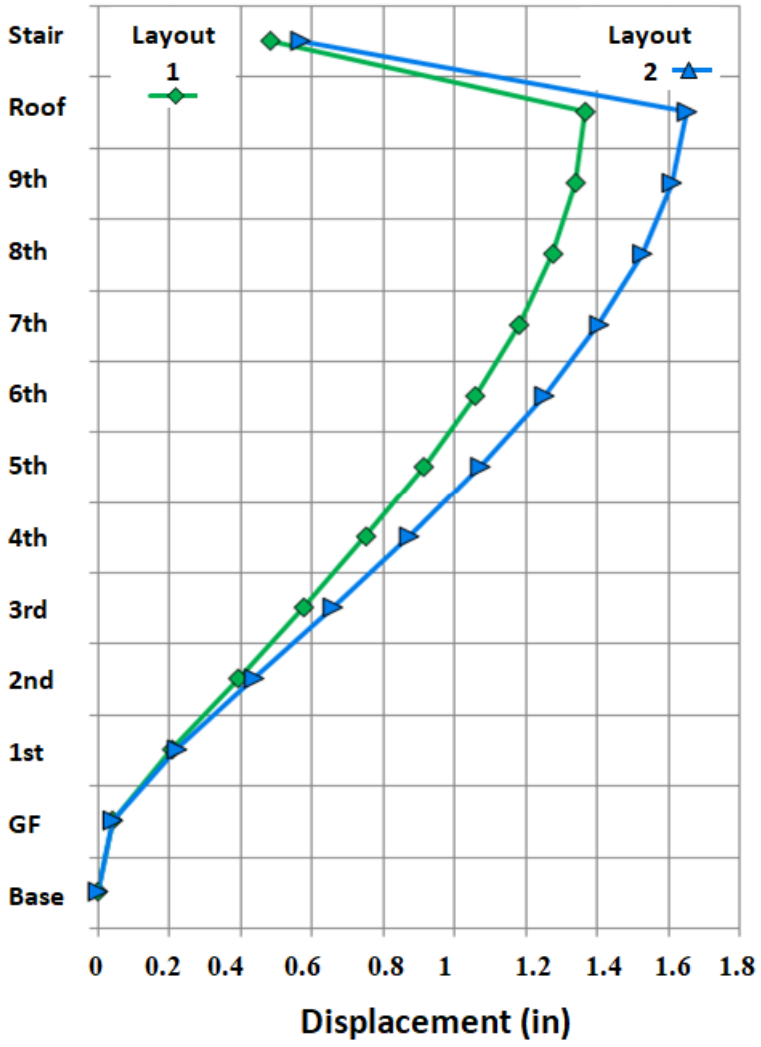


Figure-2.8 Y-Axis Displacement

2.4 PERFORMANCE EVALUATION

After selecting the beam-column arrangement, we proceed to further analysis. This beam-column layout has a total of 27 columns in size of 12x15-inch. 12x15-inch beams are used in this model. We use ETABS to help us with the design of the building. Once the modeling is complete, we apply the wind, earthquake, live, dead, and super imposed dead loads to the design of the building. We run the model after applying the all load, and then we check the longitudinal reinforcement for the beam and the rebar percentage for the columns. The size of the beam is satisfactory. The rebar percentage shows that some columns contain 5% and some columns contain 3% rebar, which does not follow the ACI code. As to the ACI code, the ideal rebar percentage is 2% to 2.5%. Since each column is the same size, we must increase the column's dimension to reduce the rebar percentage.

2.4.1 Validation Study

To determine whether our Etabs result is satisfactory, we compare the obtained results with the results of the hand calculations in the validation study. This allows us to confirm the accuracy of the model that was chosen.

Dead Load for grid- 3AB

$$\text{Self weight of slab} = \frac{(0.5 \text{ X } 17.08 \text{ X } 8.5)\text{X } 62.5}{17.08} + \frac{\big((2 \text{ X } 0.5 \text{ X } 7.5 \text{ X } 7.5) + (2.08 \text{ X } 7.5)\big)\text{X } 62.5}{17.08}$$

$$= 528.55 \text{ lb/ft}$$

Self weight of beam = 187.5 lb/ft

$$\text{Floor finishing} = \frac{(0.5 \text{ X } 17.08 \text{ X } 8.5)\text{X } 25}{17.08} + \frac{\big((2 \text{ X } 0.5 \text{ X } 7.5 \text{ X } 7.5) + (2.08 \text{ X } 7.5)\big)\text{X } 25}{17.08}$$

$$= 235.33 \text{ lb/ft}$$

$$\text{Partition wall load on beam} = \frac{(8.5 \text{ X } 0.417 \text{ X } 17.08)\text{X } 120}{17.08}$$

$$= 425.34 \text{ lb/ft}$$

Partition wall load on slab,

Total wall load = 8590.55 lb

Area = (15.08 x 17.08) ft^2 = 257.57 ft^2

$$\text{Uniformly distributed load} = \frac{8590.55}{257.57} = 33.35 \text{ lb/ft}^2$$

$$\text{Load per unit span} = \frac{\big((2 \text{ X } 0.5 \text{ X } 7.5 \text{ X} 7.5) + (2.08 \text{ X } 7.5)\big) \text{ X } 33.35}{17.08}$$

$$= 140.29 \text{ lb/ft}$$

Total dead load for 3AB grid = (528.55 +187.5 + 235.33 + 425.34 + 140.29) lb/ft

$$= 1517.01 \text{ lb/ft}$$

Dead load for grid- 3CD

$$\text{Self weight of slab} = \frac{(2 \text{ X } 0.5 \text{ X } 6.5 \text{ X } 13)\text{X } 62.5}{13}$$

$$= 406.25 \text{ lb/ft}$$

Self weight of beam = 187.5 lb/ft

Floor finishing = $\frac{(2X\ 0.5\ X\ 6.5\ X\ 13\ )X\ 25}{13}$

= 162.5 lb/ft

Partition wall load on beam = $\frac{(\ 8.5\ X\ 0.417\ X\ 13)X\ 120}{13}$

= 425.34 lb/ft

From the axial load diagram we compare the hand calculation with Etabs value shown below in Table 2.7.

Table 2.7 Software and hand calculation comparison

Column ID	Hand Calculation	Etabs Results	Variation (%)	Comment
C2	111.8	111.87	7	Satisfied
C5	173.3	173.24	6	Satisfied
C3	66.4	66.32	8	Satisfied

2.4.2 Serviceability Performance

We can see from the above discussion that layout 1 provides us with less lateral deflection. Here we also examine the story drift limitation of earthquake loads for layout 1. We obtain the earthquake loads story drift values from ETABS. We determine our story drift limit (Δ) to be 0.175, as per BNBC. Here, the story drift for both axes is represented collectively. The maximum story drift for the x-axis is 0.002183 mm which is less than 0.175 mm. So our story drift limitation check is okay for the X-axis.

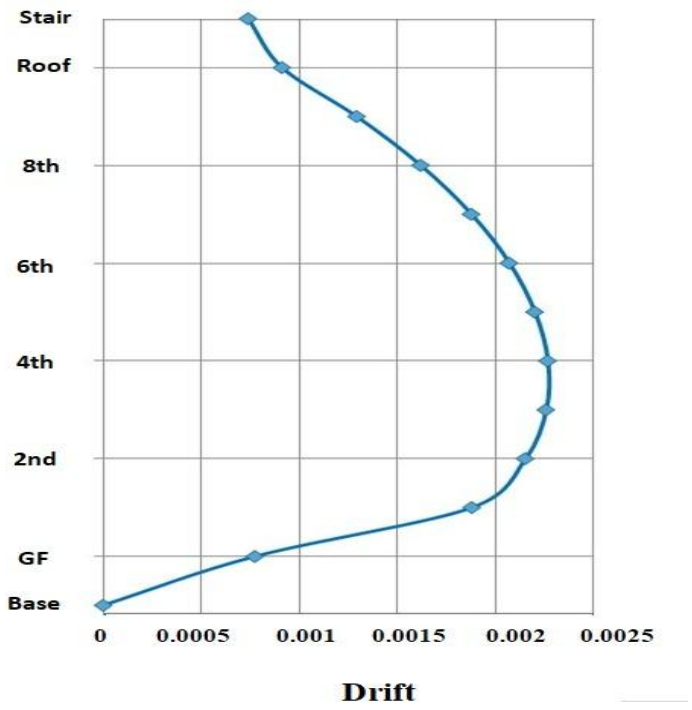


Figure-2.9 X-Axis Story Drift

The maximum story drift for the y-axis is 0.001097 mm which is less than 0.175 mm. So our story drift limitation check is okay for the Y-axis.

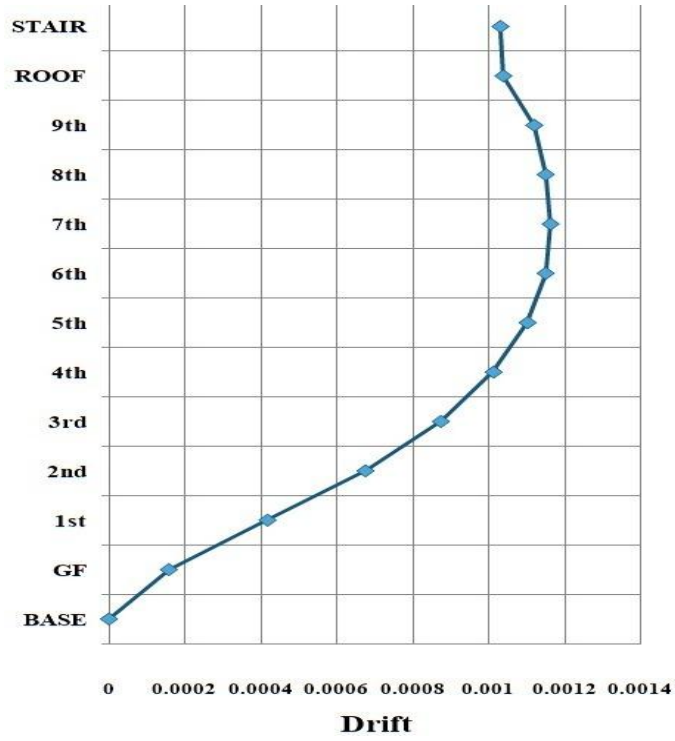


Figure-2.10 Y-Axis Story Drift

We also examine the lateral deflection limitation of earthquake loads for layout 1. We obtain the earthquake loads deflection values from ETABS. We determine our lateral deflection to be 2.78in, as per BNBC. Here, the lateral deflection for both axes is represented collectively. The maximum deflection for the x-axis is 2.3, which is more than 2.78in. So our lateral deflection limitation check is not okay for the X-axis. We need to change the column dimension.

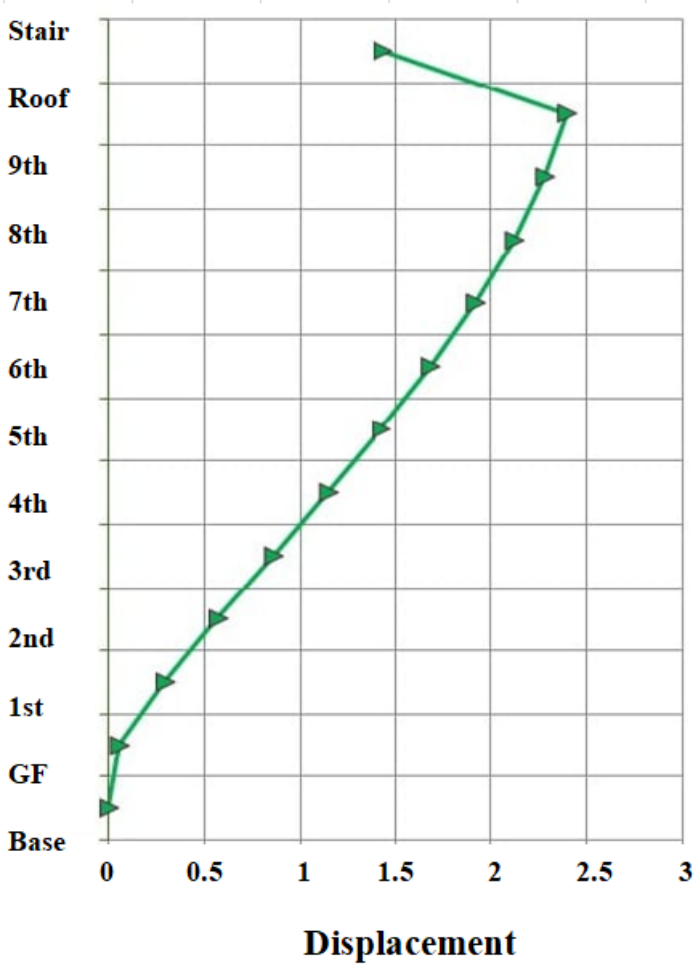


Figure-2.11 X-Axis Displacement for Layout-1

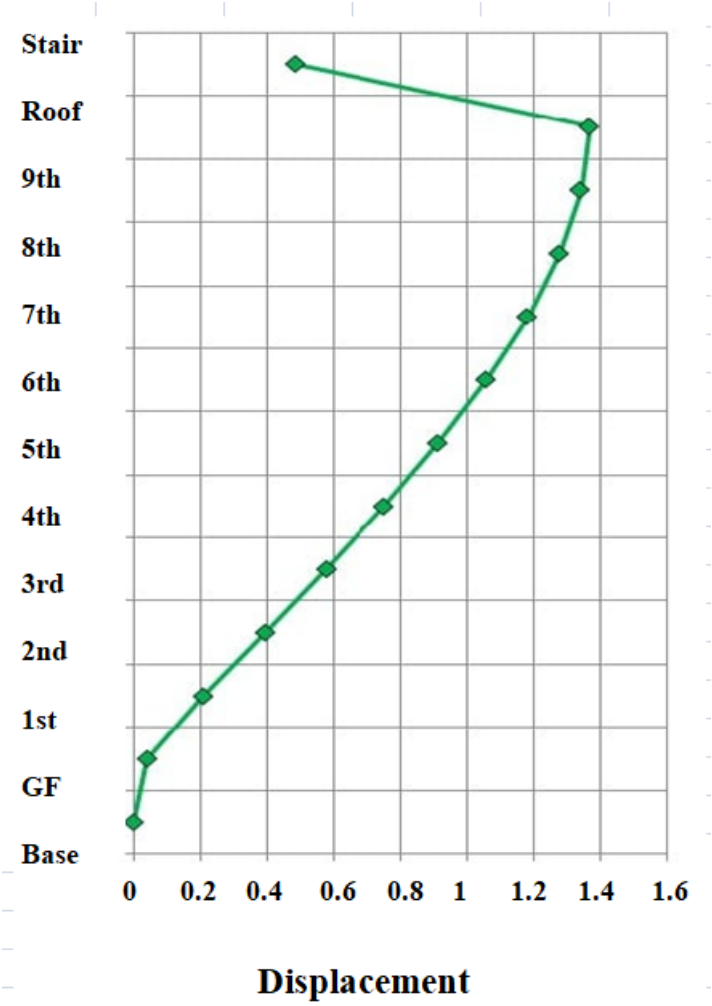


Figure-2.12 Y-Axis Displacement for Layout-1

2.5 FINAL DESIGN

We had to change the dimensions of the column after noticing that many of the column rebar percentages were exceeding 2.5%.The entire column has to be changed. The column's dimensions were changed from 12*15 inches to 12*18 inches, 12*20 inches, 12*22 inches, 12*28 inches, and 14*28 inches. After so many trials, all of the column sizes are fixed according to the rebar percentage as per ACI-318 and the beam sizes are remaining same.

2.5.1 *Analysis Results*

We presented a beam-column layout with a beam-column ID after finishing the design and summarizing the chosen solution in the tabular format below.

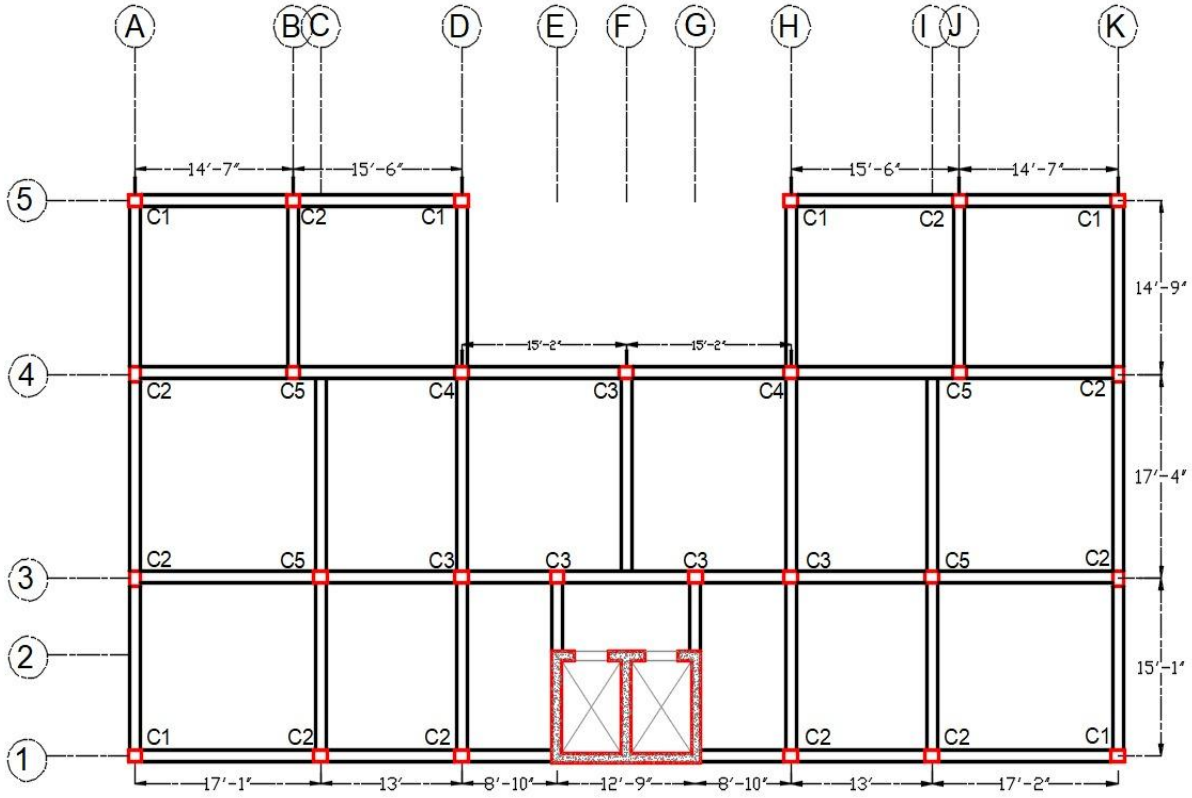


Figure-2.13 Final Beam-Column Layout

Table 2.8 Final column sizes

Column ID	Previously Selected	Modified
C1	12*15	12*18
C2	12*15	12*20
C3	12*15	12*22
C4	12*15	12*28
C5	12*15	14*28

2.5.1.2 *Beam Responses*

The beam layout and beam ID are shown here. For the first story level and the ground floor, we compiled the beam moments and shear force.

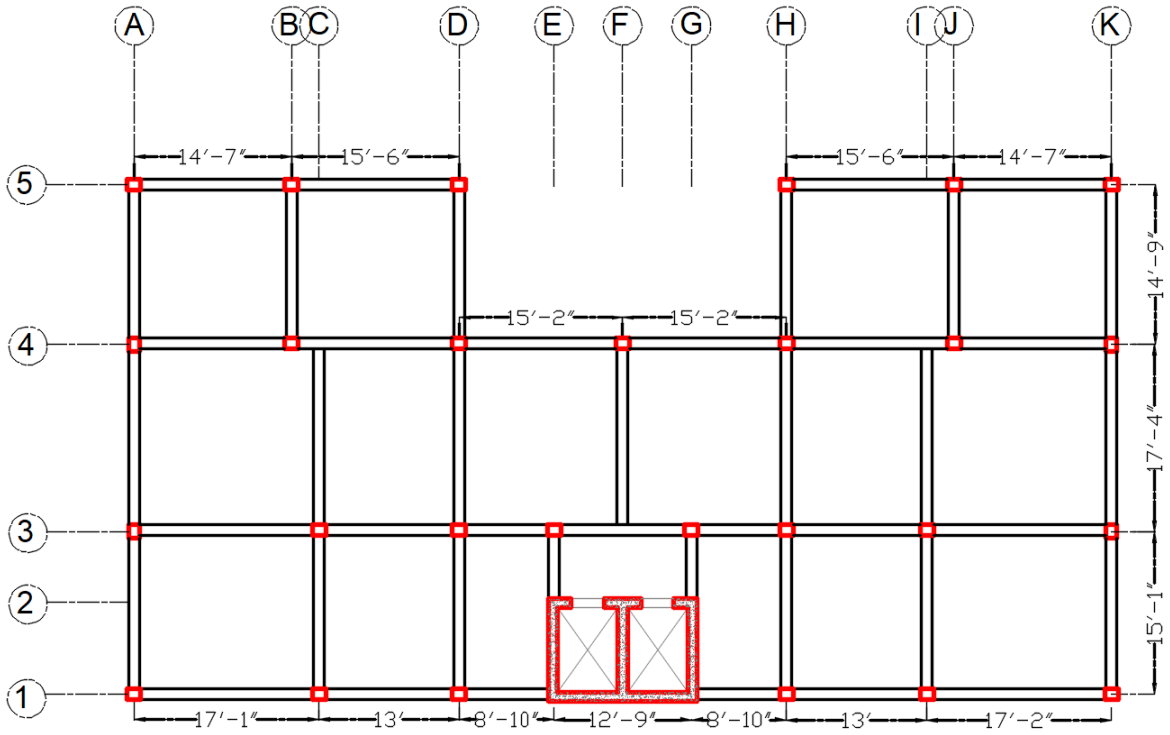


Figure-2.14 Beam Layout

Table 2.9 Design beam responses at ground floor level

Beam Id (Grid No)	Beam Section	Story Level	Beam Shear (kip)		Beam Moment (kip-ft)		
			End	Mid		End	Mid
5	12*15	GF	11.54	10.81	Top	51.96	20.75
			11.18	10.45	Bottom	45.04	21.88
4	12*15	GF	9.4	8.03	Top	40.28	17.61
			9.39	7.99	Bottom	34.14	20.62
3	12*15	GF	12.83	12.48	Top	31.55	15.15
			12.83	3.57	Bottom	30.42	18.25
1	12*15	GF	10.56	10.16	Top	29.56	15.32
			10.56	0.12	Bottom	21.19	11.36
A	12*15	GF	8.63	6.54	Top	38.24	15.25
			8.63	6.54	Bottom	32.83	17.24
B	12*15	GF	5.18	4.41	Top	28.63	9.9
			2.62	3.26	Bottom	26.79	12.56
C	12*15	GF	4.67	3.80	Top	25.88	8.88
			2.7	0.34	Bottom	20.15	15.58
D	12*15	GF	3.37	2.68	Top	17.43	6.78
			2.23	0.75	Bottom	12.79	12.27

E	12*15	GF	11.66	11.36	Top	39.21	21.72
			11.66	8.49	Bottom	19.47	17.57
F	12*15	GF	9.04	0.04	Top	25.34	6.33
			9.04	0.04	Bottom	12.67	17.15
G	12*15	GF	15.47	9.92	Top	20.11	18.71
			11.66	9.92	Bottom	25.29	17.57
H	12*15	GF	3.23	2.68	Top	17.41	6.78
			3.01	0.75	Bottom	11.93	5.13
I	12*15	GF	4.67	3.80	Top	25.88	8.88
			4.06	0.34	Bottom	19.29	15.58
J	12*15	GF	5.18	4.41	Top	28.63	9.9
			4.06	3.29	Bottom	23.79	12.56
K	12*15	GF	6.23	6.2	Top	35.68	14.21
			8.18	6.19	Bottom	30.79	16.18

Table 2.10 Design beam responses at 1st floor level

Beam Id (Grid No.)	**Beam Section**	**Story Level**	**Beam Shear (kip)**		**Beam Moment (kip-ft)**		
			End	**Mid**		**End**	**Mid**
5	12*15	1st	16.75	14	Top	83.56	21
			18.33	15.82	Bottom	62.11	32.25
4	12*15	1st	23.93	13.57	Top	74.05	17.77
			17.45	3.19	Bottom	44.55	33.38
3	12*15	1st	15.59	19.82	Top	53.70	15.36
			20.17	1.6	Bottom	39.34	48.80
1	12*15	1st	15.31	14.44	Top	48.31	18.13
			15.85	4.19	Bottom	34.22	28.46
A	12*15	1st	11.4	11.70	Top	59.91	15.63
			13.7	0.72	Bottom	42.94	28.27
B	12*15	1st	12.12	3.37	Top	49.65	12.42
			12.12	2.61	Bottom	24.83	34.67
C	12*15	1st	12.8	3.93	Top	52.16	13.04
			12.8	0.5	Bottom	26.08	36.11
D	12*15	1st	17.26	0.27	Top	46.73	11.66
			17.26	0.27	Bottom	23.37	35.47
E	12*15	1st	20.06	19.73	Top	73.23	19.86
			15.09	14.76	Bottom	53.78	31.15
F	12*15	1st	17.75	0.57	Top	45.02	11.25
			17.75	0.57	Bottom	22.51	39.23
G	12*15	1st	20.06	19.73	Top	73.25	40.52
			7.99	8.31	Bottom	61.70	31.15
H	12*15	1st	17.27	0.27	Top	46.75	11.69
			15.23	0.27	Bottom	20.84	35.84
I	12*15	1st	12.78	4.21	Top	52.13	13.03
			12.78	0.50	Bottom	26.07	36.07

J	12*15	1st	12.12	4.97	Top	49.67	12.41
			12.12	2.61	Bottom	24.83	34.08
K	12*15	1st	9.71	3.59	Top	58.13	14.54
			9.43	0.72	Bottom	39.40	28.27

2.5.1.3*Column Responses*

The column ID and layout are displayed here. The column axial force, column shear, and bending moment values are determined following Etabs analysis. As we have comparable columns on both the left (A to E) and right (G to K) sides. Therefore, while evaluating column responses, we only consider the left-side column.

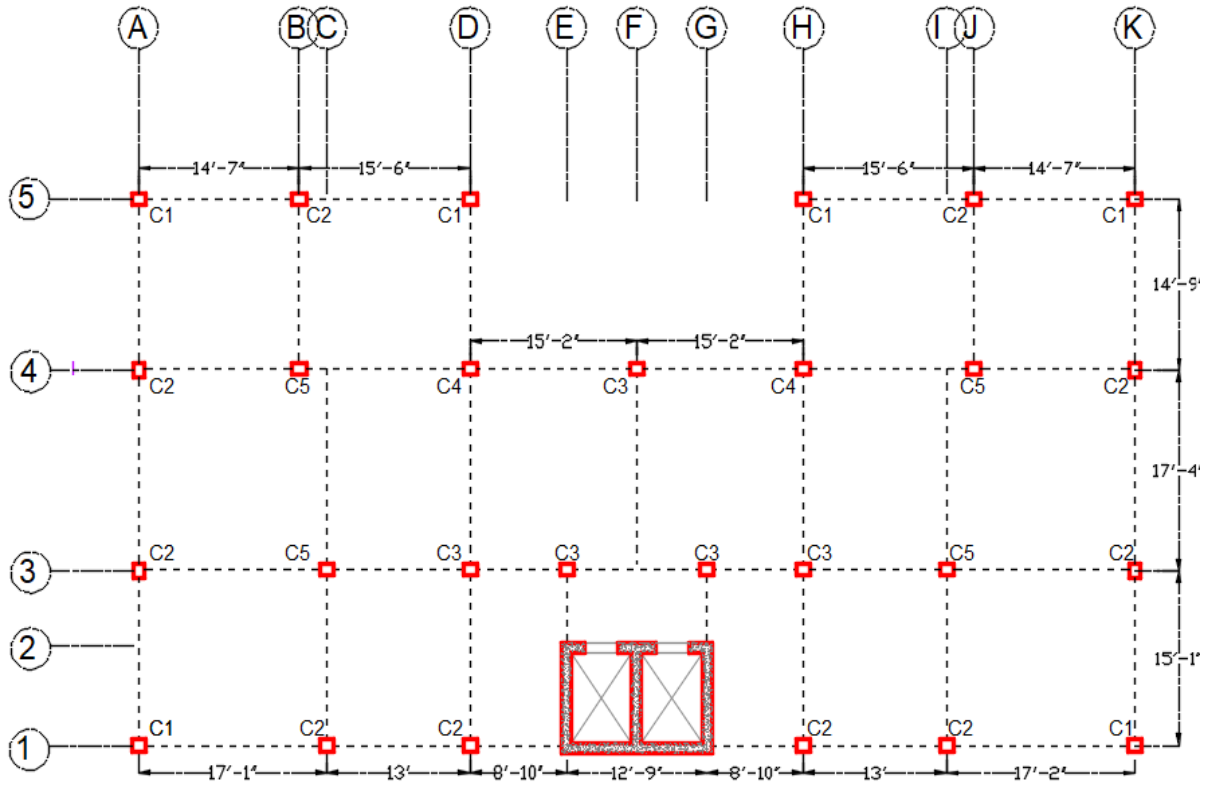


Figure-2.15 Column Layout

Table 2.11 Column shear force and bending moment for base level

Column Id (Grid)	Column Section	Storey Level	Axial Load (kip)	Column Shear (kip)		Beam Moment (kip-ft)	
				V3	V2	M3	M2
1A	12*18	Foundation	328.2	2.23	1.23	31.18	1.65
1C	12*20	Foundation	463.6	1.05	0.27	48.36	1.16
1D	12*20	Foundation	276.7	1.26	0.53	27.67	1.71

3A	12*20	Foundation	563.9	1.26	0.08	2.34	45.12
3C	14*28	Foundation	933.4	1.51	0.28	0.98	79.34
3D	12*22	Foundation	564.9	0.49	1.18	2.43	45.19
3E	12*22	Foundation	393.1	0.09	1.18	41.28	1.33
4A	12*20	Foundation	489.9	1.13	1.18	5.05	39.18
4B	14*28	Foundation	863.8	0.02	2.14	4.43	77.86
4D	12*28	Foundation	792.8	1.23	0.09	0.02	63.42
4F	12*22	Foundation	645.5	3.56	1.96	0.01	51.64
5A	12*18	Foundation	330.9	1.67	1.64	31.43	4.25
5B	12*20	Foundation	547.2	1.48	0.01	0.26	43.78
5D	12*18	Foundation	385.4	1.66	1.25	30.83	4.16
A1	12*18	Foundation	328.2	1.22	2.22	31.18	1.65
A3	12*20	Foundation	563.9	1.26	0.08	2.34	45.11
A4	12*20	Foundation	489.9	1.13	1.18	5.05	39.18
A5	12*18	Foundation	330.9	1.68	1.64	31.43	4.25
B4	14*28	Foundation	863.8	0.02	2.14	4.43	77.86
B5	12*20	Foundation	547.2	1.48	0.01	0.22	43.77
C1	12*20	Foundation	463.6	1.05	0.27	46.36	1.56
C3	14*28	Foundation	933.4	1.51	0.28	1.00	79.38
D1	12*20	Foundation	276.7	1.26	0.53	27.67	1.7
D3	12*22	Foundation	564.9	0.5	1.18	2.43	45.19
D4	12*28	Foundation	792.8	1.23	0.09	0.02	63.42
D5	12*18	Foundation	385.4	1.67	1.25	36.61	4.16
E3	12*22	Foundation	393.1	0.09	1.18	41.28	1.33
F4	12*22	Foundation	645.5	3.57	2	1	51.6

Table 2.12 Column shear force and bending moment for 5^{th} floor level

Column Id (Grid)	**Column Section**	**Storey Level**	**Axial Load (kip)**	**Column Shear (kip)**		**Beam Moment (kip-ft)**	
				V3	**V2**	**M3**	**M2**
1A	12*18	5^{th}	187.9	2.07	3.32	16.55	9.94
1C	12*20	5^{th}	255	5.37	3.46	25.50	26.33
1D	12*20	5^{th}	140.6	3.55	9.62	47.2	17.25
3A	12*20	5^{th}	317.4	7.79	0.54	31.74	38.91
3C	14*28	5^{th}	535.4	1.54	5.94	64.25	8.69
3D	12*20	5^{th}	306.2	1.91	8.37	41.11	8.81
3E	12*22	5^{th}	222.9	5.81	2.56	23.41	28.03
4A	12*20	5^{th}	278.6	5.42	5.68	29.31	27.03
4B	14*28	5^{th}	500.2	0..45	2.24	60.03	3.11
4D	12*28	5^{th}	452.9	4.95	1.22	54.35	25.09
4F	12*22	5^{th}	371.7	6.49	8.85	39.03	33.02
5A	12*18	5^{th}	196.1	5.37	5.42	26.87	27.03
5B	12*20	5^{th}	309.5	5.95	2.78	30.95	30.08
5D	12*18	5^{th}	227.1	5.24	6.56	32.64	26.37
A1	12*18	5^{th}	187.9	4.01	6.14	30.58	19.52
A3	12*20	5^{th}	317.4	7.78	0.54	31.74	38.9

A4	12*20	5th	278.6	5.42	5.68	29.31	27.04
A5	12*18	5th	196.1	5.37	5.42	26.87	27.03
B4	14*28	5th	500.2	0.45	2.24	60.03	3.19
B5	12*20	5th	309.5	5.95	2.78	30.95	30.08
C1	12*20	5th	255	5.38	3.46	25.50	26.33
C3	14*28	5th	535.4	1.54	5.94	64.25	8.69
D1	12*20	5th	140.6	3.56	9.6	47.2	17.25
D3	12*22	5th	306.2	1.9	8.4	41.11	8.81
D4	12*28	5th	452.9	4.9	1.22	54.35	25.09
D5	12*18	5th	227.1	5.24	6.56	32.64	26.37
E3	12*22	5th	222.9	5.81	2.56	23.41	28.03
F4	12*22	5th	371.7	6.5	8	39.03	33.02

2.5.1.4*Foundation Reactions*

The foundation reactions are summarized below.

Table 2.13 Foundation responses

Foundation Id (Grid)	**Axial Load (kip)**	**Column Shear (kip)**		**Beam Moment (kip-ft)**	
		V3	**V2**	**M3**	**M2**
1A	328.2	2.23	1.23	31.18	1.65
1C	463.6	1.05	0.27	48.36	1.16
1D	276.7	1.26	0.53	27.67	1.71
3A	563.9	1.26	0.08	2.34	45.12
3C	933.4	1.51	0.28	0.98	79.34
3D	564.9	0.49	1.18	2.43	45.19
3E	393.1	0.09	1.18	41.28	1.33
4A	489.9	1.13	1.18	5.05	39.18
4B	863.8	0.02	2.14	4.43	77.86
4D	792.8	1.23	0.09	0.02	63.42
4F	645.5	3.56	1.96	0.01	51.64
5A	330.9	1.67	1.64	31.43	4.25
5B	547.2	1.48	0.01	0.26	43.78
5D	385.4	1.66	1.25	30.83	4.16
A1	328.2	1.22	2.22	31.18	1.65
A3	563.9	1.26	0.08	2.34	45.11
A4	489.9	1.13	1.18	5.05	39.18
A5	330.9	1.68	1.64	31.43	4.25
B4	863.8	0.02	2.14	4.43	77.86
B5	547.2	1.48	0.01	0.22	43.77
C1	463.6	1.05	0.27	46.36	1.56
C3	933.4	1.51	0.28	1.00	79.38
D1	276.7	1.26	0.53	27.67	1.7
D3	564.9	0.5	1.18	2.43	45.19
D4	792.8	1.23	0.09	0.02	63.42
D5	385.4	1.67	1.25	36.61	4.16
E3	393.1	0.09	1.18	41.28	1.33
F4	645.5	3.57	2	1	51.6

2.5.2Structural Design

2.5.2.1 Design of Slab

For designing the slab we consider one critical slab for the rebar along the X-axis and a second critical slab for the rebar along the Y-axis. We consider S1 and S6 slab as critical slab.

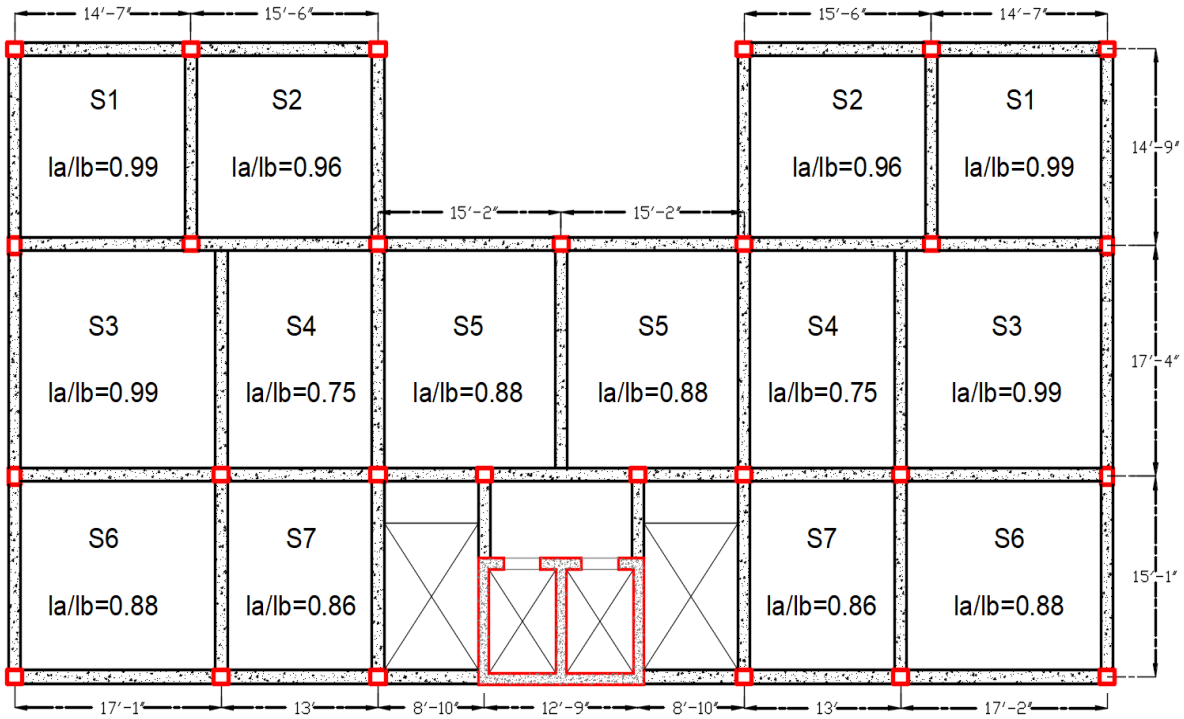


Figure-2.16 Slab Design ID

Table 2.14 Slab design detail

Slab ID	Design Direction	Thickness (in)	Effective Depth (in)	Mu_{neg} (Kip-ft)	Mu_{pos} (Kip-ft)	Aspos (in^2/ft)	Asneg (in^2/ft)	Design
S6	Y	5	4.06	1.243	2.208	0.08	0.13	10mm@10” c/c 2-10mm Ext. Top
S1	X	5	3.69	1.648	2.849	0.11	0.19	10mm@10”c/c 1-12mm Ext. Top

2.5.2.2 Design of Beam

We have similar beams on both sides, so we only consider the left side beam. In this case, we are designing beams by the ACI-318 code for beam shear.

Smax= $\frac{\text{Av fy}}{50bw}$

Smax= $\frac{d}{2}$

Smax= 24 in

Table 2.15 Beam design detail at ground floor level

Beam ID (Grid)	Required Top Reinforcement (in^2)			Shear Rebar (in^2)	
		End	Middle	End	Middle
1	Top	0.6	0.41	0.24	0.23
	Bottom	0.5	0.3		
	Design	2-16mm st top 2-16mm st bottom		10mm @ 5",6",5" c/c	
3	Top	0.63	0.40	0.3	0.2
	Bottom	0.56	0.42		
	Design	2-16mm st top 2-16mm st bottom		10mm @ 5",6",5" c/c	
4	Top	0.84	0.46	0.22	0.18
	Bottom	0.65	0.50		
	Design	2-20mm st top 2-16mm st bottom		10mm @ 5",6",5" c/c	
5	Top	1.08	0.46	0.27	0.22
	Bottom	0.85	0.50		
	Design	3-16mm st top + 1-12mm ext top 2-20mm st bottom		10mm @ 5",6",5" c/c	
A	Top	0.78	0.42	0.2	0.14
	Bottom	0.61	0.43		
	Design	2-20mm st top 2-16mm st bottom		10mm @ 5",6",5" c/c	
B	Top	0.60	0.27	0.16	0.13
	Bottom	0.50	0.32		
	Design	2-16mm st top 2-12mm + 1-10mm st bottom		10mm @ 5",6",5" c/c	
C	Top	0.53	0.25	0.15	0.09
	Bottom	0.50	0.39		
	Design	2-16mm st top 2-16mm st bottom		10mm @ 5",6",5" c/c	
D	Top	0.46	0.20	0.13	0.08
	Bottom	0.31	0.31		
	Design	2-16mm st top 2-12mm st bottom		10mm @ 5",6",5" c/c	
E	Top	0.78	0.46	0.2	0.16
	Bottom	0.56	0.42		
	Design	2-20mm st top 2-16mm st bottom		10mm @ 5",6",5" c/c	
F	Top	0.51	0.17	0.12	0.12
	Bottom	0.31	0.42		

	Design	2-16mm st top 2-12mm st bottom	10mm @ 5",6",5" c/c

Table 2.16 Beam design detail at 1st floor level

Beam ID (Grid)	Required Top Reinforcement (in^2)			Shear Rebar (in^2)	
		End	Middle	End	Middle
1	Top	1.01	0.46	0.36	0.33
	Bottom	0.63	0.52		
	Design	2-20mm st top + 1-12mm ext top 2-16mm st bottom		10mm @ 4",6",4" c/c	
3	Top	1.12	0.40	0.15	0.12
	Bottom	0.73	0.92		
	Design	2-20mm st top + 1-16mm ext top 2-20mm st bottom + 1-10mm ext bottom		10mm @ 4",6",4" c/c	
4	Top	1.59	0.46	0.56	0.28
	Bottom	0.83	0.62		
	Design	3-20mm st top + 1-16mm ext top 2-20 mm st bottom		10mm @ 4",6",4"c/c	
5	Top	1.83	0.46	0.5	0.34
	Bottom	1.19	0.60		
	Design	3-20mm st top + 2-16 mm ext top 2-20 mm + 1-16mm st bottom		10mm @ 4",6",4" c/c	
A	Top	1.26	0.41	0.32	0.18
	Bottom	0.80	0.52		
	Design	2-20 mm st top + 1-20 mm ext top 2-16mm st bottom		10mm@ 4",6",4" c/c	
B	Top	1.03	0.33	0.32	0.2
	Bottom	0.50	0.63		
	Design	2-20mm st top + 1-16 mm ext top 2-16mm st bottom		10mm@ 4",6",4"c/c	
C	Top	1.08	0.34	0.34	0.17
	Bottom	0.50	0.69		
	Design	2-20mm st top + 1-16mm ext top 2-16mm st bottom + 1-10mm ext bottom		10mm@ 4",6",4" c/c	
D	Top	1.00	0.31	0.12	0.12
	Bottom	0.50	0.67		
	Design	2-20mm st top + 1-16mm ext top 2-16mm st bottom + 1-10mm ext bottom		10mm@ 4",6",4" c/c	
E	Top	1.57	0.83	0.16	0.14
	Bottom	1.00	0.57		
	Design	3-20mm st top + 1-16 mm ext top 2-20mm + 1-12mm st bottom		10mm@ 4",6",4"c/c	
F	Top	1.00	0.30	0.11	0.1

	Bottom	0.50	0.73		
	Design	2-20mm st top + 1-12mm ext top 2-16mm st bottom + 1-10mm ext bottom		10mm@ 4",6",4" c/c	

2.5.2.3 Design of Column

Table 2.17 Column design for flexure at various floor levels

Column Id	Colum Size (in)	Base to 3rd Floor	4th Floor 7th Floor	8th to Roof
C1	12*18	1.6%(3.46in^2)	1.1%(2.4in^2)	1%(2.16in^2)
		8-20mm	4-20mm+4-12mm	6-16mm+2-12mm
C2	12*20	2.1%(5.1in^2)	1.5%(3.6in^2)	1%(2.4in^2)
		12-20mm	4-20mm+6-16mm	6-16mm + 4-12mm
C3	12*22	2.3%(6in^2)	1.6%(4.2in^2)	1%(2.6in^2)
		10-22mm	4-22mm+6-16mm	2-20mm+6-16mm
C4	12*28	2.1%(7.1in^2)	1.5%(5.1in^2)	1%(3.4in^2)
		10-22mm+4-16mm	12-20mm	10-16mm+2-12mm
C5	14*28	2.1%(8.23in^2)	1.5%(5.9in^2)	1%(3.9in^2)
		14-22mm	12-20mm+2-16mm	12-16mm+2-12mm

As per ACI 318 code spacing of tie bar shall not exceed 16 diameter of longitudinal bars, 48 diameter of tie bar, nor the least dimension of column. We provided spacing as per code requirement.

Table 2.18 Column design for shear at various floor levels

Column Id	Colum Size (in)	Base to 3rd Floor	4th Floor 7th Floor	8th to Roof
C1	12*18	0	0	0
		10mm @ 4",6",4"	10mm @ 4",8",4"	10mm @ 4",8",4"
C2	12*20	0	0	0
		10mm @ 4",6",4"	10mm @ 4",8",4"	10mm @ 4",8",4"
C3	12*22	0	0	0
		10mm @ 4",6",4"	10mm @ 4",8",4"	10mm @ 4",8",4"
C4	12*28	0	0	0
		10mm @ 4",6",4"	10mm @ 4",8",4"	10mm @ 4",8",4"
C5	14*28	0	0	0
		10mm @ 4",6",4"	10mm @ 4",8",4"	10mm @ 4",8",4"

2.5.2.4 Bearing Capacity for Deep Foundation

A pile is a common type of deep foundation. As per the client's requirement to reduce cost, and as per soil condition considerations we use cast-in-situ piles. It is desirable to transmit loads to soil strata that are beyond the reach of shallow foundations.

Table 2.19 Bearing Capacity of Cast-in-Situ Pile

Bore No: 01

Pile Depth(ft)	**SPT**	**Soil Type**	**Qskin(k/ft^2)**	**Qend(k/ft^2)**	**Qtotal(k/ft^2)**	**Qall(k/ft^2) (F.S=3)**
2.5	2	Rubbish	1.969783	4.103715	6.073498	2.024499333
5	7	Clay Soil; Medium Stiff	8.8640242	14.3630025	23.2270267	7.742342233
7.5	6		14.7733738	12.311145	27.0845188	9.028172933
10	8		22.6525066	16.41486	39.0673666	13.02245553
12.5	7		29.5467478	14.3630025	43.9097503	14.63658343
15	7		36.440989	14.3630025	50.8039915	16.93466383
17.5	9		45.3050134	18.4667175	63.7717309	21.25724363
20	11		56.138821	22.5704325	78.7092535	26.23641783
22.5	14	Silty Soil	69.9273034	28.726005	98.6533084	32.88443613
25	15		84.7006774	30.7778625	115.4785399	38.49284663
27.5	15		99.4740514	30.7778625	130.2519139	43.41730463
30	14		113.2625338	28.726005	141.9885388	47.32951293
32.5	16		129.0207994	32.82972	161.8505194	53.95017313
35	20		148.7186314	41.03715	189.7557814	63.25192713
37.5	21		169.401355	43.0890075	212.4903625	70.83012083
40	22		191.0689702	45.140865	236.2098352	78.73661173
42.5	27	Silty Sand	217.6610434	55.4001525	273.0611959	91.02039863
45	35		252.1322494	71.8150125	323.9472619	107.9824206
47.5	35		286.6034554	71.8150125	358.4184679	119.4728226
50	41		326.984011	84.1261575	411.1101685	137.0367228
52.5	41		367.3645666	84.1261575	451.4907241	150.496908
55	41		407.7451222	84.1261575	491.8712797	163.9570932
57.5	41		448.1256778	84.1261575	532.2518353	177.4172784
60	45		492.4457998	92.3335875	584.7793873	194.9264624
62.5	45		536.7659218	92.3335875	629.0995093	209.6998364
65	45		581.0860438	92.3335875	673.4196313	224.4732104
67.5	49		629.3457322	100.5410175	729.8867497	243.2955832
70	49		677.6054206	100.5410175	778.1464381	259.382146

Bore No: 02

Pile Depth(ft)	SPT	Soil Type	Qskin (k/ft^2)	Qend(k/ft^2)	Qtotal(k/ft^2)	Qall(k/ft^2) (F.S=3)
2.5	2	Rubbish	1.969783	4.10372	6.073503	2.024501
5	7	Clay Soil; Medium Stiff	8.8640242	14.36302	23.2270442	7.742348067
7.5	8		16.743157	16.41488	33.158037	11.052679
10	5		21.667615	10.2593	31.926915	10.642305
12.5	6		27.5769646	12.31116	39.8881246	13.29604153
15	7		34.4712058	14.36302	48.8342258	16.27807527
17.5	9		43.3352302	18.46674	61.8019702	20.60065673
20	11		54.1690378	22.57046	76.7394978	25.5798326
22.5	13		66.9726286	26.67418	93.6468086	31.21560287
25	15	Silty Soil	81.7460026	30.7779	112.5239026	37.50796753
27.5	14		95.534485	28.72604	124.260525	41.420175
30	14		109.3229674	28.72604	138.0490074	46.0163358
32.5	16		125.081233	32.82976	157.910993	52.63699767
35	20		144.779065	41.0372	185.816265	61.938755
37.5	21		165.4617886	43.08906	208.5508486	69.51694953
40	22		187.1294038	45.14092	232.2703238	77.42344127
42.5	23	Silty Sand	209.7819106	47.19278	256.9746906	85.6582302
45	25		234.4042006	51.2965	285.7007006	95.23356687
47.5	35		268.8754066	71.8151	340.6905066	113.5635022
50	41		309.2559622	84.12626	393.3822222	131.1274074
52.5	40		348.6516262	82.0744	430.7260262	143.5753421
55	40		388.0472902	82.0744	470.1216902	156.7072301
57.5	41		428.4278458	84.12626	512.5541058	170.8513686
60	41		468.8084014	84.12626	552.9346614	184.3115538
62.5	48		516.0831982	98.48928	614.5724782	204.8574927
65	48		563.357995	98.48928	661.847275	220.6157583
67.5	50		612.602575	102.593	715.195575	238.398525
70	50		661.847155	102.593	764.440155	254.813385

Bore No: 03

Pile Depth(ft)	SPT	Soil Type	Qskin (k/ft^2)	Qend(k/ft^2)	Qtotal(k/ft^2)	Qall(k/ft^2) (F.S=3)
2.5	2	Rubbish	1.969783	4.10372	6.073503	2.024501
5	4		5.9093494	8.20744	14.1167894	4.705596467
7.5	5		10.8338074	10.2593	21.0931074	7.0310358

10	5	Clay Soil; Medium Stiff	15.7582654	10.2593	26.0175654	8.6725218
12.5	6		21.667615	12.31116	33.978775	11.32625833
15	8		29.5467478	16.41488	45.9616278	15.3205426
17.5	9		38.4107722	18.46674	56.8775122	18.95917073
20	11		49.2445798	22.57046	71.8150398	23.9383466
22.5	13		62.0481706	26.67418	88.7223506	29.57411687
25	15	Silty Soil	76.8215446	30.7779	107.5994446	35.86648153
27.5	14		90.610027	28.72604	119.336067	39.778689
30	16		106.3682926	32.82976	139.1980526	46.39935087
32.5	16		122.1265582	32.82976	154.9563182	51.65210607
35	23		144.779065	47.19278	191.971845	63.990615
37.5	23		167.4315718	47.19278	214.6243518	71.5414506
40	23		190.0840786	47.19278	237.2768586	79.0922862
42.5	23	Silty Sand	212.7365854	47.19278	259.9293654	86.6431218
45	23		235.3890922	47.19278	282.5818722	94.1939574
47.5	32		266.9056234	65.65952	332.5651434	110.8550478
50	33		299.4070462	67.71138	367.1184262	122.3728087
52.5	38		336.832927	77.97068	414.803607	138.267869
55	48		384.1077238	98.48928	482.5970038	160.8656679
57.5	40		423.5033878	82.0744	505.5777878	168.5259293
60	41		463.8839434	84.12626	548.0102034	182.6700678
62.5	41		504.264499	84.12626	588.390759	196.130253
65	49		552.5241874	100.54114	653.0653274	217.6884425
67.5	49		600.7838758	100.54114	701.3250158	233.7750053
70	50		650.0284558	102.593	752.6214558	250.8738186

2.5.2.5 Design of Foundation

We follow BNBC 2020 for the designing of the foundation and we apply some equation while designing the foundation-

Skin Friction: $Q_s = A_s F_s = 2\pi r * L_1 * F_s$ $[F_S = 1.8\overline{N}_{60}(kPa) \leq 70kPa]$

End Friction: $Q_b = A_b F_b = \frac{\pi L^2}{4} * F_b$ $[F_b = 45N_{60}((kPa) \leq 4000kPa]$

Table 2.20 Foundation design detail for flexure and axial load

Column Id	Column Size (in)	Axial Load (kip)	Pile No.	Pile Length (ft)	Foundation Depth (in)	Rebar in X-direction	Rebar in Y-direction
C1	12*18	385.4	2	62.5	29	20mm@5.5” c/c	12mm @5” c/c
C2	12*20	563.9	3	62.5	30	20mm@5.5”c/c	20mm@5.5” c/c
C3	12*22	645.5	3	65.0	30	20mm@5.5”c/c	20mm@5.5” c/c
C4	12*28	792.8	4	65.0	28	16mm@4” c/c	16mm@4” c/c
C5	14*28	933.4	4	67.5	28	16mm@4” c/c	16mm@4” c/c

2.5.2.6 Design of Shear Wall

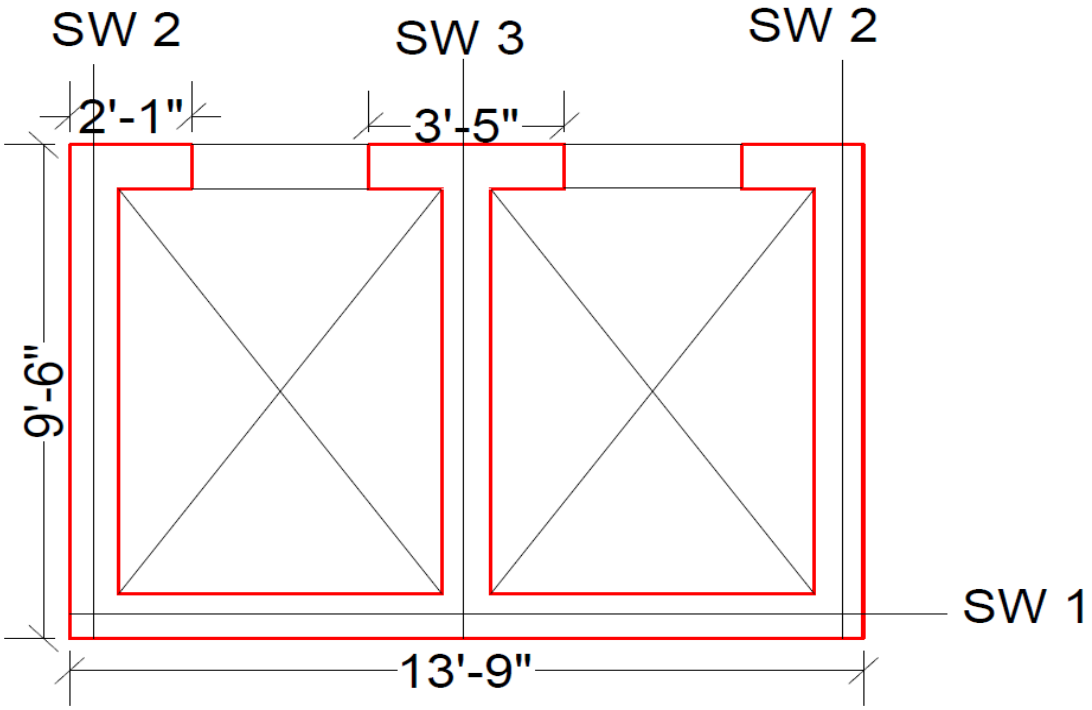


Figure-2.17 Shear Wall Id

Table 2.21 Design detail of Shear Wall at various floor levels

Shear Wall Id	Storey Range	Required flexure rebar (in^2)	Design	Required shear rebar (in^2/ft)	Design
SW1	Base to 3rd Floor	10.4	20-16mm + 24-12mm	0.3	10mm @ 6”
	4th Floor 7th Floor	9.4	16-16mm + 28-12mm	0.3	10mm @ 6”
	8th to Roof	8.8	12-16mm + 32-12mm	0.3	10mm @ 6”
SW2	Base to 3rd Floor	7.25	16-16mm + 14-12mm	0.3	10mm @ 6”

	4^{th} Floor 7^{th} Floor	6.5	12-16mm + 18 -12mm	0.3	10mm @ 6”
	8^{th} to Roof	6.2	8-16mm + 22-12mm	0.3	10mm @ 6”
SW3	Base to 3^{rd} Floor	7.2	8-16mm + 30-12mm	0.3	10mm @ 6”
	4^{th} Floor 7^{th} Floor	6.5	4-16mm + 34-12mm	0.3	10mm @ 6”
	8^{th} to Roof	6.2	38-12mm	0.3	10mm @ 6”

2.6 DESIGN OF WATER AND SEWERAGE TANKS

2.6.1 Design of Overhead Water Tank

In the floor plan, there are 2 units per floor. We consider 2 individual overhead water tanks for both units. And we also consider 8 persons per unit.

Overhead Water Tank-1

Guideline for Water Requirements for Various Occupancies and Facility Groups in Liters per Capital per Day (LPCD) = 135 liter

Total Person (Assume) = 72

The average person uses water = 72 x 135

= 9720 liter

= 389 cft (cubic foot) (1liter=0.04cft)

Total overhead water tank area = 8.5ft x 6ft = $51ft^2$

So the overhead water tank height, H = 7.6 ft

Overhead Water Tank-2

Guideline for Water Requirements for Various Occupancies and Facility Groups in Liters per Capital per Day (LPCD) = 135 liter

Total Person (Assume) = 72

The average person uses water = 72 x 135

= 9720 liter

=389 cft (cubic foot) (1liter=0.04cft)

Total overhead water tank area = 8.5ft x 6ft = $51ft^2$

So the overhead water tank height, H = 7.6 ft

2.6.2 Design of Underground Water Tank

Guideline for Water Requirements for Various Occupancies and Facility Groups in Liters per Capital per Day (LPCD) = 135 liter (Building Services I: Plumbing)

Total Person (Assume) = 144

The average person uses water = 144 x 135

= 19440 liter

= 777.6 cft (1liter=0.04cft)

Total underground water tank area = 25ft x 7.5ft

= 187.5 ft^2

Underground water tank height H = 4.15 ft (for 1 day)

We want to keep water for 3 days = 4.15 ft x 3

= 12.45 ft ~12.5 ft (for 3 days)

So our final underground water tank height is 12.5 ft

2.6.3 Design of Sewerage Tank

Guideline for Water Requirements for Various Occupancies and Facility Groups in Liters per Capital per Day (LPCD) = 135 liter

Total Person (Assume) = 144

The average person uses water = 144 x 135

= 19440 liter

= 19.44 m^3

Total sewerage tank area = $\frac{19.44}{1.7}$ (assume, H = 1.7m)

= 11.435 m^2

Assume, width = B and length, L = 3B

So, Area = L x B

11.435 = 3B x B

So, Width, B = 1.95 m = 6.4 ft

Length, L = 1.95 x 3 = 5.85 m = 19.2 ft

Height, H = (1.7 + 0.3) x 3.28 = 6.6 ft (added, clearance = 0.3 m)

2.7 DRAWING DETAILS

Drawing details are summarized at the end of the report in APPENDIX A.

2.8 USE OF MODERN ENGINEERING TOOLS

We used software like AutoCAD and ETABS to analyze, design and drafting the building. We also used Microsoft Excel to produce graphs and calculation purposes. We used AutoCAD software for design purposes like the beam-column layout and also for drawing and ETABS software for modeling the structure. Multi-storied buildings are designed by using this software. Moreover, ETABS has some limitations it is not suitable for water tanks as well, especially underground water tanks because it cannot perform soil-structure interaction, which is one of the reasons that it is not suitable for underground water tanks. We encounter complex difficulties when modeling stairs in ETABS.

Chapter-3

PROJECT PLANNING

3.1BILL OF QUANTITIES

We follow the PWD schedule of rates 2018 for preparing the total bill of quantity of the building and we consider a structural element as well as the bathroom fittings, kitchen fittings, door, windows and balcony grills.

Table 3.1 Bill of quantity of the G+9 storied building for RCC and Finishing Works

PROJECT: G+9 Storied Residential Building					
Bill of Quantity with Specifications and Costing					
Item. No.	**Description**	**Quantity**	**Unit**	**Rate**	**Amount**
1	**SITE PREPERATION**				
1.1	Demolition of existing structure and removal of waste.	1	L.S	50000	50,000
1.2	Layout and Marking Giving layout, providing center lines, setup local bench-mark pillars, fixing wooden spikes and marking layout with chalk powder, etc. complete as per instruction of Engineer-in-charge.	120	Sqm.	25	3,000
2	**SITE OFFICE & MOBILIZATION**				
2.1	Mobilization Mobilization and cleaning site before commencing actual physical work and during contract period and demobilization after completion of the Works under contract accepted by Engineer. This work shall also covers clayey cleaning and clearing, cutting or filling, dressing the project area on and in the ground to an extent that all the events of works of the project can be executed smoothly in a working environment with a particular attention on safety and security in all respects, and to stockpile the end outcome to a place for disposal agreed by the Engineer, where, payments are to be based on ground area determined by the Engineer and be proportionate to the percentage progress of work under contract as a whole in all respects and approved by the Engineer.	156	Sqm	21	3,276

2.2	Site Office Engineer's site office made of corrugated sheet 20 sqm plinth area furniture, first aid-box, safety helmet, consumables, stationeries etc.	1	L.S	50000	50,000
2.3	Boundary Wall Dismantling and Repair Works	1	Job	44000	44,000
2.4	Safety Measures Supply, installation and execution of safety measures and labor welfare facilities i.e., safety helmet, shoes, vests, first aid tool box, drinking water, toilet, safety barricade, temporary fencing etc. as specified in the general conditions of contract (clause 51).	1	L.S	50000	50,000
2.5	Safety Canopy Providing temporary safety canopy around construction work place where public safety is likely to be endangered due to construction activities; which shall be made of truss system of steel sections (main frame) at 1800 mm c/c with purlins @ 750 mm c/c, making flooring system by corrugated galvanized iron sheets of thickness 0.45 mm, laying wire mesh net on iron sheets, providing continuous gutter along the edges of the building with downpipe @ 6000 mm c/c, including fitting and fixing in position providing necessary anchors, cables, wires, ties etc. by standard anchoring and welding, nut-bolts etc, all complete and accepted by the Engineer-in-charge.	1	L.S	50000	50,000
3	**EARTH WORK**				
3.1	Earth Excavation Earth work in excavation in all kinds of soil for foundation trenches including. layout, providing center lines, local bench-mark pillars, leveling, ramming and preparing the base, fixing bamboo spikes and marking layout with chalk powder, providing necessary tools and plants, protecting and maintaining the trench dry etc., stacking, cleaning the excavated earth at a safe distance out of the area enclosed by the layout etc. all complete and accepted by the Engineer, subject to submit method statement of carrying out excavation work to the Engineer for approval. However, Engineer's approval shall not relieve the contractor of his responsibilities and obligations under the contract. Extra rate for each additional 0.05 m depth exceeding 1.5 m.	15	Cum.	282	4,230
3.2	Back Filling Work Back filling in foundation trenches with sand in	130	Cum	602	78,260

	150mm layers including supply of filling sand (FM 0.8) and leveling, watering and compaction by frog hammer/plate vibrator to achieve minimum dry density of 90% with optimum moisture content (Modified proctor test) by ramming each layer up to finished level all complete as per instruction of Engineer-in-charge.				
3.3	Disposal Clearing and disposing of excavated earth from the construction site by truck or any other means to a place within 30 km radius of the city area including loading, unloading at both ends, leveling and dressing the carried earth etc. complete accepted by the Engineer.	35	Cum	800	28,000
				Total	360,766

Sub Structure Pile-

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re-marks
1	Boring/drilling by wash or percussion method for 2 pile (1016 mm dia)	meter	665	1648	1095920	
2	Boring/drilling by wash or percussion method for 4 pile (2032 mm dia)	meter	36.4	3296	119974.4	
3	Removing of spoils / mud accumulated during boring for cast in situ pile (2 piles)	cum	269.22	557	149955.5	
4	Removing of spoils / mud accumulated during boring for cast in situ pile (4 piles)	cum	29.54	557	16453.78	
5	Cast in situ pile with reinforced cement concrete with mix ratio 1 : 1.5 : 3 having minimum f'cr = 26 Mpa	cum	304.1248	13463	4094432	
6	Pile Longitudinal Reinforcement	M.ton	28.3178	60500	1713227	
7	Pile Tie Bar	M.ton	8.505	60500	514552.5	
				Total =	7704515	

Pile Cap

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re Marks
8	One layer brick flat soling in foundation with first class/picked jhama bricks including preparation of bed and filling the interstices with local sand, leveling etc.	sqm	262.0534	420	110062.4	
9	Mass concrete (C.C) in foundation (1:3:6) with cement, brick chips and sand of F.M. 1.2	cum	19.9164	6647	132384.3	
10	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	33.8646	11817	400178	
11	Flexure Reinforcement	M.ton	1.5848	60500	95880.4	
12	Top Bar	M.ton	1.0122	60500	61238.1	
13	Dowel Bar	M.ton	0.8736	60500	52852.8	
14	Skin Rebar	M.ton	0.0574	60500	3472.7	
				Total =	856068.7	

Base Column

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re marks
15	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	2.94	12031	35371.14	
16	Longitudinal Reinforcement	M. ton	2.081	60500	125900.5	
17	Tie Bars	M. ton	1.05	60500	63525	
				Total =	224796.6	

Shear Wall

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re marks
18	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	1.51	12031	18166.81	
19	Longitudinal Reinforcement	M. ton	0.73	60500	44165	
20	Tie Bars	M. ton	0.02	60500	1210	
				Total =	63541.81	

Sewerage Tank & Underground Water Tank

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re marks
21	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	21.532	11903	256295	
22	Longitudinal Bars	M. ton	2.21	60500	133705	
23	Automatic machine-made 1st class standard bricks	per	9.633	9000	86697	
				Total =	476697	

Super-Structure – Ground Floor Beam

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re Marks
2	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	44.17	11903	525755.5	
25	Longitudinal Bars	M. ton	2.5	60500	151250	
26	Tie Bars	M. ton	2.35	60500	142175	
				Total =	819180.5	

Column

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re Marks

27	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	24.24	12031	291631.4	
28	Longitudinal Reinforcement	M. ton	3.63	60500	219615	
29	Tie Bars	M. ton	2.14	60500	129470	
30	Hooks	M. ton	1.08	60500	65340	
				Total =	706056.4	

Shear Wall

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re Marks
31	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	30.06	12031	361651.9	
32	Longitudinal Reinforcement	M. ton	0.4332	60500	26208.6	
33	Tie Bars	M. ton	0.033	60500	1996.5	
				Total =	389857	

Stair

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re marks
34	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	2.772	11903	32995.12	
35	Longitudinal Reinforcement	M. ton	0.71	60500	42955	
36	Horizontal Reinforcement	M. ton	0.12	60500	7260	
	Total sum for 2 stair			Total =	166420.2	

Floor Finish

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re marks
37	Parking Lot- Supplying, fitting and fixing of pavement tiles of	sqm	752.37	2481	1866630	

	size 300 mm x 300 mm					
38	Stair- Supplying, fitting and fixing country made GP homogeneous Glazed stair tiles having size of width 250 mm to 300 mm and length 300 mm	sqm	11.26	1553	17486.78	
				Total =	1884117	

Wall

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Remarks
39	Automatic machine-made 1st class standard bricks	Per % 0 nos	63.71	9000	573390	
40	Mass concrete in floor (1:2:4) with brick chips and local sand of F.M. 1.2	cum	1846	7575	13983450	
				Total =	14556840	

SUB STRUCTURE- & SUPER-STRUCTURE			
Item No	**Item of Works**	**Amount**	
1	SUB STRUCTURE- PILE	7704515.302	
2	PILE CAP	856068.717	
3	BASE- COLUMN	224796.64	
4	SHEAR WALL	63541.81	
5	Sewerage Tank & Underground Water Tank	450500	
6	GROUND FLOOR BEAM	819180.51	
7	COLUMN	706056.44	
8	SHEAR WALL	389856.96	
9	STAIR	166420.232	
10	FLOOR FINISH	1884116.75	
11	WALL	14556840	
	TOTAL TK	27821893.36	BDT

FIRST FLOOR						
BEAM						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
1	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	40.17	11903	478143.5	
2	Longitudinal Bars	M. ton	2.5	60500	151250	
3	Tie Bars	M. ton	2.35	60500	142175	
				Total =	771568.5	
COLUMN						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
4	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	24.24	12031	291631.4	
5	Longitudinal Reinforcement	M. ton	2.63	60500	159115	
6	Tie Bars	M. ton	2.14	60500	129470	
7	Hooks	M. ton	1.08	60500	65340	
				Total =	645556.4	
SHEAR WALL						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
8	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	30.06	12031	361651.9	
9	Longitudinal Reinforcement	M. ton	0.4332	60500	26208.6	
10	Tie Bars	M. ton	0.033	60500	1996.5	
				Total =	389857	
STAIR						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**

11	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	2.772	11903	32995.12	
12	Longitudinal Reinforcement	M.ton	0.71	60500	42955	
13	Horizontal Reinforcement	M.ton	0.12	60500	7260	
	Total sum for 2 Stair			Total =	166420.2	
FLOOR FINISH						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
14	Supplying, fitting and fixing country made GP glazed / unglazed homogenous floor tiles (300 mm x 300 mm)	sqm	276.2	1273	351602.6	
15	Toilet- Supplying, fitting and fixing country made GP (water absorbtion ≤ 0.5%) GP (homogeneous) 300 mm x 300 mm floor tiles	sqm	30.2	1526	46085.2	
16	Veranda- Supplying, fitting and fixing machine-made clay roof tiles of size 100 mm x 200 mm or equivalent (red colour)	sqm	28.92	2683	77592.36	
17	Stair- Supplying, fitting and fixing country made GP homogeneous Glazed stair tiles having size of width 250 mm to 300 mm and length 300 mm	sqm	24.65	1553	38281.45	
				Total =	513561.6	
BATHROOM FITTINGS						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
18	Special coloured Cabinet basin (Deep Blue, Ruby, Rain Forest, Green) 500x450x180 mm, 9 kg	Each	1	3920	3920	
19	32 mm dia PVC waste pipe for W-Basin connection	Each	1	150	150	
20	12 mm CP concealed fixed Sink cock	Each	1	875	875	
21	12 mm plastic bib cock with internal brass thread	Each	1	452	452	
22	450 x 600 x 5 mm mirror	Each	1	550	550	
23	Porcelain soap tray (white)	Each	1	363	363	

24	Supplying, fitting and fixing of CP shower mixture including shower head only with all necessary hardware and consumables approved and accepted by the Engineer- in charge	Each	1	4530	4530	
25	White 465 x 340 x 415 mm commode	Each	1	1450	1450	
26	CP Moving push shower	Each	1	715	715	
27	Supplying, fitting and fixing of medium quality C.P. towel rail of 600 mm long and 20 mm in dia with C.P. holder including making drills in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in charge.	Each	1	627	627	
28	Supplying, fitting and fixing of standard porcelain toilet paper holder of 150 mm x 150 mm x 126 mm size including making drills in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in-charge. Light colored.	Each	1	355	355	
29	Supplying, fitting and fixing in position different dia one-way brass stop cock (best quality and heavy type) etc. complete in all respect as per specification of Titas Gas T and D Co. Ltd. approved and accepted by the Engineer-in-charge. 12 mm x 6 mm N.D.	Each	1	270	270	
30	125 mm dia atainless-steel floor-grating	Each	1	150	150	
31	Medium quality CP iron frame with brackets for 600 x 125 x 5 mm size glass shelf.	Each	1	350	350	
	Total sum for 10 bathrooms			Total =	147570	
KITCHEN						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**

32	12 mm CP concealed fixed Sink cock	Each	1	875	875	
33	Stainless steel, single bowl sink: Singapore/ M'Asia, size 450 mm x 1050 mm	Each	1	2500	2500	
34	WEF (walton Ezhaust Fan) 0601 (White) - Wall mounting. - One speed - Fan shuts off automatically when motor is unusually hot	Each	1	650	650	
35	Medium quality CP Towel Rail 600 x 20 mm dia size	Each	1	375	375	
36	125 mm dia stainless-steel floor-grating	Each	1	150	150	
37	12 x 6 mm gas stop cock	Each	1	195	195	
38	I. 50 PSI API 5L, Grade-B ERW M.S. Pipe- 25 mm ND (33.40 mm OD)	Each	1	100	100	
39	50 x 50 x 25 mm N.D. Tee CD40	Each	1	260	260	
40	50 x 25 mm reducer	Each	1	85	85	
	Total sum for 2 kitchens			Total =	10380	

DOORS

Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
41	Supplying and making door and window frames (Chowkat) for all floors with matured seasoned wood of required size. Painting two coats of coal tar to the surface in contact with wall. Fitting and fixing in	cum	3.251	154787	503212.5	

	position etc. all complete and accepted by the Engineer-incharge. (All sizes of wood are finished). - Silkarai					
42	Supplying, fitting and fixing M.S. flat bar clamp of 150 mm x 38 mm x 6 mm size having bifurcated ends to door and window frames with necessary rowel plug, screws etc. including cutting grooves in chowkat if necessary, etc. all complete and accepted by the Engineer-in-charge.	Each	27	97	2619	
43	SS fittings of door	sqm	56.35	329	18539.15	
44	Bedrooms	cum	0.892	154787	138070	For 10 Doors
45	Toilets	cum	0.401	154787	62069.59	For 10 Doors
46	Main doors	cum	0.26	154787	40244.62	For 2 Doors
47	Kitchens	cum			0	
48	Veranda 6 wooden	cum	0.26	154787	40244.62	For 6 Doors
	Total sum for 28 doors			Total =	805000	

WINDOWS

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Remarks
49	Supplying, fitting and fixing of aluminium sliding window as per the U.S. Architectural Aluminium Manufacturer‟s Association (AAMA) standard specification and BDS 1879:2014 having 1.2 mm thick outer bottom (size 75.50 mm, 32mm), 1.2 mm thick outer top (size 75.50 mm, 16.80 mm), 1.2 mm thick shutter top (size 33 mm.26.80, 22 mm), 1.2 mm thick shutter bottom (size 60mm, 24.40 mm), 1.2 mm thick outer side (size 75.50 mm,19.90 mm), 1.2 mm thick shutter lock (size 49.20 mm 26.20 mm) and 1.2 mm thick inter lock (size 34.40 mm, 32.10 mm) sections all aluminium members (total weight kg/sqm) will be anodized to aluminium	sqm				

	bronze/silver/ss/black colour with a coat not less than 15 microns in thickness or powder coated to any colour with a coat not less than 25 microns in thickness and density of 4 mg per square cm etc. including all accessories like sliding door key lock, sliding door wheel, sliding door mohiar, sliding door neoprene, bolts and nuts including sealants, keeping provision for fitting 5 mm thick glass including labour charge for fitting of accessories, making grooves and mending good damages, carriage, and electricity complete in all respect as per drawing and accepted by the Engineer-in-charge. - Powder coated to any colour.					
50	Bedroom - per floor	sqm	9.72	3720	36158.4	For 10 Windows
51	Dining room- per floor	sqm	3.73	3720	13875.6	For 2 Windows
52	Kitchen	sqm	2.92	3720	10862.4	For 2 Windows
53	Bathroom	sqm	1.23	3720	4575.6	For 10 Windows
54	Stair window	sqm	1.86	3720	6919.2	For 2 Windows
	Total sum for 26 windows			Total =	72391.2	
WINDOW GRILL, VERANDAH GRILL & NETTING						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
55	Supplying, fitting and fixing window grill made of 12 mm x 12 mm M.S. solid bar 140 mm c/c with outer frame of 38 mm x 6mm F.I. bar as per design approved and accepted by the Engineer-in-charge.	sqm	19.27	2,442	47057.34	
56	Supplying, fitting and fixing verandah grill made of 10 mm dia	sqm	65.41	2357	154171.4	

	M.S. rod provided @ 75 mm c/c in any position both ways as per design with outside frame of 25 mm x 25 mm x 6 mm M.S. angle including fabricating, welding in each point, painting 2 coats of synthetic enamel paint over a coat of anti-corrosive priming including cost of electricity, tools and plants, workshop charges, carriage of the same including cutting groves in the R.C.C. or brick work, mending good the damages with C.C. (1:2:4) etc, all complete for all floors accepted by the Engineer-in-charge. [Rate is excluding the cost of painting] (Total weight per sqm should be min 21.00 kg. and add or deduct @ Tk. 112.00 for each kg/sqm excess or less respectively)					
	Sum			Total =	201229	
SLAB						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Remarks**
	Estimation of slab concrete:					
57	Mass concrete in floor (1:2:4) with brick chips and local sand of F.M. 1.2	cum	90.41	7575	684855.8	
58	Grade 600(600Mpa / 600N/mm2 ≈ 60900psi/ 60 Grade), BDS-6935-2006, B400: and ratio fy to fu => 1.25	M. ton	7.14	60500	431970	
				Total =	1116826	
WALL AND LINTEL						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Remarks**
59	Automatic machine-made 1st class standard bricks	per % 0 nos	65	9000	585000	
60	Mass concrete in floor (1:2:4) with brick chips and local sand of F.M. 1.2	cum	950	7575	7196250	
				Total =	7781250	

FIRST FLOOR FINISH			
Item No	**Item of Works**	**Amount**	
1	BEAM	771568.51	
2	COLUMN	645556.44	
3	SHEAR WALL	389856.96	
4	STAIR	166420.232	
5	FLOOR FINISH	513561.61	
6	BATHROOM FITTINGS	147570	
7	KITCHEN	10380	
8	DOORS	804999.518	
9	WINDOWS	72391.2	
10	WINDOW GRILL, VERANDAH GRILL & NETTING	201228.71	
11	SLAB	1116825.75	
12	WALL AND LINTEL	7781250	
	TOTAL TK	12621608.93	BDT.

2nd FLOOR						
BEAM						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
1	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	40.17	11903	478143.5	
2	Longitudinal Bars	M. ton	2.5	60500	151250	
3	Tie Bars	M. ton	2.35	60500	142175	
				Total =	771568.5	
COLUMN						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
4	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	24.24	12031	291631.4	
5	Longitudinal Reinforcement	M. ton	2.63	60500	159115	
6	Tie Bars	M. ton	2.14	60500	129470	
7	Hooks	M. ton	1.08	60500	65340	
				Total =	645556.4	
SHEAR WALL						

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re marks
8	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	30.06	12031	361651.9	
9	Longitudinal Reinforcement	M. ton	0.4332	60500	26208.6	
10	Tie Bars	M. ton	0.033	60500	1996.5	
				Total =	389857	
STAIR						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
11	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	2.772	11903	32995.12	
12	Longitudinal Reinforcement	M.ton	0.71	60500	42955	
13	Horizontal Reinforcement	M.ton	0.12	60500	7260	
	Total sum for 2 Stair			Total =	166420.2	
FLOOR FINISH						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
14	Supplying, fitting and fixing country made GP glazed / unglazed homogenous floor tiles (300 mm x 300 mm)	sqm	276.2	1273	351602.6	
15	Toilet- Supplying, fitting and fixing country made GP (water absorbtion ≤ 0.5%) GP (homogeneous) 300 mm x 300 mm floor tiles	sqm	30.2	1526	46085.2	
16	Veranda- Supplying, fitting and fixing machine-made clay roof tiles of size 100 mm x 200 mm or equivalent (red colour)	sqm	28.92	2683	77592.36	
17	Stair- Supplying, fitting and fixing country made GP homogeneous Glazed stair tiles having size of width 250 mm to 300 mm and length 300 mm	sqm	24.65	1553	38281.45	

				Total =	513561.6	
BATHROOM FITTINGS						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
18	Special coloured Cabinet basin (Deep Blue, Ruby, Rain Forest, Green) 500x450x180 mm, 9 kg	Each	1	3920	3920	
19	32 mm dia PVC waste pipe for W-Basin connection	Each	1	150	150	
20	12 mm CP concealed fixed Sink cock	Each	1	875	875	
21	12 mm plastic bib cock with internal brass thread	Each	1	452	452	
22	450 x 600 x 5 mm mirror	Each	1	550	550	
23	Porcelain soap tray (white)	Each	1	363	363	
24	Supplying, fitting and fixing of CP shower mixture including shower head only with all necessary hardware and consumables approved and accepted by the Engineer- in charge	Each	1	4530	4530	
25	White 465 x 340 x 415 mm commode	Each	1	1450	1450	
26	CP Moving push shower	Each	1	715	715	
27	Supplying, fitting and fixing of medium quality C.P. towel rail of 600 mm long and 20 mm in dia with C.P. holder including making drills in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in charge.	Each	1	627	627	
28	Supplying, fitting and fixing of standard porcelain toilet paper holder of 150 mm x 150 mm x 126 mm size including making drills in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in-charge. Light colored.	Each	1	355	355	

29	Supplying, fitting and fixing in position different dia one-way brass stop cock (best quality and heavy type) etc. complete in all respect as per specification of Titas Gas T and D Co. Ltd. approved and accepted by the Engineer-in-charge. 12 mm x 6 mm N.D.	Each	1	270	270	
30	125 mm dia atainless-steel floor-grating	Each	1	150	150	
31	Medium quality CP iron frame with brackets for 600 x 125 x 5 mm size glass shelf.	Each	1	350	350	
	Total sum for 10 bathrooms			Total =	147570	
KITCHEN						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
32	12 mm CP concealed fixed Sink cock	Each	1	875	875	
33	Stainless steel, single bowl sink: Singapore/ M'Asia, size 450 mm x 1050 mm	Each	1	2500	2500	
34	WEF (walton Ezhaust Fan) 0601 (White) - Wall mounting. - One speed - Fan shuts off automatically when motor is unusually hot	Each	1	650	650	
35	Medium quality CP Towel Rail 600 x 20 mm dia size	Each	1	375	375	
36	125 mm dia stainless-steel floor-grating	Each	1	150	150	
37	12 x 6 mm gas stop cock	Each	1	195	195	
38	I. 50 PSI API 5L, Grade-B ERW M.S. Pipe- 25 mm ND (33.40 mm OD)	Each	1	100	100	
39	50 x 50 x 25 mm N.D. Tee CD40	Each	1	260	260	

40	50 x 25 mm reducer	Each	1	85	85	
	Total sum for 2 kitchens			Total =	10380	
DOORS						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
41	Supplying and making door and window frames (Chowkat) for all floors with matured seasoned wood of required size. Painting two coats of coal tar to the surface in contact with wall. Fitting and fixing in position etc. all complete and accepted by the Engineer-incharge. (All sizes of wood are finished). - Silkarai	cum	3.251	154787	503212.5	
42	Supplying, fitting and fixing M.S. flat bar clamp of 150 mm x 38 mm x 6 mm size having bifurcated ends to door and window frames with necessary rowel plug, screws etc. including cutting grooves in chowkat if necessary, etc. all complete and accepted by the Engineer-in-charge.	Each	27	97	2619	
43	SS fittings of door	sqm	56.35	329	18539.15	
44	Bedrooms	cum	0.892	154787	138070	For 10 Doors
45	Toilets	cum	0.401	154787	62069.59	For 10 Doors
46	Main doors	cum	0.26	154787	40244.62	For 2 Doors
47	Kitchens	cum			0	
48	Veranda 6 wooden	cum	0.26	154787	40244.62	For 6 Doors
	Total sum for 28 doors			Total =	805000	
WINDOWS						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Remarks**
49	Supplying, fitting and fixing of aluminium sliding window as per	sqm				

	the U.S. Architectural Aluminium Manufacturer‟s Association (AAMA) standard specification and BDS 1879:2014 having 1.2 mm thick outer bottom (size 75.50 mm, 32mm), 1.2 mm thick outer top (size 75.50 mm, 16.80 mm), 1.2 mm thick shutter top (size 33 mm.26.80, 22 mm), 1.2 mm thick shutter bottom (size 60mm, 24.40 mm), 1.2 mm thick outer side (size 75.50 mm,19.90 mm), 1.2 mm thick shutter lock (size 49.20 mm 26.20 mm) and 1.2 mm thick inter lock (size 34.40 mm, 32.10 mm) sections all aluminium members (total weight kg/sqm) will be anodized to aluminium bronze/silver/ss/black colour with a coat not less than 15 microns in thickness or powder coated to any colour with a coat not less than 25 microns in thickness and density of 4 mg per square cm etc. including all accessories like sliding door key lock, sliding door wheel, sliding door mohiar, sliding door neoprene, bolts and nuts including sealants, keeping provision for fitting 5 mm thick glass including labour charge for fitting of accessories, making grooves and mending good damages, carriage, and electricity complete in all respect as per drawing and accepted by the Engineer-in-charge. - Powder coated to any colour.					
50	Bedroom - per floor	sqm	9.72	3720	36158.4	For 10 Windows
51	Dining room- per floor	sqm	3.73	3720	13875.6	For 2 Windows
52	Kitchen	sqm	2.92	3720	10862.4	For 2 Windows
53	Bathroom	sqm	1.23	3720	4575.6	For 10 Windows

54	Stair window	sqm	1.86	3720	6919.2	For 2 Windows
	Total sum for 26 windows			Total =	72391.2	
WINDOW GRILL, VERANDAH GRILL & NETTING						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
55	Supplying, fitting and fixing window grill made of 12 mm x 12 mm M.S. solid bar 140 mm c/c with outer frame of 38 mm x 6mm F.I. bar as per design approved and accepted by the Engineer-in-charge.	sqm	19.27	2,442	47057.34	
56	Supplying, fitting and fixing verandah grill made of 10 mm dia M.S. rod provided @ 75 mm c/c in any position both ways as per design with outside frame of 25 mm x 25 mm x 6 mm M.S. angle including fabricating, welding in each point, painting 2 coats of synthetic enamel paint over a coat of anti-corrosive priming including cost of electricity, tools and plants, workshop charges, carriage of the same including cutting groves in the R.C.C. or brick work, mending good the damages with C.C. (1:2:4) etc, all complete for all floors accepted by the Engineer-in-charge. [Rate is excluding the cost of painting] (Total weight per sqm should be min 21.00 kg. and add or deduct @ Tk. 112.00 for each kg/sqm excess or less respectively)	sqm	65.41	2357	154171.4	
	Sum			Total =	201229	
SLAB						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
	Estimation of slab concrete:					
57	Mass concrete in floor (1:2:4) with brick chips and local sand of F.M. 1.2	cum	90.41	7575	684855.8	
58	Grade 600(600Mpa / 600N/mm2 ≈ 60900psi/ 60 Grade), BDS-6935-	M.ton	7.14	60500	431970	

	2006, B400: and ratio fy to fu => 1.25					
				Total =	1116826	

WALL AND LINTEL

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Remarks
60	Mass concrete in floor (1:2:4) with brick chips and local sand of F.M. 1.2	cum	950	7575	7196250	
				Total =	7781250	

2nd FLOOR FINISH

Item No	Item of Works	Amount	
1	BEAM	771568.51	
2	COLUMN	645556.44	
3	SHEAR WALL	389856.96	
4	STAIR	166420.232	
5	FLOOR FINISH	513561.61	
6	BATHROOM FITTINGS	147570	
7	KITCHEN	10380	
8	DOORS	804999.518	
9	WINDOWS	72391.2	
10	WINDOW GRILL, VERANDAH GRILL & NETTING	201228.71	
11	SLAB	1116825.75	
12	WALL AND LINTEL	7781250	
	TOTAL TK	12621608.93	BDT.

3 rd FLOOR

BEAM

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re marks
1	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	40.17	11903	478143.5	
2	Longitudinal Bars	M. ton	2.5	60500	151250	
3	Tie Bars	M. ton	2.35	60500	142175	
				Total =	771568.5	

COLUMN						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
4	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	24.24	12031	291631.4	
5	Longitudinal Reinforcement	M. ton	2.63	60500	159115	
6	Tie Bars	M. ton	2.14	60500	129470	
7	Hooks	M. ton	1.08	60500	65340	
				Total =	645556.4	
SHEAR WALL						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
8	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	30.06	12031	361651.9	
9	Longitudinal Reinforcement	M. ton	0.4332	60500	26208.6	
10	Tie Bars	M. ton	0.033	60500	1996.5	
				Total =	389857	
STAIR						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
11	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	2.772	11903	32995.12	
12	Longitudinal Reinforcement	M.ton	0.71	60500	42955	
13	Horizontal Reinforcement	M.ton	0.12	60500	7260	
	Total sum for 2 Stair			Total =	166420.2	
FLOOR FINISH						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
14	Supplying, fitting and fixing country made GP glazed / unglazed homogenous floor tiles (300 mm x 300 mm)	sqm	276.2	1273	351602.6	

15	Toilet- Supplying, fitting and fixing country made GP (water absorbtion ≤ 0.5%) GP (homogeneous) 300 mm x 300 mm floor tiles	sqm	30.2	1526	46085.2	
16	Veranda- Supplying, fitting and fixing machine-made clay roof tiles of size 100 mm x 200 mm or equivalent (red colour)	sqm	28.92	2683	77592.36	
17	Stair- Supplying, fitting and fixing country made GP homogeneous Glazed stair tiles having size of width 250 mm to 300 mm and length 300 mm	sqm	24.65	1553	38281.45	
				Total =	513561.6	
BATHROOM FITTINGS						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
18	Special coloured Cabinet basin (Deep Blue, Ruby, Rain Forest, Green) 500x450x180 mm, 9 kg	Each	1	3920	3920	
19	32 mm dia PVC waste pipe for W-Basin connection	Each	1	150	150	
20	12 mm CP concealed fixed Sink cock	Each	1	875	875	
21	12 mm plastic bib cock with internal brass thread	Each	1	452	452	
22	450 x 600 x 5 mm mirror	Each	1	550	550	
23	Porcelain soap tray (white)	Each	1	363	363	
24	Supplying, fitting and fixing of CP shower mixture including shower head only with all necessary hardware and consumables approved and accepted by the Engineer- in charge	Each	1	4530	4530	
25	White 465 x 340 x 415 mm commode	Each	1	1450	1450	
26	CP Moving push shower	Each	1	715	715	
27	Supplying, fitting and fixing of medium quality C.P. towel rail of 600 mm long and 20 mm in dia with C.P. holder including making	Each	1	627	627	

	drills in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in charge.					
28	Supplying, fitting and fixing of standard porcelain toilet paper holder of 150 mm x 150 mm x 126 mm size including making drills in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in-charge. Light colored.	Each	1	355	355	
29	Supplying, fitting and fixing in position different dia one-way brass stop cock (best quality and heavy type) etc. complete in all respect as per specification of Titas Gas T and D Co. Ltd. approved and accepted by the Engineer-in-charge. 12 mm x 6 mm N.D.	Each	1	270	270	
30	125 mm dia atainless-steel floor-grating	Each	1	150	150	
31	Medium quality CP iron frame with brackets for 600 x 125 x 5 mm size glass shelf.	Each	1	350	350	
	Total sum for 10 bathrooms			Total =	147570	
KITCHEN						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
32	12 mm CP concealed fixed Sink cock	Each	1	875	875	
33	Stainless steel, single bowl sink: Singapore/ M'Asia, size 450 mm x 1050 mm	Each	1	2500	2500	
34	WEF (walton Ezhaust Fan) 0601 (White) - Wall mounting. - One speed	Each	1	650	650	

	- Fan shuts off automatically when motor is unusually hot					
35	Medium quality CP Towel Rail 600 x 20 mm dia size	Each	1	375	375	
36	125 mm dia stainless-steel floor-grating	Each	1	150	150	
37	12 x 6 mm gas stop cock	Each	1	195	195	
38	I. 50 PSI API 5L, Grade-B ERW M.S. Pipe- 25 mm ND (33.40 mm OD)	Each	1	100	100	
39	50 x 50 x 25 mm N.D. Tee CD40	Each	1	260	260	
40	50 x 25 mm reducer	Each	1	85	85	
	Total sum for 2 kitchens			Total =	10380	
DOORS						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
41	Supplying and making door and window frames (Chowkat) for all floors with matured seasoned wood of required size. Painting two coats of coal tar to the surface in contact with wall. Fitting and fixing in position etc. all complete and accepted by the Engineer-incharge. (All sizes of wood are finished). - Silkarai	cum	3.251	154787	503212.5	
42	Supplying, fitting and fixing M.S. flat bar clamp of 150 mm x 38 mm x 6 mm size having bifurcated ends to door and window frames with necessary rowel plug, screws etc. including cutting grooves in chowkat if necessary, etc. all complete and accepted by the Engineer-in-charge.	Each	27	97	2619	

43	SS fittings of door	sqm	56.35	329	18539.15	
44	Bedrooms	cum	0.892	154787	138070	For 10 Doors
45	Toilets	cum	0.401	154787	62069.59	For 10 Doors
46	Main doors	cum	0.26	154787	40244.62	For 2 Doors
47	Kitchens	cum			0	
48	Veranda 6 wooden	cum	0.26	154787	40244.62	For 6 Doors
	Total sum for 28 doors			Total =	805000	

WINDOWS

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Remarks
49	Supplying, fitting and fixing of aluminium sliding window as per the U.S. Architectural Aluminium Manufacturer‟s Association (AAMA) standard specification and BDS 1879:2014 having 1.2 mm thick outer bottom (size 75.50 mm, 32mm), 1.2 mm thick outer top (size 75.50 mm, 16.80 mm), 1.2 mm thick shutter top (size 33 mm.26.80, 22 mm), 1.2 mm thick shutter bottom (size 60mm, 24.40 mm), 1.2 mm thick outer side (size 75.50 mm,19.90 mm), 1.2 mm thick shutter lock (size 49.20 mm 26.20 mm) and 1.2 mm thick inter lock (size 34.40 mm, 32.10 mm) sections all aluminium members (total weight kg/sqm) will be anodized to aluminium bronze/silver/ss/black colour with a coat not less than 15 microns in thickness or powder coated to any colour with a coat not less than 25 microns in thickness and density of 4 mg per square cm etc. including all accessories like sliding door key lock, sliding door wheel, sliding door mohiar, sliding door neoprene, bolts and nuts including sealants, keeping provision for fitting 5 mm thick glass including labour charge for	sqm				

	fitting of accessories, making grooves and mending good damages, carriage, and electricity complete in all respect as per drawing and accepted by the Engineer-in-charge. - Powder coated to any colour.					
50	Bedroom - per floor	sqm	9.72	3720	36158.4	For 10 Windows
51	Dining room- per floor	sqm	3.73	3720	13875.6	For 2 Windows
52	Kitchen	sqm	2.92	3720	10862.4	For 2 Windows
53	Bathroom	sqm	1.23	3720	4575.6	For 10 Windows
54	Stair window	sqm	1.86	3720	6919.2	For 2 Windows
	Total sum for 26 windows			Total =	72391.2	
WINDOW GRILL, VERANDAH GRILL & NETTING						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
55	Supplying, fitting and fixing window grill made of 12 mm x 12 mm M.S. solid bar 140 mm c/c with outer frame of 38 mm x 6mm F.I. bar as per design approved and accepted by the Engineer-in-charge.	sqm	19.27	2,442	47057.34	
56	Supplying, fitting and fixing verandah grill made of 10 mm dia M.S. rod provided @ 75 mm c/c in any position both ways as per design with outside frame of 25 mm x 25 mm x 6 mm M.S. angle including fabricating, welding in each point, painting 2 coats of synthetic enamel paint over a coat of anti-corrosive priming including cost of electricity, tools and plants, workshop charges, carriage of the same including cutting groves in the R.C.C. or brick work, mending good the damages with C.C. (1:2:4) etc, all complete for all floors accepted by the Engineer-in-charge. [Rate is excluding the cost	sqm	65.41	2357	154171.4	

	of painting] (Total weight per sqm should be min 21.00 kg. and add or deduct @ Tk. 112.00 for each kg/sqm excess or less respectively)					
	Sum			Total =	201229	

SLAB

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Remarks
	Estimation of slab concrete:					
57	Mass concrete in floor (1:2:4) with brick chips and local sand of F.M. 1.2	cum	90.41	7575	684855.8	
58	Grade 600(600Mpa / 600N/mm2 ≈ 60900psi/ 60 Grade), BDS-6935-2006, B400: and ratio fy to fu => 1.25	M.ton	7.14	60500	431970	
				Total =	1116826	

WALL AND LINTEL

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Remarks
59	Automatic machine-made 1st class standard bricks	per % 0 nos	65	9000	585000	
60	Mass concrete in floor (1:2:4) with brick chips and local sand of F.M. 1.2	cum	950	7575	7196250	
				Total =	7781250	

3rd FLOOR FINISH

Item No	Item of Works	Amount	
1	BEAM	771568.51	
2	COLUMN	645556.44	
3	SHEAR WALL	389856.96	
4	STAIR	166420.232	
5	FLOOR FINISH	513561.61	
6	BATHROOM FITTINGS	147570	
7	KITCHEN	10380	
8	DOORS	804999.518	
9	WINDOWS	72391.2	
10	WINDOW GRILL, VERANDAH GRILL & NETTING	201228.71	
11	SLAB	1116825.75	

12	WALL AND LINTEL	7781250	
	TOTAL TK	12621608.93	BDT.

4th FLOOR

Beam

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re marks
1	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	40.17	11903	478143.5	
2	Longitudinal Bars	M.ton	2.5	60500	151250	
3	Tie Bars	M.ton	2.35	60500	142175	
				Total =	771568.5	

Column

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Remar ks
4	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	24.24	12031	291631.4	
5	Longitudinal Reinforcement	M.ton	2.32	60500	140360	
6	Tie Bars	M.ton	2.04	60500	123420	
7	Hooks	M.ton	0.95	60500	57475	
				Total =	612886.4	

SHEAR WALL

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re marks
8	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	30.06	12031	361651.9	
9	Longitudinal Reinforcement	M.ton	0.408	60500	24684	
10	Tie Bars	M.ton	0.033	60500	1996.5	
				Total =	388332.4	

STAIR						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
11	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	2.772	11903	32995.12	
12	Longitudinal Reinforcement	M.ton	0.71	60500	42955	
13	Horizontal Reinforcement	M.ton	0.12	60500	7260	
	Total sum for 2 Stair			Total =	166420.2	
FLOOR FINISH						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
14	Supplying, fitting and fixing country made GP glazed / unglazed homogenous floor tiles (300 mm x 300 mm)	sqm	276.2	1273	351602.6	
15	Toilet- Supplying, fitting and fixing country made GP (water absorbtion ≤ 0.5%) GP (homogeneous) 300 mm x 300 mm floor tiles	sqm	30.2	1526	46085.2	
16	Veranda- Supplying, fitting and fixing machine-made clay roof tiles of size 100 mm x 200 mm or equivalent (red colour)	sqm	28.92	2683	77592.36	
17	Stair- Supplying, fitting and fixing country made GP homogeneous Glazed stair tiles having size of width 250 mm to 300 mm and length 300 mm	sqm	24.65	1553	38281.45	
				Total =	513561.6	
BATHROOM FITTINGS						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
18	Special coloured Cabinet basin (Deep Blue, Ruby, Rain Forest, Green) 500x450x180 mm, 9 kg	Each	1	3920	3920	
19	32 mm dia PVC waste pipe for W-Basin connection	Each	1	150	150	
20	12 mm CP concealed fixed Sink cock	Each	1	875	875	

21	12 mm plastic bib cock with internal brass thread	Each	1	452	452	
22	450 x 600 x 5 mm mirror	Each	1	550	550	
23	Porcelain soap tray (white)	Each	1	363	363	
24	Supplying, fitting and fixing of CP shower mixture including shower head only with all necessary hardware and consumables approved and accepted by the Engineer- in charge	Each	1	4530	4530	
25	White 465 x 340 x 415 mm commode	Each	1	1450	1450	
26	CP Moving push shower	Each	1	715	715	
27	Supplying, fitting and fixing of medium quality C.P. towel rail of 600 mm long and 20 mm in dia with C.P. holder including making drills in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in charge.	Each	1	627	627	
28	Supplying, fitting and fixing of standard porcelain toilet paper holder of 150 mm x 150 mm x 126 mm size including making drills in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in- charge. Light colored.	Each	1	355	355	
29	Supplying, fitting and fixing in position different dia one-way brass stop cock (best quality and heavy type) etc. complete in all respect as per specification of Titas Gas T and D Co. Ltd. approved and accepted by the Engineer-in-charge. 12 mm x 6 mm N.D.	Each	1	270	270	
30	125 mm dia atainless-steel floor-grating	Each	1	150	150	
31	Medium quality CP iron frame with brackets for 600 x 125 x 5 mm size glass shelf.	Each	1	350	350	

	Total sum for 10 bathrooms			Total =	147570	
KITCHEN						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
32	12 mm CP concealed fixed Sink cock	Each	1	875	875	
33	Stainless steel, single bowl sink: Singapore/M'Asia, size 450 mm x 1050 mm	Each	1	2500	2500	
34	WEF(walton Ezhaust Fan) 0601 (White) - Wall mounting. - One speed - Fan shuts off automatically when motor is unusually hot	Each	1	650	650	
35	Medium quality CP Towel Rail 600 x 20 mm dia size	Each	1	375	375	
37	12 x 6 mm gas stop cock	Each	1	195	195	
38	I. 50 PSI API 5L, Grade-B ERW M.S. Pipe- 25 mm ND (33.40 mm OD)	Each	1	100	100	
39	50 x 50 x 25 mm N.D. Tee CD40	Each	1	260	260	
40	50 x 25 mm reducer	Each	1	85	85	
	Total sum for 2 kitchens			Total =	10380	
DOORS						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
41	Supplying and making door and window frames (Chowkat) for all	cum	3.251	154787	503212.5	

	floors with matured seasoned wood of required size. Painting two coats of coal tar to the surface in contact with wall. Fitting and fixing in position etc. all complete and accepted by the Engineer-incharge. (All sizes of wood are finished). – Silkarai					
42	Supplying, fitting and fixing M.S. flat bar clamp of 150 mm x 38 mm x 6 mm size having bifurcated ends to door and window frames with necessary rowel plug, screws etc. including cutting grooves in chowkat if necessary, etc. all complete and accepted by the Engineer-in-charge.	Each	27	97	2619	
43	SS fittings of door	sqm	56.35	329	18539.15	
44	Bedrooms	cum	0.892	154787	138070	For 10 Doors
45	Toilets	cum	0.401	154787	62069.59	For 10 Doors
46	Main doors	cum	0.26	154787	40244.62	For 2 Doors
47	Kitchens	cum			0	
48	Veranda 6 wooden	cum	0.26	154787	40244.62	For 6 Doors
	Total sum for 28 doors			Total =	805000	

WINDOWS

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Remarks
49	Supplying, fitting and fixing of aluminium sliding window as per the U.S. Architectural Aluminium Manufacturer‟s Association (AAMA) standard specification and BDS 1879:2014 having 1.2 mm thick outer bottom (size 75.50 mm, 32mm), 1.2 mm thick outer top (size 75.50 mm, 16.80 mm), 1.2 mm thick shutter top (size 33 mm.26.80, 22 mm), 1.2 mm thick shutter bottom (size 60mm, 24.40 mm), 1.2 mm thick outer side (size	sqm				

	75.50 mm,19.90 mm), 1.2 mm thick shutter lock (size 49.20 mm 26.20 mm) and 1.2 mm thick inter lock (size 34.40 mm, 32.10 mm) sections all aluminium members (total weight kg/sqm) will be anodized to aluminium bronze/silver/ss/black colour with a coat not less than 15 microns in thickness or powder coated to any colour with a coat not less than 25 microns in thickness and density of 4 mg per square cm etc. including all accessories like sliding door key lock, sliding door wheel, sliding door mohiar, sliding door neoprene, bolts and nuts including sealants, keeping provision for fitting 5 mm thick glass including labour charge for fitting of accessories, making grooves and mending good damages, carriage, and electricity complete in all respect as per drawing and accepted by the Engineer-in-charge. - Powder coated to any colour.					
50	Bedroom - per floor	sqm	9.72	3720	36158.4	For 10 Windows
51	Dining room- per floor	sqm	3.73	3720	13875.6	For 2 Windows
52	Kitchen	sqm	2.92	3720	10862.4	For 2 Windows
53	Bathroom	sqm	1.23	3720	4575.6	For 10 Windows
54	Stair window	sqm	1.86	3720	6919.2	For 2 Windows
	Total sum for 26 windows			Total =	72391.2	

WINDOW GRILL, VERANDAH GRILL & NETTING

Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
55	Supplying, fitting and fixing window grill made of 12 mm x 12 mm M.S.	sqm	19.27	2,442	47057.34	

	solid bar 140 mm c/c with outer frame of 38 mm x 6mm F.I. bar as per design approved and accepted by the Engineer-in-charge.					
56	Supplying, fitting and fixing verandah grill made of 10 mm dia M.S. rod provided @ 75 mm c/c in any position both ways as per design with outside frame of 25 mm x 25 mm x 6 mm M.S. angle including fabricating, welding in each point, painting 2 coats of synthetic enamel paint over a coat of anti-corrosive priming including cost of electricity, tools and plants, workshop charges, carriage of the same including cutting groves in the R.C.C. or brick work, mending good the damages with C.C. (1:2:4) etc, all complete for all floors accepted by the Engineer-in-charge. [Rate is excluding the cost of painting] (Total weight per sqm should be min 21.00 kg. and add or deduct @ Tk. 112.00 for each kg/sqm excess or less respectively)	sqm	65.41	2357	154171.4	
	Sum			Total =	201229	

Slab

Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Remarks**
	Estimation of slab concrete:					
57	Mass concrete in floor (1:2:4) with brick chips and local sand of F.M. 1.2	cum	90.41	7575	684855.8	
58	Grade 600(600Mpa / 600N/mm2 ≈ 60900psi/ 60 Grade), BDS-6935-2006, B400: and ratio fy to fu => 1.25	M.ton	7.14	60500	431970	
				Total =	1116826	

WALL AND LINTEL

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re marks
59	Automatic machine-made 1st class standard bricks	per % 0 nos	65	9000	585000	
60	Mass concrete in floor (1:2:4) with brick chips and local sand of F.M. 1.2	cum	950	7575	7196250	
				Total =	7781250	

4th FLOOR FINISH			
Item No	**Item of Works**	**Amount**	
1	BEAM	771568.51	
2	COLUMN	612886.44	
3	SHEAR WALL	388332.36	
4	STAIR	166420.232	
5	FLOOR FINISH	513561.61	
6	BATHROOM FITTINGS	147570	
7	KITCHEN	10380	
8	DOORS	804999.518	
9	WINDOWS	72391.2	
10	WINDOW GRILL, VERANDAH GRILL & NETTING	201228.71	
11	SLAB	1116825.75	
12	WALL AND LINTEL	7781250	
	TOTAL TK	12587414.33	BDT.

5th FLOOR

BEAM

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re Marks
1	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	40.17	11903	478143.5	
2	Longitudinal Bars	M.ton	2.5	60500	151250	

3	Tie Bars	M.ton	2.35	60500	142175	
				Total =	771568.5	
COLUMN						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Remarks**
4	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	24.24	12031	291631.4	
5	Longitudinal Reinforcement	M.ton	2.32	60500	140360	
6	Tie Bars	M.ton	2.04	60500	123420	
7	Hooks	M.ton	0.95	60500	57475	
				Total =	612886.4	
SHEAR WALL						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
8	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	30.06	12031	361651.9	
9	Longitudinal Reinforcement	M.ton	0.408	60500	24684	
10	Tie Bars	M.ton	0.033	60500	1996.5	
				Total =	388332.4	
STAIR						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
11	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	2.772	11903	32995.12	
12	Longitudinal Reinforcement	M.ton	0.71	60500	42955	
13	Horizontal Reinforcement	M.ton	0.12	60500	7260	
	Total sum for 2 Stair			Total =	166420.2	
FLOOR FINISH						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
14	Supplying, fitting and fixing country made GP glazed / unglazed	sqm	276.2	1273	351602.6	

	homogenous floor tiles (300 mm x 300 mm)					
15	Toilet- Supplying, fitting and fixing country made GP (water absorbtion ≤ 0.5%) GP (homogeneous) 300 mm x 300 mm floor tiles	sqm	30.2	1526	46085.2	
16	Veranda- Supplying, fitting and fixing machine-made clay roof tiles of size 100 mm x 200 mm or equivalent (red colour)	sqm	28.92	2683	77592.36	
17	Stair- Supplying, fitting and fixing country made GP homogeneous Glazed stair tiles having size of width 250 mm to 300 mm and length 300 mm	sqm	24.65	1553	38281.45	
				Total =	513561.6	
BATHROOM FITTINGS						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
18	Special coloured Cabinet basin (Deep Blue, Ruby, Rain Forest, Green) 500x450x180 mm, 9 kg	Each	1	3920	3920	
19	32 mm dia PVC waste pipe for W-Basin connection	Each	1	150	150	
20	12 mm CP concealed fixed Sink cock	Each	1	875	875	
21	12 mm plastic bib cock with internal brass thread	Each	1	452	452	
22	450 x 600 x 5 mm mirror	Each	1	550	550	
23	Porcelain soap tray (white)	Each	1	363	363	
24	Supplying, fitting and fixing of CP shower mixture including shower head only with all necessary hardware and consumables approved and accepted by the Engineer- in charge	Each	1	4530	4530	
25	White 465 x 340 x 415 mm commode	Each	1	1450	1450	
26	CP Moving push shower	Each	1	715	715	
27	Supplying, fitting and fixing of medium quality C.P. towel rail of 600 mm long and 20 mm in dia with C.P. holder including making drills in	Each	1	627	627	

	walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in charge.					
28	Supplying, fitting and fixing of standard porcelain toilet paper holder of 150 mm x 150 mm x 126 mm size including making drills in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in- charge. Light colored.	Each	1	355	355	
29	Supplying, fitting and fixing in position different dia one-way brass stop cock (best quality and heavy type) etc. complete in all respect as per specification of Titas Gas T and D Co. Ltd. approved and accepted by the Engineer-in-charge. 12 mm x 6 mm N.D.	Each	1	270	270	
30	125 mm dia atainless-steel floor-grating	Each	1	150	150	
31	Medium quality CP iron frame with brackets for 600 x 125 x 5 mm size glass shelf.	Each	1	350	350	
	Total sum for 10 bathrooms			Total =	147570	
KITCHEN						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
32	12 mm CP concealed fixed Sink cock	Each	1	875	875	
33	Stainless steel, single bowl sink: Singapore/M'Asia, size 450 mm x 1050 mm	Each	1	2500	2500	
34	WEF(walton Ezhaust Fan) 0601 (White) - Wall mounting. - One speed	Each	1	650	650	

	- Fan shuts off automatically when motor is unusually hot					
35	Medium quality CP Towel Rail 600 x 20 mm dia size	Each	1	375	375	
36	125 mm dia stainless-steel floor-grating	Each	1	150	150	
37	12 x 6 mm gas stop cock	Each	1	195	195	
38	I. 50 PSI API 5L, Grade-B ERW M.S. Pipe- 25 mm ND (33.40 mm OD)	Each	1	100	100	
39	50 x 50 x 25 mm N.D. Tee CD40	Each	1	260	260	
40	50 x 25 mm reducer	Each	1	85	85	
	Total sum for 2 kitchens			Total =	10380	
DOORS						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
41	Supplying and making door and window frames (Chowkat) for all floors with matured seasoned wood of required size. Painting two coats of coal tar to the surface in contact with wall. Fitting and fixing in position etc. all complete and accepted by the Engineer-incharge. (All sizes of wood are finished). - Silkarai	cum	3.251	154787	503212.5	
42	Supplying, fitting and fixing M.S. flat bar clamp of 150 mm x 38 mm x 6 mm size having bifurcated ends to door and window frames with necessary rowel plug, screws etc. including cutting grooves in chowkat	Each	27	97	2619	

	if necessary, etc. all complete and accepted by the Engineer-in-charge.					
43	SS fittings of door	sqm	56.35	329	18539.15	
44	Bedrooms	cum	0.892	154787	138070	For 10 Doors
45	Toilets	cum	0.401	154787	62069.59	For 10 Doors
46	Main doors	cum	0.26	154787	40244.62	For 2 Doors
47	Kitchens	cum			0	
48	Veranda 6 wooden	cum	0.26	154787	40244.62	For 6 Doors
	Total sum for 28 doors			Total =	805000	

WINDOWS

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Remarks
49	Supplying, fitting and fixing of aluminium sliding window as per the U.S. Architectural Aluminium Manufacturer‟s Association (AAMA) standard specification and BDS 1879:2014 having 1.2 mm thick outer bottom (size 75.50 mm, 32mm), 1.2 mm thick outer top (size 75.50 mm, 16.80 mm), 1.2 mm thick shutter top (size 33 mm.26.80, 22 mm), 1.2 mm thick shutter bottom (size 60mm, 24.40 mm), 1.2 mm thick outer side (size 75.50 mm,19.90 mm), 1.2 mm thick shutter lock (size 49.20 mm 26.20 mm) and 1.2 mm thick inter lock (size 34.40 mm, 32.10 mm) sections all aluminium members (total weight kg/sqm) will be anodized to aluminium bronze/silver/ss/black colour with a coat not less than 15 microns in thickness or powder coated to any colour with a coat not less than 25 microns in thickness and density of 4 mg per square cm etc. including all accessories like sliding door key lock, sliding door wheel, sliding door mohiar, sliding door neoprene, bolts and nuts including sealants, keeping	sqm				

	provision for fitting 5 mm thick glass including labour charge for fitting of accessories, making grooves and mending good damages, carriage, and electricity complete in all respect as per drawing and accepted by the Engineer-in-charge. - Powder coated to any colour.					
50	Bedroom - per floor	sqm	9.72	3720	36158.4	For 10 Windows
51	Dining room- per floor	sqm	3.73	3720	13875.6	For 2 Windows
52	Kitchen	sqm	2.92	3720	10862.4	For 2 Windows
53	Bathroom	sqm	1.23	3720	4575.6	For 10 Windows
54	Stair window	sqm	1.86	3720	6919.2	For 2 Windows
	Total sum for 26 windows			Total =	72391.2	

WINDOW GRILL, VERANDAH GRILL & NETTING

Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
55	Supplying, fitting and fixing window grill made of 12 mm x 12 mm M.S. solid bar 140 mm c/c with outer frame of 38 mm x 6mm F.I. bar as per design approved and accepted by the Engineer-in-charge.	sqm	19.27	2,442	47057.34	
56	Supplying, fitting and fixing verandah grill made of 10 mm dia M.S. rod provided @ 75 mm c/c in any position both ways as per design with outside frame of 25 mm x 25 mm x 6 mm M.S. angle including fabricating, welding in each point, painting 2 coats of synthetic enamel paint over a coat of anti-corrosive priming including cost of electricity, tools and plants, workshop charges, carriage of the same including cutting groves in the R.C.C. or brick work, mending good	sqm	65.41	2357	154171.4	

	the damages with C.C. (1:2:4) etc, all complete for all floors accepted by the Engineer-in-charge. [Rate is excluding the cost of painting] (Total weight per sqm should be min 21.00 kg. and add or deduct @ Tk. 112.00 for each kg/sqm excess or less respectively)					
	Sum			Total =	201229	

Slab

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re marks
	Estimation of slab concrete:					
57	Mass concrete in floor (1:2:4) with brick chips and local sand of F.M. 1.2	cum	90.41	7575	684855.8	
58	Grade 600(600Mpa / 600N/mm2 ≈ 60900psi/ 60 Grade), BDS-6935-2006, B400: and ratio fy to fu => 1.25	M.ton	7.14	60500	431970	
				Total =	1116826	

WALL AND LINTEL

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re marks
59	Automatic machine-made 1st class standard bricks	per % 0 nos	65	9000	585000	
60	Mass concrete in floor (1:2:4) with brick chips and local sand of F.M. 1.2	cum	950	7575	7196250	
				Total =	7781250	

5th FLOOR FINISH

Item No	Item of Works	Amount	
1	BEAM	771568.51	
2	COLUMN	612886.44	
3	SHEAR WALL	388332.36	

4	STAIR	166420.232	
5	FLOOR FINISH	513561.61	
6	BATHROOM FITTINGS	147570	
7	KITCHEN	10380	
8	DOORS	804999.518	
9	WINDOWS	72391.2	
10	WINDOW GRILL, VERANDAH GRILL & NETTING	201228.71	
11	SLAB	1116825.75	
12	WALL AND LINTEL	7781250	
	TOTAL TK	12587414.33	BDT.

6th FLOOR

BEAM

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re marks
1	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	40.17	11903	478143.5	
2	Longitudinal Bars	M.ton	2.5	60500	151250	
3	Tie Bars	M.ton	2.35	60500	142175	
				Total =	771568.5	

COLUMN

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Remar ks
4	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	24.24	12031	291631.4	
5	Longitudinal Reinforcement	M.ton	2.32	60500	140360	
6	Tie Bars	M.ton	2.04	60500	123420	
7	Hooks	M.ton	0.95	60500	57475	
				Total =	612886.4	

SHEAR WALL

Item	Items of Works	Unit	Quantity	Unit	Amount	Re

no				Rate		marks
8	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	30.06	12031	361651.9	
9	Longitudinal Reinforcement	M.ton	0.408	60500	24684	
10	Tie Bars	M.ton	0.033	60500	1996.5	
				Total =	388332.4	

STAIR

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re marks
11	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	2.772	11903	32995.12	
12	Longitudinal Reinforcement	M.ton	0.71	60500	42955	
13	Horizontal Reinforcement	M.ton	0.12	60500	7260	
	Total sum for 2 Stair			Total =	166420.2	

FLOOR FINISH

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re marks
14	Supplying, fitting and fixing country made GP glazed / unglazed homogenous floor tiles (300 mm x 300 mm)	sqm	276.2	1273	351602.6	
15	Toilet- Supplying, fitting and fixing country made GP (water absorbtion ≤ 0.5%) GP (homogeneous) 300 mm x 300 mm floor tiles	sqm	30.2	1526	46085.2	
16	Veranda- Supplying, fitting and fixing machine-made clay roof tiles of size 100 mm x 200 mm or equivalent (red colour)	sqm	28.92	2683	77592.36	
17	Stair- Supplying, fitting and fixing country made GP homogeneous Glazed stair tiles having size of width 250 mm to 300 mm and length 300 mm	sqm	24.65	1553	38281.45	
				Total =	513561.6	

BATHROOM FITTINGS

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re marks

18	Special coloured Cabinet basin (Deep Blue, Ruby, Rain Forest, Green) 500x450x180 mm, 9 kg	Each	1	3920	3920	
19	32 mm dia PVC waste pipe for W-Basin connection	Each	1	150	150	
20	12 mm CP concealed fixed Sink cock	Each	1	875	875	
21	12 mm plastic bib cock with internal brass thread	Each	1	452	452	
22	450 x 600 x 5 mm mirror	Each	1	550	550	
23	Porcelain soap tray (white)	Each	1	363	363	
24	Supplying, fitting and fixing of CP shower mixture including shower head only with all necessary hardware and consumables approved and accepted by the Engineer- in charge	Each	1	4530	4530	
25	White 465 x 340 x 415 mm commode	Each	1	1450	1450	
26	CP Moving push shower	Each	1	715	715	
27	Supplying, fitting and fixing of medium quality C.P. towel rail of 600 mm long and 20 mm in dia with C.P. holder including making drills in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in charge.	Each	1	627	627	
28	Supplying, fitting and fixing of standard porcelain toilet paper holder of 150 mm x 150 mm x 126 mm size including making drills in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in- charge. Light colored.	Each	1	355	355	
29	Supplying, fitting and fixing in position different dia one-way brass stop cock (best quality and heavy type) etc. complete in all respect as per specification of Titas Gas T and D Co. Ltd. approved and accepted by	Each	1	270	270	

	the Engineer-in-charge. 12 mm x 6 mm N.D.					
30	125 mm dia atainless-steel floor-grating	Each	1	150	150	
31	Medium quality CP iron frame with brackets for 600 x 125 x 5 mm size glass shelf.	Each	1	350	350	
	Total sum for 10 bathrooms			Total =	147570	
KITCHEN						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
32	12 mm CP concealed fixed Sink cock	Each	1	875	875	
33	Stainless steel, single bowl sink: Singapore/M'Asia, size 450 mm x 1050 mm	Each	1	2500	2500	
34	WEF(walton Ezhaust Fan) 0601 (White) - Wall mounting. - One speed - Fan shuts off automatically when motor is unusually hot	Each	1	650	650	
35	Medium quality CP Towel Rail 600 x 20 mm dia size	Each	1	375	375	
36	125 mm dia stainless-steel floor-grating	Each	1	150	150	
37	12 x 6 mm gas stop cock	Each	1	195	195	
38	I. 50 PSI API 5L, Grade-B ERW M.S. Pipe- 25 mm ND (33.40 mm OD)	Each	1	100	100	
39	50 x 50 x 25 mm N.D. Tee CD40	Each	1	260	260	
40	50 x 25 mm reducer	Each	1	85	85	
	Total sum for 2 kitchens			Total =	10380	

DOORS						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
41	Supplying and making door and window frames (Chowkat) for all floors with matured seasoned wood of required size. Painting two coats of coal tar to the surface in contact with wall. Fitting and fixing in position etc. all complete and accepted by the Engineer-incharge. (All sizes of wood are finished). - Silkarai	cum	3.251	154787	503212.5	
42	Supplying, fitting and fixing M.S. flat bar clamp of 150 mm x 38 mm x 6 mm size having bifurcated ends to door and window frames with necessary rowel plug, screws etc. including cutting grooves in chowkat if necessary, etc. all complete and accepted by the Engineer-in-charge.	Each	27	97	2619	
43	SS fittings of door	sqm	56.35	329	18539.15	
44	Bedrooms	cum	0.892	154787	138070	For 10 Doors
45	Toilets	cum	0.401	154787	62069.59	For 10 Doors
46	Main doors	cum	0.26	154787	40244.62	For 2 Doors
47	Kitchens	cum			0	
48	Veranda 6 wooden	cum	0.26	154787	40244.62	For 6 Doors
	Total sum for 28 doors			Total =	805000	

WINDOWS						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
49	Supplying, fitting and fixing of aluminium sliding window as per the U.S. Architectural Aluminium Manufacturer‟s Association (AAMA) standard specification and BDS 1879:2014 having 1.2	sqm				

	mm thick outer bottom (size 75.50 mm, 32mm), 1.2 mm thick outer top (size 75.50 mm, 16.80 mm), 1.2 mm thick shutter top (size 33 mm.26.80, 22 mm), 1.2 mm thick shutter bottom (size 60mm, 24.40 mm), 1.2 mm thick outer side (size 75.50 mm,19.90 mm), 1.2 mm thick shutter lock (size 49.20 mm 26.20 mm) and 1.2 mm thick inter lock (size 34.40 mm, 32.10 mm) sections all aluminium members (total weight kg/sqm) will be anodized to aluminium bronze/silver/ss/black colour with a coat not less than 15 microns in thickness or powder coated to any colour with a coat not less than 25 microns in thickness and density of 4 mg per square cm etc. including all accessories like sliding door key lock, sliding door wheel, sliding door mohiar, sliding door neoprene, bolts and nuts including sealants, keeping provision for fitting 5 mm thick glass including labour charge for fitting of accessories, making grooves and mending good damages, carriage, and electricity complete in all respect as per drawing and accepted by the Engineer-in-charge. - Powder coated to any colour.					
50	Bedroom - per floor	sqm	9.72	3720	36158.4	For 10 Windows
51	Dining room- per floor	sqm	3.73	3720	13875.6	For 2 Windows
52	Kitchen	sqm	2.92	3720	10862.4	For 2 Windows
53	Bathroom	sqm	1.23	3720	4575.6	For 10 Windows
54	Stair window	sqm	1.86	3720	6919.2	For 2 Windows
	Total sum for 26 windows			Total =	72391.2	
WINDOW GRILL, VERANDAH GRILL & NETTING						

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re marks
55	Supplying, fitting and fixing window grill made of 12 mm x 12 mm M.S. solid bar 140 mm c/c with outer frame of 38 mm x 6mm F.I. bar as per design approved and accepted by the Engineer-in-charge.	sqm	19.27	2,442	47057.34	
56	Supplying, fitting and fixing verandah grill made of 10 mm dia M.S. rod provided @ 75 mm c/c in any position both ways as per design with outside frame of 25 mm x 25 mm x 6 mm M.S. angle including fabricating, welding in each point, painting 2 coats of synthetic enamel paint over a coat of anti-corrosive priming including cost of electricity, tools and plants, workshop charges, carriage of the same including cutting groves in the R.C.C. or brick work, mending good the damages with C.C. (1:2:4) etc, all complete for all floors accepted by the Engineer-in-charge. [Rate is excluding the cost of painting] (Total weight per sqm should be min 21.00 kg. and add or deduct @ Tk. 112.00 for each kg/sqm excess or less respectively)	sqm	65.41	2357	154171.4	
	Sum			Total =	201229	

Slab

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re marks
	Estimation of slab concrete:					
57	Mass concrete in floor (1:2:4) with brick chips and local sand of F.M. 1.2	cum	90.41	7575	684855.8	

58	Grade 600(600Mpa / 600N/mm2 ≈ 60900psi/ 60 Grade), BDS-6935-2006, B400: and ratio fy to fu => 1.25	M.ton	7.14	60500	431970	
				Total =	1116826	
WALL AND LINTEL						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
59	Automatic machine-made 1st class standard bricks	per % 0 nos	65	9000	585000	
60	Mass concrete in floor (1:2:4) with brick chips and local sand of F.M. 1.2	cum	950	7575	7196250	
				Total =	7781250	

6th FLOOR FINISH			
Item No	**Item of Works**	**Amount**	
1	BEAM	771568.51	
2	COLUMN	612886.44	
3	SHEAR WALL	388332.36	
4	STAIR	166420.232	
5	FLOOR FINISH	513561.61	
6	BATHROOM FITTINGS	147570	
7	KITCHEN	10380	
8	DOORS	804999.518	
9	WINDOWS	72391.2	
10	WINDOW GRILL, VERANDAH GRILL & NETTING	201228.71	
11	SLAB	1116825.75	
12	WALL AND LINTEL	7781250	
	TOTAL TK	12587414.33	BDT.

7th FLOOR						
BEAM						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
1	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	40.17	11903	478143.5	
2	Longitudinal Bars	M.ton	2.5	60500	151250	
3	Tie Bars	M.ton	2.35	60500	142175	
				Total =	771568.5	
COLUMN						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Remarks**
4	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	24.24	12031	291631.4	
5	Longitudinal Reinforcement	M.ton	2.32	60500	140360	
6	Tie Bars	M.ton	2.04	60500	123420	
7	Hooks	M.ton	0.95	60500	57475	
				Total =	612886.4	
SHEAR WALL						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
8	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	30.06	12031	361651.9	
9	Longitudinal Reinforcement	M.ton	0.408	60500	24684	
10	Tie Bars	M.ton	0.033	60500	1996.5	
				Total =	388332.4	
STAIR						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re Marks**

11	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	2.772	11903	32995.12	
12	Longitudinal Reinforcement	M.ton	0.71	60500	42955	
13	Horizontal Reinforcement	M.ton	0.12	60500	7260	
	Total sum for 2 Stair			Total =	166420.2	
FLOOR FINISH						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re Marks**
14	Supplying, fitting and fixing country made GP glazed / unglazed homogenous floor tiles (300 mm x 300 mm)	sqm	276.2	1273	351602.6	
15	Toilet- Supplying, fitting and fixing country made GP (water absorbtion ≤ 0.5%) GP (homogeneous) 300 mm x 300 mm floor tiles	sqm	30.2	1526	46085.2	
16	Veranda- Supplying, fitting and fixing machine-made clay roof tiles of size 100 mm x 200 mm or equivalent (red colour)	sqm	28.92	2683	77592.36	
17	Stair- Supplying, fitting and fixing country made GP homogeneous Glazed stair tiles having size of width 250 mm to 300 mm and length 300 mm	sqm	24.65	1553	38281.45	
				Total =	513561.6	
BATHROOM FITTINGS						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re Marks**
18	Special coloured Cabinet basin (Deep Blue, Ruby, Rain Forest, Green) 500x450x180 mm, 9 kg	Each	1	3920	3920	
19	32 mm dia PVC waste pipe for W-Basin connection	Each	1	150	150	
20	12 mm CP concealed fixed Sink cock	Each	1	875	875	
21	12 mm plastic bib cock with internal brass thread	Each	1	452	452	
22	450 x 600 x 5 mm mirror	Each	1	550	550	

23	Porcelain soap tray (white)	Each	1	363	363	
24	Supplying, fitting and fixing of CP shower mixture including shower head only with all necessary hardware and consumables approved and accepted by the Engineer- in charge	Each	1	4530	4530	
25	White 465 x 340 x 415 mm commode	Each	1	1450	1450	
26	CP Moving push shower	Each	1	715	715	
27	Supplying, fitting and fixing of medium quality C.P. towel rail of 600 mm long and 20 mm in dia with C.P. holder including making drills in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in charge.	Each	1	627	627	
28	Supplying, fitting and fixing of standard porcelain toilet paper holder of 150 mm x 150 mm x 126 mm size including making drills in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in- charge. Light colored.	Each	1	355	355	
29	Supplying, fitting and fixing in position different dia one-way brass stop cock (best quality and heavy type) etc. complete in all respect as per specification of Titas Gas T and D Co. Ltd. approved and accepted by the Engineer-in-charge. 12 mm x 6 mm N.D.	Each	1	270	270	
30	125 mm dia atainless-steel floor-grating	Each	1	150	150	
31	Medium quality CP iron frame with brackets for 600 x 125 x 5 mm size glass shelf.	Each	1	350	350	
	Total sum for 10 bathrooms			Total =	147570	
KITCHEN						

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re Marks
32	12 mm CP concealed fixed Sink cock	Each	1	875	875	
33	Stainless steel, single bowl sink: Singapore/M'Asia, size 450 mm x 1050 mm	Each	1	2500	2500	
34	WEF(walton Ezhaust Fan) 0601 (White) - Wall mounting. - One speed - Fan shuts off automatically when motor is unusually hot	Each	1	650	650	
35	Medium quality CP Towel Rail 600 x 20 mm dia size	Each	1	375	375	
36	125 mm dia stainless-steel floor-grating	Each	1	150	150	
37	12 x 6 mm gas stop cock	Each	1	195	195	
38	I. 50 PSI API 5L, Grade-B ERW M.S. Pipe- 25 mm ND (33.40 mm OD)	Each	1	100	100	
39	50 x 50 x 25 mm N.D. Tee CD40	Each	1	260	260	
40	50 x 25 mm reducer	Each	1	85	85	
	Total sum for 2 kitchens			Total =	10380	

DOORS

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re Marks
41	Supplying and making door and window frames (Chowkat) for all	cum	3.251	154787	503212.5	

	floors with matured seasoned wood of required size. Painting two coats of coal tar to the surface in contact with wall. Fitting and fixing in position etc. all complete and accepted by the Engineer-incharge. (All sizes of wood are finished). - Silkarai					
42	Supplying, fitting and fixing M.S. flat bar clamp of 150 mm x 38 mm x 6 mm size having bifurcated ends to door and window frames with necessary rowel plug, screws etc. including cutting grooves in chowkat if necessary, etc. all complete and accepted by the Engineer-in-charge.	Each	27	97	2619	
43	SS fittings of door	sqm	56.35	329	18539.15	
44	Bedrooms	cum	0.892	154787	138070	For 10 Doors
45	Toilets	cum	0.401	154787	62069.59	For 10 Doors
46	Main doors	cum	0.26	154787	40244.62	For 2 Doors
47	Kitchens	cum			0	
48	Veranda 6 wooden	cum	0.26	154787	40244.62	For 6 Doors
	Total sum for 28 doors			Total =	805000	

WINDOWS

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Remarks
49	Supplying, fitting and fixing of aluminium sliding window as per the U.S. Architectural Aluminium Manufacturer‟s Association (AAMA) standard specification and BDS 1879:2014 having 1.2 mm thick outer bottom (size 75.50 mm, 32mm), 1.2 mm thick outer top (size 75.50 mm, 16.80 mm), 1.2 mm thick shutter top (size 33 mm.26.80, 22 mm), 1.2 mm thick shutter bottom (size 60mm, 24.40 mm), 1.2 mm thick outer side (size	sqm				

	75.50 mm,19.90 mm), 1.2 mm thick shutter lock (size 49.20 mm 26.20 mm) and 1.2 mm thick inter lock (size 34.40 mm, 32.10 mm) sections all aluminium members (total weight kg/sqm) will be anodized to aluminium bronze/silver/ss/black colour with a coat not less than 15 microns in thickness or powder coated to any colour with a coat not less than 25 microns in thickness and density of 4 mg per square cm etc. including all accessories like sliding door key lock, sliding door wheel, sliding door mohiar, sliding door neoprene, bolts and nuts including sealants, keeping provision for fitting 5 mm thick glass including labour charge for fitting of accessories, making grooves and mending good damages, carriage, and electricity complete in all respect as per drawing and accepted by the Engineer-in-charge. - Powder coated to any colour.					
50	Bedroom - per floor	sqm	9.72	3720	36158.4	For 10 Windows
51	Dining room- per floor	sqm	3.73	3720	13875.6	For 2 Windows
52	Kitchen	sqm	2.92	3720	10862.4	For 2 Windows
53	Bathroom	sqm	1.23	3720	4575.6	For 10 Windows
54	Stair window	sqm	1.86	3720	6919.2	For 2 Windows
	Total sum for 26 windows			Total =	72391.2	

WINDOW GRILL, VERANDAH GRILL & NETTING

Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
55	Supplying, fitting and fixing window grill made of 12 mm x 12 mm M.S.	sqm	19.27	2,442	47057.34	

	solid bar 140 mm c/c with outer frame of 38 mm x 6mm F.I. bar as per design approved and accepted by the Engineer-in-charge.					
56	Supplying, fitting and fixing verandah grill made of 10 mm dia M.S. rod provided @ 75 mm c/c in any position both ways as per design with outside frame of 25 mm x 25 mm x 6 mm M.S. angle including fabricating, welding in each point, painting 2 coats of synthetic enamel paint over a coat of anti-corrosive priming including cost of electricity, tools and plants, workshop charges, carriage of the same including cutting groves in the R.C.C. or brick work, mending good the damages with C.C. (1:2:4) etc, all complete for all floors accepted by the Engineer-in-charge. [Rate is excluding the cost of painting] (Total weight per sqm should be min 21.00 kg. and add or deduct @ Tk. 112.00 for each kg/sqm excess or less respectively)	sqm	65.41	2357	154171.4	
	Sum			Total =	201229	

Slab

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re marks
	Estimation of slab concrete:					
57	Mass concrete in floor (1:2:4) with brick chips and local sand of F.M. 1.2	cum	90.41	7575	684855.8	
58	Grade 600(600Mpa / 600N/mm2 ≈ 60900psi/ 60 Grade), BDS-6935-2006, B400: and ratio fy to fu => 1.25	M.ton	7.14	60500	431970	
				Total =	1116826	

WALL AND LINTEL

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re marks
59	Automatic machine-made 1st class standard bricks	per % 0 nos	65	9000	585000	
60	Mass concrete in floor (1:2:4) with brick chips and local sand of F.M. 1.2	cum	950	7575	7196250	
				Total =	7781250	

7th FLOOR FINISH			
Item No	**Item of Works**	**Amount**	
1	BEAM	771568.51	
2	COLUMN	612886.44	
3	SHEAR WALL	388332.36	
4	STAIR	166420.232	
5	FLOOR FINISH	513561.61	
6	BATHROOM FITTINGS	147570	
7	KITCHEN	10380	
8	DOORS	804999.518	
9	WINDOWS	72391.2	
10	WINDOW GRILL, VERANDAH GRILL & NETTING	201228.71	
11	SLAB	1116825.75	
12	WALL AND LINTEL	7781250	
	TOTAL TK	12587414.33	BDT.

8th FLOOR

BEAM

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re marks
1	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	40.17	11903	478143.5	
2	Longitudinal Bars	M.ton	2.5	60500	151250	
3	Tie Bars	M.ton	2.35	60500	142175	
				Total =	771568.5	

COLUMN						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
4	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	24.24	12031	291631.4	
5	Longitudinal Reinforcement	M. ton	1.52	60500	91960	
6	Tie Bars	M. ton	2.04	60500	123420	
7	Hooks	M. ton	0.95	60500	57475	
				Total =	564486.4	
SHEAR WALL						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
8	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	30.06	12031	361651.9	
9	Longitudinal Reinforcement	M. ton	0.3828	60500	23159.4	
10	Tie Bars	M. ton	0.033	60500	1996.5	
				Total =	386807.8	
STAIR						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
11	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	2.772	11903	32995.12	
12	Longitudinal Reinforcement	M. ton	0.71	60500	42955	
13	Horizontal Reinforcement	M. ton	0.12	60500	7260	
	Total sum for 2 Stair			Total =	166420.2	
FLOOR FINISH						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
14	Supplying, fitting and fixing country made GP glazed / unglazed homogenous floor tiles (300 mm x 300 mm)	sqm	276.2	1273	351602.6	
15	Toilet- Supplying, fitting and fixing country made GP (water absorbtion ≤ 0.5%) GP (homogeneous) 300 mm x 300 mm floor tiles	sqm	30.2	1526	46085.2	

16	Veranda- Supplying, fitting and fixing machine-made clay roof tiles of size 100 mm x 200 mm or equivalent (red colour)	sqm	28.92	2683	77592.36	
17	Stair- Supplying, fitting and fixing country made GP homogeneous Glazed stair tiles having size of width 250 mm to 300 mm and length 300 mm	sqm	24.65	1553	38281.45	
				Total =	513561.6	
BATHROOM FITTINGS						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Remarks**
18	Special coloured Cabinet basin (Deep Blue, Ruby, Rain Forest, Green) 500x450x180 mm, 9 kg	Each	1	3920	3920	
19	32 mm dia PVC waste pipe for W-Basin connection	Each	1	150	150	
20	12 mm CP concealed fixed Sink cock	Each	1	875	875	
21	12 mm plastic bib cock with internal brass thread	Each	1	452	452	
22	450 x 600 x 5 mm mirror	Each	1	550	550	
23	Porcelain soap tray (white)	Each	1	363	363	
24	Supplying, fitting and fixing of CP shower mixture including shower head only with all necessary hardware and consumables approved and accepted by the Engineer- in charge	Each	1	4530	4530	
25	White 465 x 340 x 415 mm commode	Each	1	1450	1450	
26	CP Moving push shower	Each	1	715	715	
27	Supplying, fitting and fixing of medium quality C.P. towel rail of 600 mm long and 20 mm in dia with C.P. holder including making drills in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in charge.	Each	1	627	627	
28	Supplying, fitting and fixing of standard porcelain toilet paper holder of 150 mm x	Each	1	355	355	

	150 mm x 126 mm size including making drills in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in- charge. Light colored.					
29	Supplying, fitting and fixing in position different dia one-way brass stop cock (best quality and heavy type) etc. complete in all respect as per specification of Titas Gas T and D Co. Ltd. approved and accepted by the Engineer-in-charge. 12 mm x 6 mm N.D.	Each	1	270	270	
30	125 mm dia atainless-steel floor-grating	Each	1	150	150	
31	Medium quality CP iron frame with brackets for 600 x 125 x 5 mm size glass shelf.	Each	1	350	350	
	Total sum for 10 bathrooms			Total =	147570	
KITCHEN						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
32	12 mm CP concealed fixed Sink cock	Each	1	875	875	
33	Stainless steel, single bowl sink: Singapore/M'Asia, size 450 mm x 1050 mm	Each	1	2500	2500	
34	WEF(walton Ezhaust Fan) 0601 (White) - Wall mounting. - One speed - Fan shuts off automatically when motor is unusually hot	Each	1	650	650	
35	Medium quality CP Towel Rail 600 x 20 mm dia size	Each	1	375	375	
36	125 mm dia stainless-steel floor-grating	Each	1	150	150	
37	12 x 6 mm gas stop cock	Each	1	195	195	
38	I. 50 PSI API 5L, Grade-B ERW M.S. Pipe- 25 mm	Each	1	100	100	

	ND (33.40 mm OD)					
39	50 x 50 x 25 mm N.D. Tee CD40	Each	1	260	260	
40	50 x 25 mm reducer	Each	1	85	85	
	Total sum for 2 kitchens			Total =	10380	
DOORS						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
41	Supplying and making door and window frames (Chowkat) for all floors with matured seasoned wood of required size. Painting two coats of coal tar to the surface in contact with wall. Fitting and fixing in position etc. all complete and accepted by the Engineer-incharge. (All sizes of wood are finished). - Silkarai	cum	3.251	154787	503212.5	
42	Supplying, fitting and fixing M.S. flat bar clamp of 150 mm x 38 mm x 6 mm size having bifurcated ends to door and window frames with necessary rowel plug, screws etc. including cutting grooves in chowkat if necessary, etc. all complete and accepted by the Engineer-in-charge.	Each	27	97	2619	
43	SS fittings of door	sqm	56.35	329	18539.15	
44	Bedrooms	cum	0.892	154787	138070	For 10 Doors
45	Toilets	cum	0.401	154787	62069.59	For 10 Doors
46	Main doors	cum	0.26	154787	40244.62	For 2 Doors
47	Kitchens	cum			0	
48	Veranda 6 wooden	cum	0.26	154787	40244.62	For 6 Doors
	Total sum for 28 doors			Total =	805000	
WINDOWS						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
49	Supplying, fitting and fixing of aluminium sliding window as per the	sqm				

	U.S. Architectural Aluminium Manufacturer‟s Association (AAMA) standard specification and BDS 1879:2014 having 1.2 mm thick outer bottom (size 75.50 mm, 32mm), 1.2 mm thick outer top (size 75.50 mm, 16.80 mm), 1.2 mm thick shutter top (size 33 mm.26.80, 22 mm), 1.2 mm thick shutter bottom (size 60mm, 24.40 mm), 1.2 mm thick outer side (size 75.50 mm,19.90 mm), 1.2 mm thick shutter lock (size 49.20 mm 26.20 mm) and 1.2 mm thick inter lock (size 34.40 mm, 32.10 mm) sections all aluminium members (total weight kg/sqm) will be anodized to aluminium bronze/silver/ss/black colour with a coat not less than 15 micrones in thickness or powder coated to any colour with a coat not less than 25 micrones in thickness and density of 4 mg per square cm etc. including all accessories like sliding door key lock, sliding door wheel, sliding door mohiar, sliding door neoprene, bolts and nuts including sealants, keeping provision for fitting 5 mm thick glass including labour charge for fitting of accessories, making grooves and mending good damages, carriage, and electricity complete in all respect as per drawing and accepted by the Engineer-in-charge. - Powder coated to any colour.					
50	Bedroom - per floor	sqm	9.72	3720	36158.4	For 10 Windows
51	Dining room- per floor	sqm	3.73	3720	13875.6	For 2 Windows
52	Kitchen	sqm	2.92	3720	10862.4	For 2 Windows
53	Bathroom	sqm	1.23	3720	4575.6	For 10 Windows

54	Stair window	sqm	1.86	3720	6919.2	For 2 Windows
	Total sum for 26 windows			Total =	72391.2	
WINDOW GRILL, VERANDAH GRILL & NETTING						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
55	Supplying, fitting and fixing window grill made of 12 mm x 12 mm M.S. solid bar 140 mm c/c with outer frame of 38 mm x 6mm F.I. bar as per design approved and accepted by the Engineer-in-charge.	sqm	19.27	2,442	47057.34	
56	Supplying, fitting and fixing verandah grill made of 10 mm dia M.S. rod provided @ 75 mm c/c in any position both ways as per design with outside frame of 25 mm x 25 mm x 6 mm M.S. angle including fabricating, welding in each point, painting 2 coats of synthetic enamel paint over a coat of anti-corrosive priming including cost of electricity, tools and plants, workshop charges, carriage of the same including cutting groves in the R.C.C. or brick work, mending good the damages with C.C. (1:2:4) etc, all complete for all floors accepted by the Engineer-in-charge. [Rate is excluding the cost of painting] (Total weight per sqm should be min 21.00 kg. and add or deduct @ Tk. 112.00 for each kg/sqm excess or less respectively)	sqm	65.41	2357	154171.4	
	Sum			Total =	201229	

SLAB						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
	Estimation of slab concrete:					
57	Mass concrete in floor (1:2:4) with brick chips and local sand of F.M. 1.2	cum	90.41	7575	684855.8	
58	Grade 600(600Mpa / 600N/mm2 ≈ 60900psi/ 60 Grade), BDS-6935-2006,	M.ton	7.14	60500	431970	

	B400: and ratio fy to fu => 1.25					
				Total =	1116826	
WALL AND LINTEL						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
59	Automatic machine-made 1st class standard bricks	per % 0 nos	65	9000	585000	
60	Mass concrete in floor (1:2:4) with brick chips and local sand of F.M. 1.2	cum	950	7575	7196250	
				Total =	7781250	

8th FLOOR FINISH			
Item No	**Item of Works**	**Amount**	
1	BEAM	771568.51	
2	COLUMN	564486.44	
3	SHEAR WALL	386807.76	
4	STAIR	166420.232	
5	FLOOR FINISH	513561.61	
6	BATHROOM FITTINGS	147570	
7	KITCHEN	10380	
8	DOORS	804999.518	
9	WINDOWS	72391.2	
10	WINDOW GRILL, VERANDAH GRILL & NETTING	201228.71	
11	SLAB	1116825.75	
12	WALL AND LINTEL	7781250	
	TOTAL TK	12537489.73	BDT.

9th FLOOR						
BEAM						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
1	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	40.17	11903	478143.5	
2	Longitudinal Bars	M.ton	2.5	60500	151250	
3	Tie Bars	M.ton	2.35	60500	142175	
				Total =	771568.5	
COLUMN						

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re marks
4	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	24.24	12031	291631.4	
5	Longitudinal Reinforcement	M. ton	1.52	60500	91960	
6	Tie Bars	M. ton	2.04	60500	123420	
7	Hooks	M. ton	0.95	60500	57475	
				Total =	564486.4	
SHEAR WALL						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
8	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	30.06	12031	361651.9	
9	Longitudinal Reinforcement	M. ton	0.3828	60500	23159.4	
10	Tie Bars	M. ton	0.033	60500	1996.5	
				Total =	386807.8	
STAIR						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
11	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	2.772	11903	32995.12	
12	Longitudinal Reinforcement	M. ton	0.71	60500	42955	
13	Horizontal Reinforcement	M. ton	0.12	60500	7260	
	Total sum for 2 Stair			Total =	166420.2	
FLOOR FINISH						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
14	Supplying, fitting and fixing country made GP glazed / unglazed homogenous floor tiles (300 mm x 300 mm)	sqm	276.2	1273	351602.6	
15	Toilet- Supplying, fitting and fixing country made GP (water absorbtion ≤ 0.5%) GP (homogeneous) 300 mm x 300 mm floor tiles	sqm	30.2	1526	46085.2	
16	Veranda- Supplying, fitting and fixing machine-made clay roof tiles of size 100	sqm	28.92	2683	77592.36	

	mm x 200 mm or equivalent (red colour)					
17	Stair- Supplying, fitting and fixing country made GP homogeneous Glazed stair tiles having size of width 250 mm to 300 mm and length 300 mm	sqm	24.65	1553	38281.45	
				Total =	513561.6	
BATHROOM FITTINGS						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
18	Special coloured Cabinet basin (Deep Blue, Ruby, Rain Forest, Green) 500x450x180 mm, 9 kg	Each	1	3920	3920	
19	32 mm dia PVC waste pipe for W-Basin connection	Each	1	150	150	
20	12 mm CP concealed fixed Sink cock	Each	1	875	875	
21	12 mm plastic bib cock with internal brass thread	Each	1	452	452	
22	450 x 600 x 5 mm mirror	Each	1	550	550	
23	Porcelain soap tray (white)	Each	1	363	363	
24	Supplying, fitting and fixing of CP shower mixture including shower head only with all necessary hardware and consumables approved and accepted by the Engineer- in charge	Each	1	4530	4530	
25	White 465 x 340 x 415 mm commode	Each	1	1450	1450	
26	CP Moving push shower	Each	1	715	715	
27	Supplying, fitting and fixing of medium quality C.P. towel rail of 600 mm long and 20 mm in dia with C.P. holder including making drills in walls and mending good the damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in charge.	Each	1	627	627	
28	Supplying, fitting and fixing of standard porcelain toilet paper holder of 150 mm x 150 mm x 126 mm size including making drills in walls and mending good the	Each	1	355	355	

	damages with cement mortar (1:4) etc. all complete approved and accepted by the Engineer- in- charge. Light colored.					
29	Supplying, fitting and fixing in position different dia one-way brass stop cock (best quality and heavy type) etc. complete in all respect as per specification of Titas Gas T and D Co. Ltd. approved and accepted by the Engineer-in-charge. 12 mm x 6 mm N.D.	Each	1	270	270	
30	125 mm dia atainless-steel floor-grating	Each	1	150	150	
31	Medium quality CP iron frame with brackets for 600 x 125 x 5 mm size glass shelf.	Each	1	350	350	
	Total sum for 10 bathrooms			Total =	147570	
KITCHEN						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
32	12 mm CP concealed fixed Sink cock	Each	1	875	875	
33	Stainless steel, single bowl sink: Singapore/M'Asia, size 450 mm x 1050 mm	Each	1	2500	2500	
34	WEF(walton Ezhaust Fan) 0601 (White) - Wall mounting. - One speed - Fan shuts off automatically when motor is unusually hot	Each	1	650	650	
35	Medium quality CP Towel Rail 600 x 20 mm dia size	Each	1	375	375	
36	125 mm dia stainless-steel floor-grating	Each	1	150	150	
37	12 x 6 mm gas stop cock	Each	1	195	195	
38	I. 50 PSI API 5L, Grade-B ERW M.S. Pipe- 25 mm ND (33.40 mm OD)	Each	1	100	100	

39	50 x 50 x 25 mm N.D. Tee CD40	Each	1	260	260	
40	50 x 25 mm reducer	Each	1	85	85	
	Total sum for 2 kitchens			Total =	10380	
DOORS						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
41	Supplying and making door and window frames (Chowkat) for all floors with matured seasoned wood of required size. Painting two coats of coal tar to the surface in contact with wall. Fitting and fixing in position etc. all complete and accepted by the Engineer-incharge. (All sizes of wood are finished). - Silkarai	cum	3.251	154787	503212.5	
42	Supplying, fitting and fixing M.S. flat bar clamp of 150 mm x 38 mm x 6 mm size having bifurcated ends to door and window frames with necessary rowel plug, screws etc. including cutting grooves in chowkat if necessary, etc. all complete and accepted by the Engineer-in-charge.	Each	27	97	2619	
43	SS fittings of door	sqm	56.35	329	18539.15	
44	Bedrooms	cum	0.892	154787	138070	For 10 Doors
45	Toilets	cum	0.401	154787	62069.59	For 10 Doors
46	Main doors	cum	0.26	154787	40244.62	For 2 Doors
47	Kitchens	cum			0	
48	Veranda 6 wooden	cum	0.26	154787	40244.62	For 6 Doors
	Total sum for 28 doors			Total =	805000	

WINDOWS						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
49	Supplying, fitting and fixing of aluminium sliding window as per the U.S. Architectural Aluminium Manufacturer‟s Association (AAMA)	sqm				

	standard specification and BDS 1879:2014 having 1.2 mm thick outer bottom (size 75.50 mm, 32mm), 1.2 mm thick outer top (size 75.50 mm, 16.80 mm), 1.2 mm thick shutter top (size 33 mm.26.80, 22 mm), 1.2 mm thick shutter bottom (size 60mm, 24.40 mm), 1.2 mm thick outer side (size 75.50 mm,19.90 mm), 1.2 mm thick shutter lock (size 49.20 mm 26.20 mm) and 1.2 mm thick inter lock (size 34.40 mm, 32.10 mm) sections all aluminium members (total weight kg/sqm) will be anodized to aluminium bronze/silver/ss/black colour with a coat not less than 15 microns in thickness or powder coated to any colour with a coat not less than 25 microns in thickness and density of 4 mg per square cm etc. including all accessories like sliding door key lock, sliding door wheel, sliding door mohiar, sliding door neoprene, bolts and nuts including sealants, keeping provision for fitting 5 mm thick glass including labour charge for fitting of accessories, making grooves and mending good damages, carriage, and electricity complete in all respect as per drawing and accepted by the Engineer-in-charge. - Powder coated to any colour.					
50	Bedroom - per floor	sqm	9.72	3720	36158.4	For 10 Windows
51	Dining room- per floor	sqm	3.73	3720	13875.6	For 2 Windows
52	Kitchen	sqm	2.92	3720	10862.4	For 2 Windows
53	Bathroom	sqm	1.23	3720	4575.6	For 10 Windows
54	Stair window	sqm	1.86	3720	6919.2	For 2 Windows
	Total sum for 26 windows			Total =	72391.2	
WINDOW GRILL, VERANDAH GRILL & NETTING						

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re marks
55	Supplying, fitting and fixing window grill made of 12 mm x 12 mm M.S. solid bar 140 mm c/c with outer frame of 38 mm x 6mm F.I. bar as per design approved and accepted by the Engineer-in-charge.	sqm	19.27	2,442	47057.34	
56	Supplying, fitting and fixing verandah grill made of 10 mm dia M.S. rod provided @ 75 mm c/c in any position both ways as per design with outside frame of 25 mm x 25 mm x 6 mm M.S. angle including fabricating, welding in each point, painting 2 coats of synthetic enamel paint over a coat of anti-corrosive priming including cost of electricity, tools and plants, workshop charges, carriage of the same including cutting groves in the R.C.C. or brick work, mending good the damages with C.C. (1:2:4) etc, all complete for all floors accepted by the Engineer-in-charge. [Rate is excluding the cost of painting] (Total weight per sqm should be min 21.00 kg. and add or deduct @ Tk. 112.00 for each kg/sqm excess or less respectively)	sqm	65.41	2357	154171.4	
	Sum			Total =	201229	
SLAB						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
	Estimation of slab concrete:					
57	Mass concrete in floor (1:2:4) with brick chips and local sand of F.M. 1.2	cum	90.41	7575	684855.8	
58	Grade 600(600Mpa / 600N/mm2 ≈ 60900psi/ 60 Grade), BDS-6935-2006, B400: and ratio fy to fu => 1.25	M.ton	7.14	60500	431970	
				Total =	1116826	
WALL AND LINTEL						

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re marks
59	Automatic machine-made 1st class standard bricks	per % 0 nos	65	9000	585000	
60	Mass concrete in floor (1:2:4) with brick chips and local sand of F.M. 1.2	cum	950	7575	7196250	
				Total =	7781250	

9th FLOOR FINISH			
Item No	**Item of Works**	**Amount**	
1	BEAM	771568.51	
2	COLUMN	564486.44	
3	SHEAR WALL	386807.76	
4	STAIR	166420.232	
5	FLOOR FINISH	513561.61	
6	BATHROOM FITTINGS	147570	
7	KITCHEN	10380	
8	DOORS	804999.518	
9	WINDOWS	72391.2	
10	WINDOW GRILL, VERANDAH GRILL & NETTING	201228.71	
11	SLAB	1116825.75	
12	WALL AND LINTEL	7781250	
	TOTAL TK	12537489.73	BDT.

ROOF

BEAM

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re marks
1	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	40.17	11903	478143.5	
2	Longitudinal Bars	M.ton	2.5	60500	151250	
3	Tie Bars	M.ton	2.35	60500	142175	
				Total =	771568.5	

COLUMN

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re marks
4	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	24.24	12031	291631.4	
5	Longitudinal Reinforcement	M.ton	1.52	60500	91960	
6	Tie Bars	M.ton	2.04	60500	123420	
7	Hooks	M.ton	0.95	60500	57475	
				Total =	564486.4	
SHEAR WALL						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
8	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	30.06	12031	361651.9	
9	Longitudinal Reinforcement	M.ton	0.3828	60500	23159.4	
10	Tie Bars	M.ton	0.033	60500	1996.5	
				Total =	386807.8	
STAIR ROOM						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
11	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	2.772	11903	32995.12	
12	Longitudinal Reinforcement	M.ton	0.71	60500	42955	
13	Horizontal Reinforcement	M.ton	0.12	60500	7260	
	Total sum for 2 Stair			Total =	166420.2	
FLOOR FINISH						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
14	Supplying, fitting and fixing country made GP glazed /	sqm	276.2	1273	351602.6	

	unglazed homogenous floor tiles (300 mm x 300 mm)					
15	Toilet- Supplying, fitting and fixing country made GP (water absorbtion ≤ 0.5%) GP (homogeneous) 300 mm x 300 mm floor tiles	sqm	30.2	1526	46085.2	
				Total =	397687.8	
SHUTTERING						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
	FORMWORK (Wooden)					
	Centering and shuttering, including strutting, propping etc. and removal of form for:					
1	Column:					
	Side	sqm	8.508	429	3649.932	
	Middle	sqm	3.64	429	1561.56	
	Corner	sqm	3.5	429	1501.5	
2	T-beam, L-beam and rectangular beam:					
	X-direction	sqm	8.45	414	3498.3	
	Y-direction	sqm	10.402	414	4306.428	
3	Floor & roof slab	sqm	302.4	456	137894.4	
4	Individual and combined footings	sqm	418.6	399	167021.4	
	SUM				319433.5	

RATES OF MAN, MATERIAL AND MARK-UPS						
Item no	**Items of Works**	**Unit**	**Quantity**	**Unit Rate**	**Amount**	**Re marks**
1	5-ton capacity truck-fare in Dhaka city including loading & unloading	Per Trip	98.02	1,700	166634	
2	Temporary camp at site for soil investigation work	Per Site	1	1,053	1053	
3	Field Engineer including site allowances: 1-3yrs Exp, Membership with IEB	Per Day	44	1,800	79200	
4	Rig operators including site allowances	Per Day	28	600	16800	
5	Helper to rig operator/c site allowances	Per Day	28	390	10920	

6	Unskilled labor including site allowances	Per Day	450	320	144000	
7	Hire charge of boring rig	Per Day	28	3,000	84000	
8	Supplying, fitting, fixing, operating and maintenance of the construction supervision lift (1000Kg capacity) for supervision of building construction work during the entire construction period including all necessary components like, steel frame, car, guide rails. push button, driving motor, gear box, car door, travelling cable, RCC base for steel frame, necessary connections with the building, electric supply & electricity bill and dismantling the same after completion of the building construction etc. all complete complying all safety factors and accepted by the Engineer-in-charge. (The construction supervision lift shall be the contractor property after completion of work). Number of months shall be calculated as 1/2 (half) of the project period for new construction and full project period for vertical extension work. The contractor must submit detail structural drawing of supporting frame with foundation and lift specification prior to supply on site. - 6th to 10th floor, hoisting speed 40 m/min	Per Month	9.52	28,287.00	269292.2	
9	Scaffolding	Per sft	2940	9	26460	
10	Cleaning and disposing of excavated earth from the construction site by truck or by any other means to a place within 30 km radius of the city or town area including loading & unloading at both ends, leveling and dressing the carried earth etc. complete and accepted by the	cum	127.4	539	68668.6	

	Engineer-in-charge.					
11	Hire charge of dump truck/ tripping trucks	Per Day	4	5,000	20000	
12	Hire charge of concrete mixer machine	Per Day	255	1,200	306000	
	SUM				1193028	

Overhead Water Tank

Item no	Items of Works	Unit	Quantity	Unit Rate	Amount	Re marks
1	Reinforced cement concrete works with minimum cement content relates to mix ratio 1:2:4 having minimum f'cr = 27 Mpa	cum	6.23	11903	74155.7	
2	Longitudinal Bars	M. ton	0.652	60500	39446	
	Sum			Total =	227203.4	

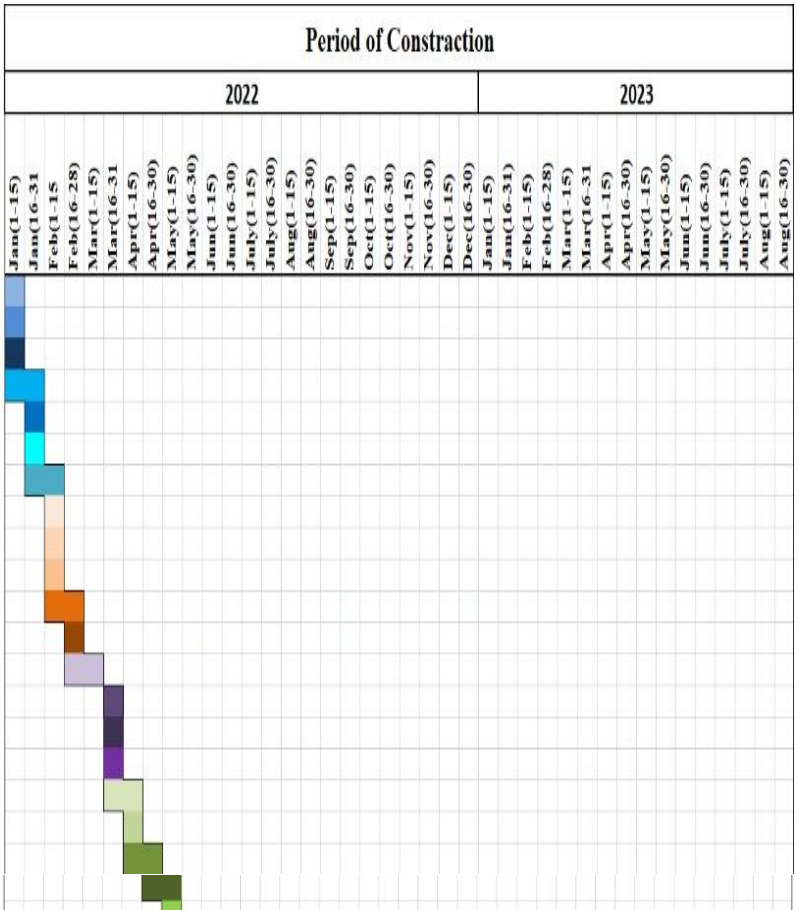
ROOF FINISH			
Item No	**Item of Works**	**Amount**	
1	BEAM	771568.51	
2	COLUMN	564486.44	
3	SHEAR WALL	386807.76	
4	STAIR ROOM	166420.232	
5	FLOOR FINISH	397687.8	
6	SHUTTERING	319433.52	
7	RATES OF MAN, MATERIAL AND MARK-UPS	1193027.84	
8	Overhead Water Tank	227203.4	
	TOTAL TK	4026635.482	BDT.

Item no	Name	Amount	
1	Abstract Cost	476697	
2	Sub Structure & Super-Structure	27821893.76	
3	FIRST FLOOR	12621608.93	
4	2nd FLOOR	12621608.93	
5	3rd FLOOR	12621608.93	
6	4th FLOOR	12587414.33	
7	5th FLOOR	12587414.33	
8	6th FLOOR	12587414.33	
9	7th FLOOR	12587414.33	
10	8th FLOOR	12537489.73	
11	9th FLOOR	12537489.73	
12	ROOF	4026635.482	
	Total Cost of the Project	145614687	BDT.

3.2 PROJECT SCHEDULE

Table 3.2 Project schedule of G+9 storied building

G+9 Storied Building Project	Duration 600 (Days)	Starting Date 01-01-2022	Hand-over Date 24-08-2023
Task Description	**Task Duration**	**Start Date**	**End Date**
Start/ Commencement of Work	0	1-Jan-2023	1-Jan-2023
Mobilization at Site	6	2-Jan-2023	8-Jan-2023
Surveying & Layout	3	9-Jan-2023	12-Jan-2023
Excavation	4	13-Jan-2023	17-Jan-2023
Footing	4	18-Jan-2023	22-Jan-2023
Column Upto Plinth Level	5	23-Jan-2023	28-Jan-2023
Backfilling in Footing	4	29-Jan-2023	2-Feb-2023
Plinth Beam	**3**	3-Feb-2023	6-Feb-2023
Earth Filling in Plinth Level	2	7-Feb-2023	9-Feb-2023
Anti Termite Treatment	2	10-Feb-2023	12-Feb-2023
CC Flooring with PCC	3	13-Feb-2023	16-Feb-2023
Column GF to 1st Floor	3	17-Feb-2023	20-Feb-2023
1st Floor Slab	**21**	21-Feb-2023	14-Mar-2023
Brickwork at Ground Floor	5	15-Mar-2023	20-Mar-2023
Internal Plaster at GF	5	21-Mar-2023	26-Mar-2023
Flooring Work - GF	3	27-Mar-2023	30-Mar-2023
Door & Window Work - GF	4	31-Mar-2023	4-Apr-2023
Internal Painting - GF	5	5-Apr-2023	10-Apr-2023
Column 1st to 2nd Floor	5	11-Apr-2023	16-Apr-2023
2nd Floor Slab	**21**	17-Apr-2023	8-May-2023
Brickwork at 1st Floor	5	9-May-2023	14-May-2023
Internal Plaster at 1st Floor	5	15-May-2023	20-May-2023
Flooring Work - 1st	3	21-May-2023	24-May-2023
Door & Window Work - 1st	4	25-May-2023	29-May-2023
Internal Painting - 1st	5	30-May-2023	4-Jun-2023
Column 2nd to 3rd Floor	5	5-Jun-2023	10-Jun-2023
3rd Floor Slab	**21**	11-Jun-2023	2-Jul-2023
Brickwork at 2nd Floor	5	3-Jul-2023	8-Jul-2023
Internal Plaster at 2nd Floor	5	9-Jul-2023	14-Jul-2023
Flooring Work - 2nd	3	15-Jul-2023	18-Jul-2023
Door & Window Work - 2nd	4	19-Jul-2023	23-Jul-2023
Internal Painting - 2nd	5	24-Jul-2023	29-Jul-2023
Column 3rd to 4th Floor	5	30-Jul-2023	4-Aug-2023
4th Floor Slab	**21**	5-Aug-2023	26-Aug-2023
Brickwork at 3rd Floor	5	27-Aug-2023	1-Sep-2023
Internal Plaster at 3rd Floor	5	2-Sep-2023	7-Sep-2023
Flooring Work - 3rd	3	8-Sep-2023	11-Sep-2023
Door & Window Work - 3rd	4	12-Sep-2023	16-Sep-2023
Internal Painting - 3rd	5	17-Sep-2023	22-Sep-2023
Column 4th to 5th Floor	5	23-Sep-2023	28-Sep-2023
5th Floor Slab	**21**	29-Sep-2023	20-Oct-2023
Brickwork at 4th Floor	5	21-Oct-2023	26-Oct-2023
Internal Plaster at 4th Floor	5	27-Oct-2023	1-Nov-2023
Flooring Work - 4th	3	2-Nov-2023	5-Nov-2023
Door & Window Work - 4th	4	6-Nov-2023	10-Nov-2023
Internal Painting - 4th	5	11-Nov-2023	16-Nov-2023
Column 5th to 6th Floor	5	17-Nov-2023	22-Nov-2023



6th Floor Slab	**21**	23-Nov-2023	14-Dec-2023
Brickwork at 5th Floor	5	15-Dec-2023	20-Dec-2023
Internal Plaster at 5th Floor	5	21-Dec-2023	26-Dec-2023
Flooring Work - 5th	3	27-Dec-2023	30-Dec-2023
Door & Window Work - 5th	4	31-Dec-2023	4-Jan-2024
Internal Painting - 5th	5	5-Jan-2024	10-Jan-2024
Column 6th to 7th Floor	5	11-Jan-2024	16-Jan-2024
7th Floor Slab	**21**	17-Jan-2024	7-Feb-2024
Brickwork at 6th Floor	5	8-Feb-2024	13-Feb-2024
Internal Plaster at 6th Floor	5	14-Feb-2024	19-Feb-2024
Flooring Work - 6th	3	20-Feb-2024	23-Feb-2024
Door & Window Work - 6th	4	24-Feb-2024	28-Feb-2024
Internal Painting - 6th	5	1-Mar-2024	6-Mar-2024
Column 7th to 8th Floor	5	7-Mar-2024	12-Mar-2024
8th Floor Slab	**21**	13-Mar-2024	3-Apr-2024
Brickwork at 7th Floor	5	4-Apr-2024	9-Apr-2024
Internal Plaster at 7th Floor	5	10-Apr-2024	15-Apr-2024
Flooring Work - 7th	3	16-Apr-2024	19-Apr-2024
Door & Window Work - 7th	4	20-Apr-2024	24-Apr-2024
Internal Painting - 7th	5	25-Apr-2024	30-Apr-2024
Column 8th to 9th Floor	5	1-May-2024	6-May-2024
9th Floor Slab	**21**	7-May-2024	28-May-2024
Brickwork at 8th Floor	5	29-May-2024	3-Jun-2024
Internal Plaster at 8th Floor	5	4-Jun-2024	9-Jun-2024
Flooring Work - 8th	3	10-Jun-2024	13-Jun-2024
Door & Window Work - 8th	4	14-Jun-2024	18-Jun-2024
Internal Painting - 8th	5	19-Jun-2024	24-Jun-2024
Column 9th to 10th Floor	5	25-Jun-2024	30-Jun-2024
10th Floor Slab	**21**	1-Jul-2024	22-Jul-2024
Brickwork at 9th Floor	5	23-Jul-2024	28-Jul-2024
Internal Plaster at 9th Floor	5	29-Jul-2024	3-Aug-2024
Flooring Work - 9th	3	4-Aug-2024	7-Aug-2024
Door & Window Work - 9th	4	8-Aug-2024	12-Aug-2024
Internal Painting - 9th	5	13-Aug-2024	18-Aug-2024
Stair Column 10th to Stair 11th Floor	5	19-Aug-2024	24-Aug-2024

3.3 ETHICAL ISSUES RELATED TO THE PROJECT

Construction projects are increasingly challenging and sophisticated today. Along with the growing uncertainties in technology, budgets, and the development process, challenges are further exacerbated by the involvement of many professional organizations in a project. We sometimes face crises and dilemmas while working on this project. In carrying out large and complex assignments, we confront issues that aren't purely technical. There are business and financial ramifications to consider in our projects, and sometimes we must suppress our engineering egos in favor of the client's interests.

As per the BNBC code for spt value pile depth should be 100ft for each borehole but in our soil report pile depth is less than 100ft which violates the code requirements.

As structural engineers, it is our responsibility to inform our clients and conductors to follow all the guidelines we establish. Sometimes clients wish to use their entire plot to build a structure, thus they choose not to follow the FAR, MGC, and Setback regulations. RAJUK strictly instructed us to follow these guidelines; hence this is considered unethical.

Ensuring safety is often seen as one of the main ethical responsibilities of structural engineers. We applied various loads to the structure to ensure safety against earthquakes and heavy wind as per code, which is also one of the requirements of clients. So we have to ethically follow these rules of applying load which have to be economical also.

CHAPTER-4

CONCLUSIONS

4.1 CONCLUSIONS

The study aims at providing a complete concept of design and analysis of a multi-storied residential building. In this project, the planning and design of the residential building with an RCC-framed structure have been successfully finished. Software such as ETABS and AutoCAD is used to design structural parts such as beams, columns, foundations, and shear walls. Only the analysis of the slab design is performed manually, and AutoCAD is used to draw the slab detailing. Following the BNBC code completely, we applied a variety of loads (Live load, Earthquake load, and Wind load) to the structure to ensure safety against earthquakes and heavy wind to provide a safe, secure, and climate-controlled space for its residents and their belongings. We also performed manual calculations to determine the software analysis accuracy, giving the almost same result. 10% variation was considered as suitable for the adequacy check between the manual calculation and the values provided by ETABS. The structural plan has been optimized to reduce costs. In order to lower the cost to the client, we try to use as few columns and small-size columns as possible. According to the BOQ and the project schedule, the whole project can be done by 145614689 BDT as per the PWD rate and within 17 months. To assist in finding employment is one of the fundamental objectives. Because the project building is a residential complex, personnel will need to fill various positions following construction, including security guards and housekeepers. In other words, after the construction is complete, this goal will be achieved. To minimize the building cost we try to place fewer beams and columns and we try to reduce column sizes by following the limitations of the code. Since there is no particular solution for beam-columns. Different applications of design concepts are possible, which results in over-designed models that may or may not be economical. These are the attributes of the depth of analysis required for the complicated engineering problem P3 where the problem arises. According to the needs of the stakeholders, roof gardens will be built on the available space. To fulfill this requirement, the structure is overloaded. Moreover, they want the floor to be tiled, which raises the cost of the project. The issue is in the characteristics of the complex engineering problem P6 and the attribute of the extent of stakeholder involvement and conflicting

requirements. We find all these attributes in the complex engineering problem shown in Appendix-D.

REFERENCES:

[1] Bangladesh National Building Code (BNBC) 2020. Housing and Building Research Institute, Bangladesh Standards and Testing Institution; 2020.

[2] ACI Committee 318. 2014. ACI 318-14/ACI 318R-14, building code requirements for structural concrete and commentary. Farmington Hills, MI: American Concrete Institute; 2014.

[3] ASCE/SEI 7-10. 2010. Minimum design loads for buildings and other structures. Reston, VA: American Society of Civil Engineers; 2010.

[4] PWD Schedule of Rates 2018 for Civil Works. Public Works Department, fifteenth edition, 01 May 2018

[5] http://www.ijirset.com/upload/2016/january/45_A_Review.pdf

Appendix A

Drawing Details of the Project Solution

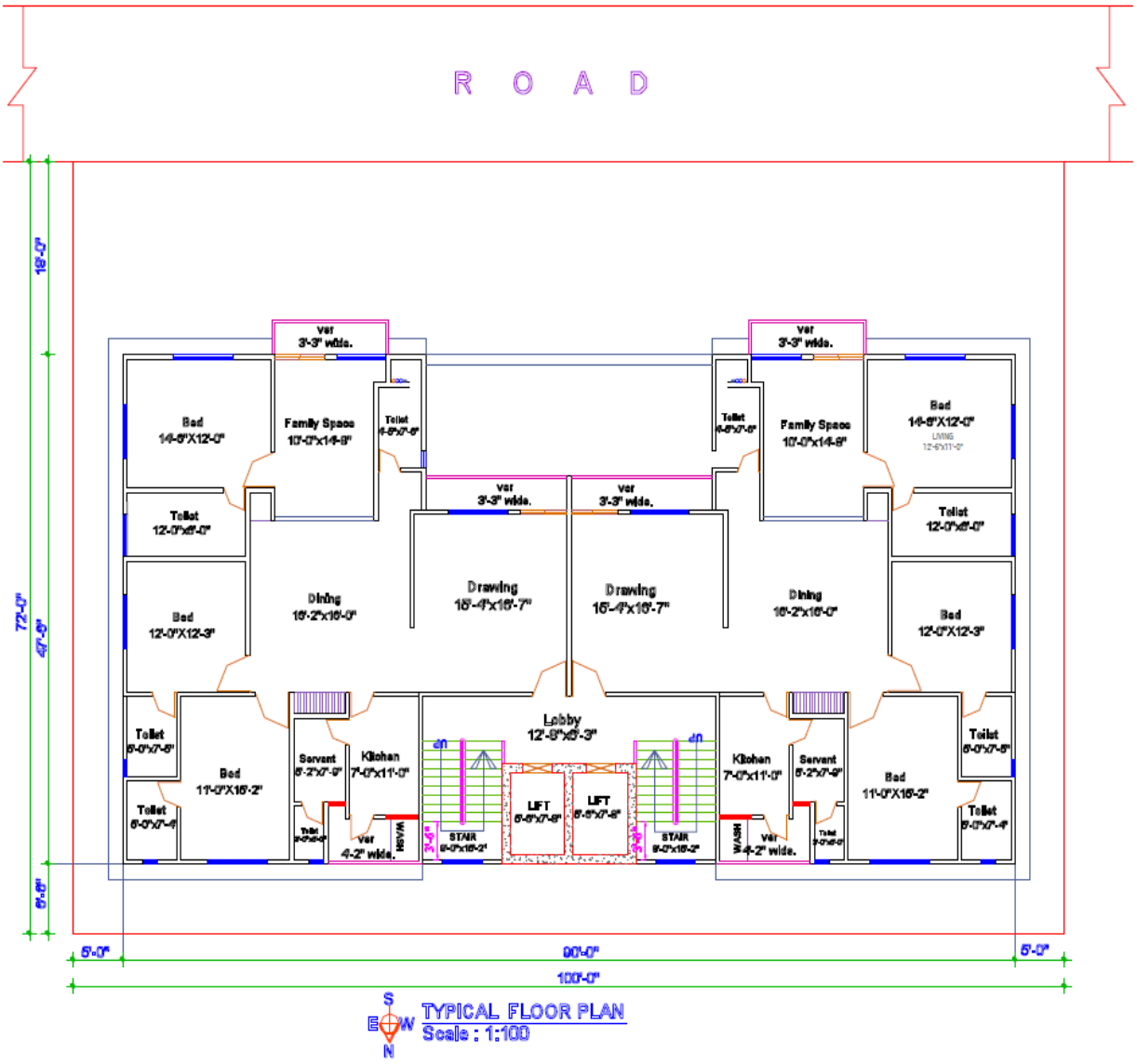


Exhibit A1- Architectural Drawing

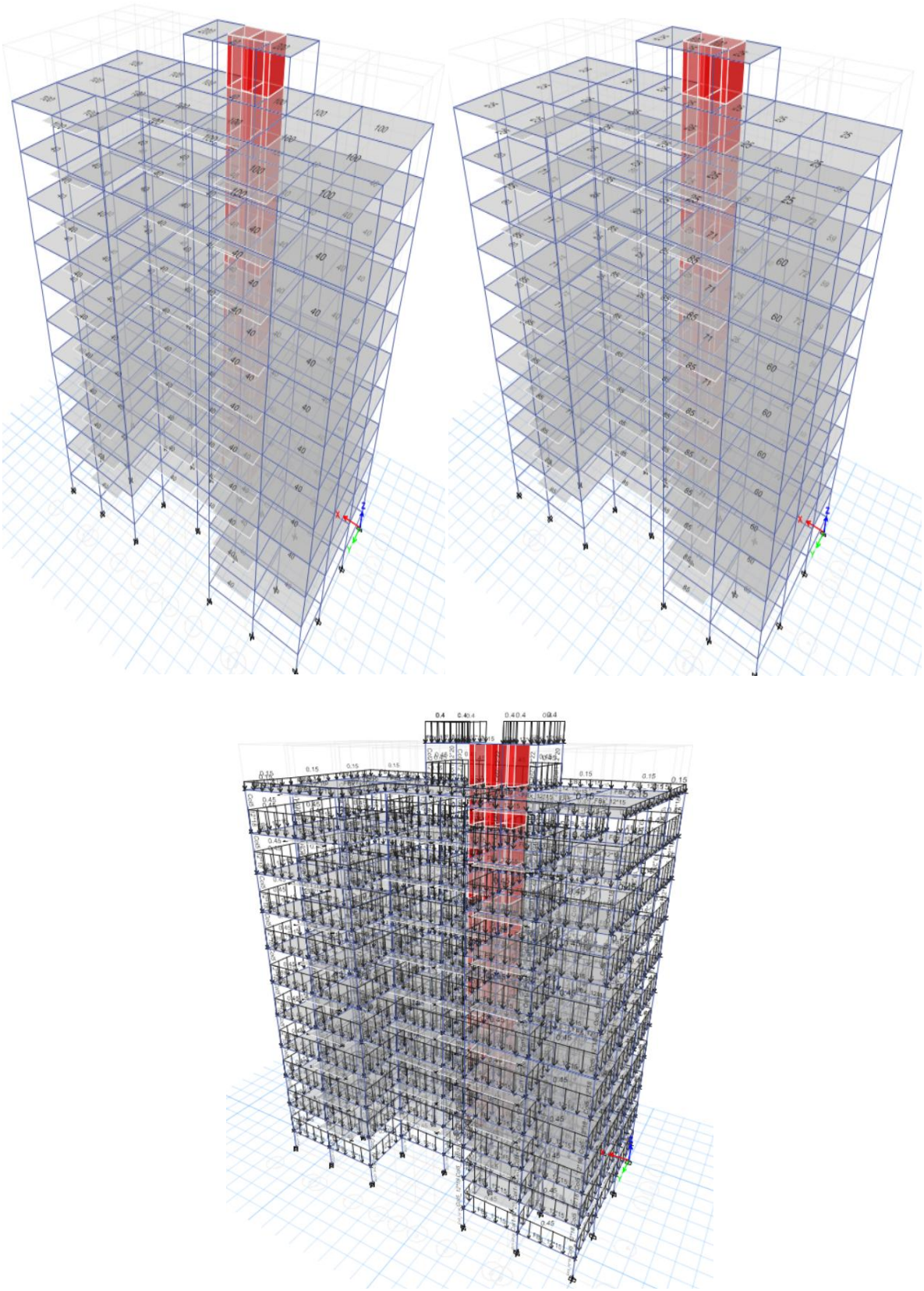


Exhibit A2- Load Plan

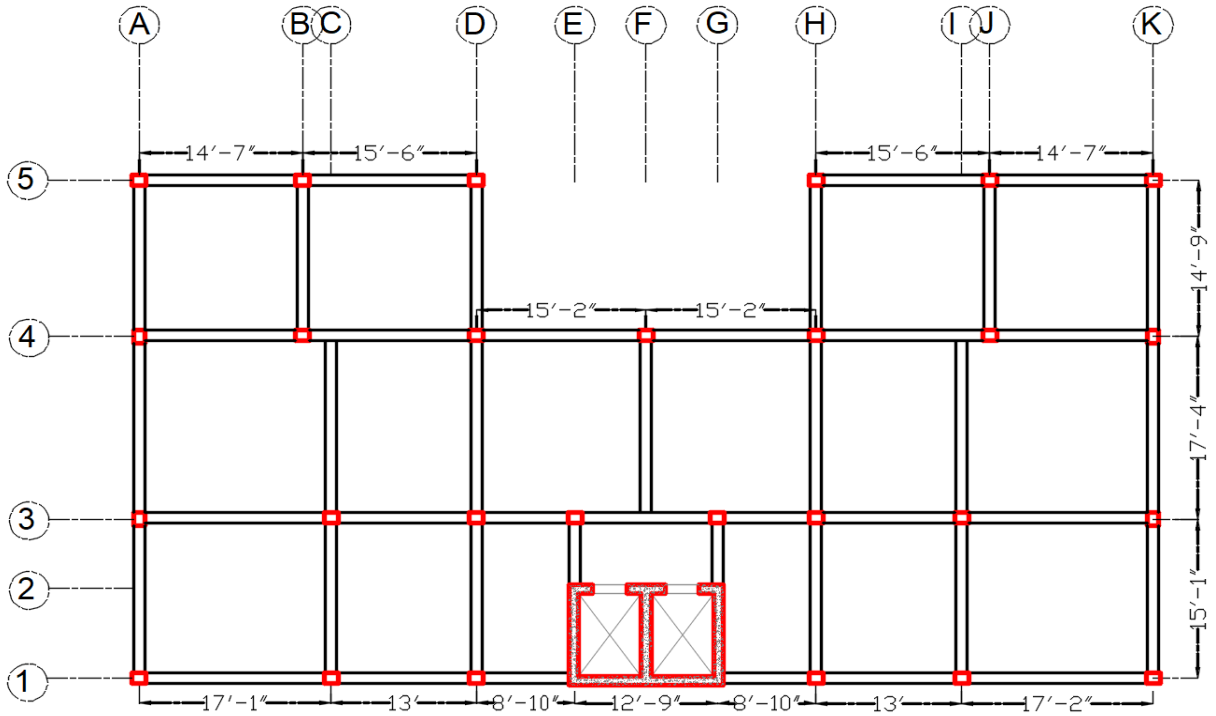


Exhibit A3- Beam-Column Layout

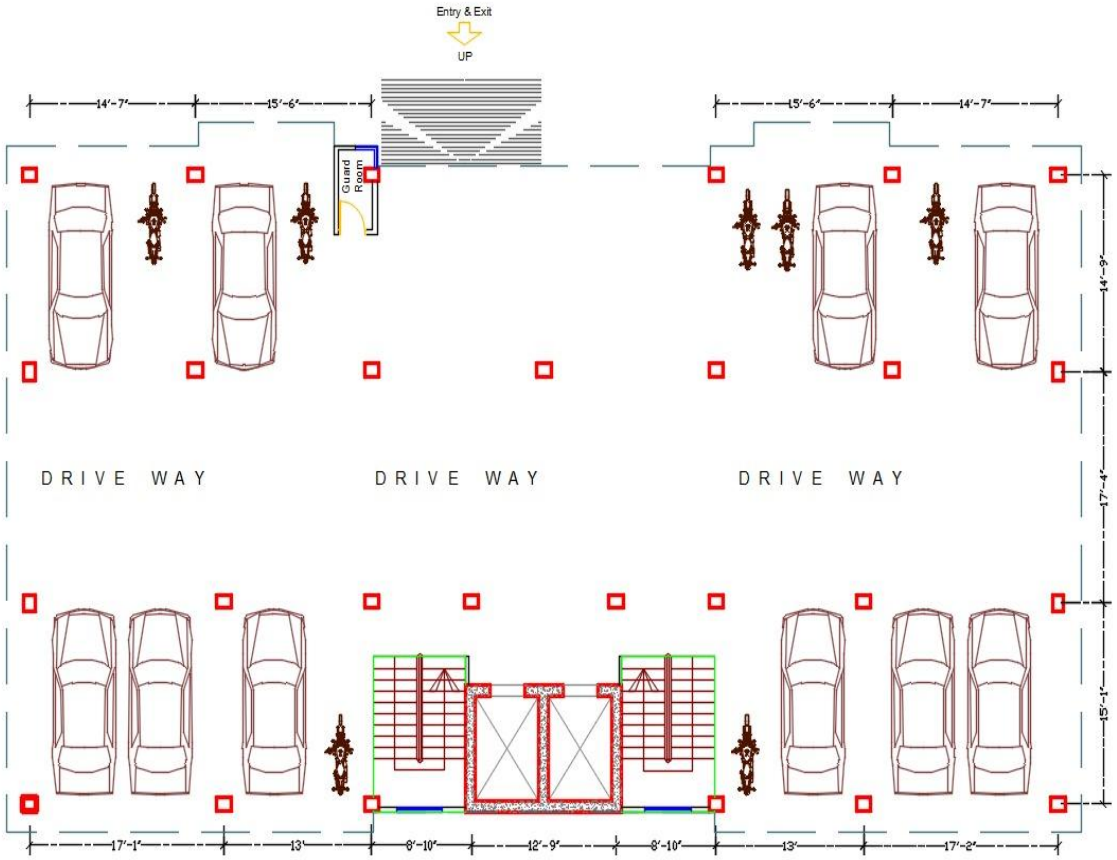
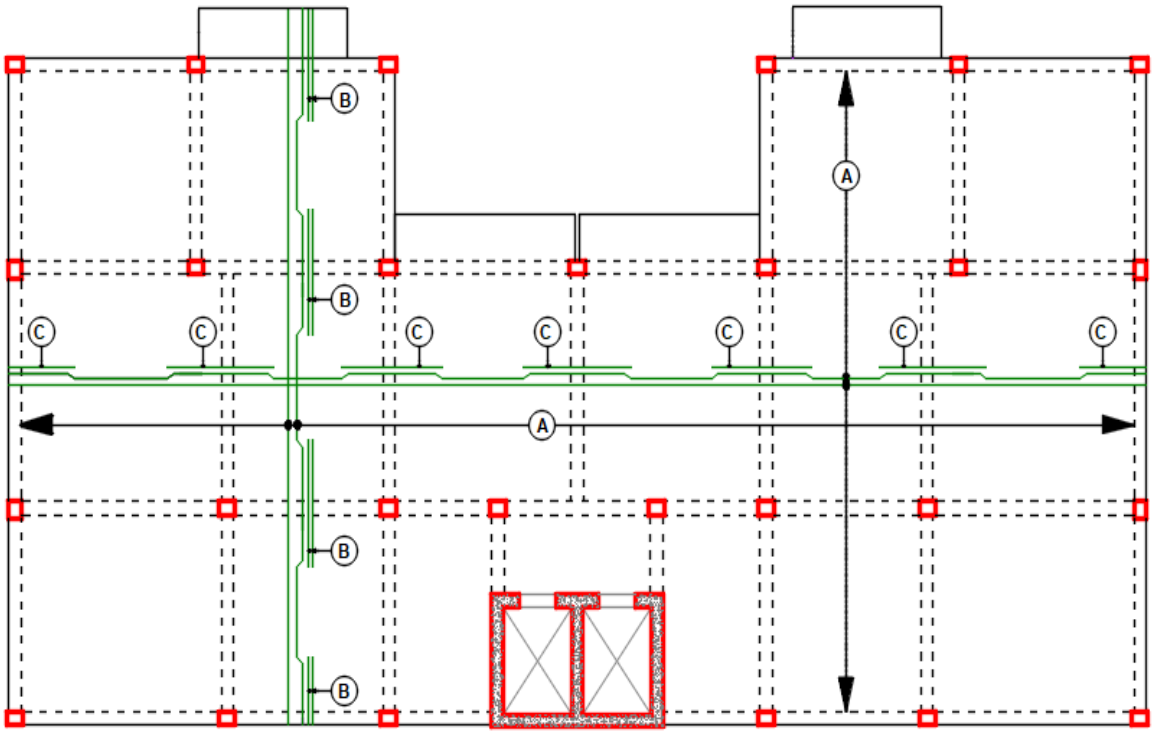


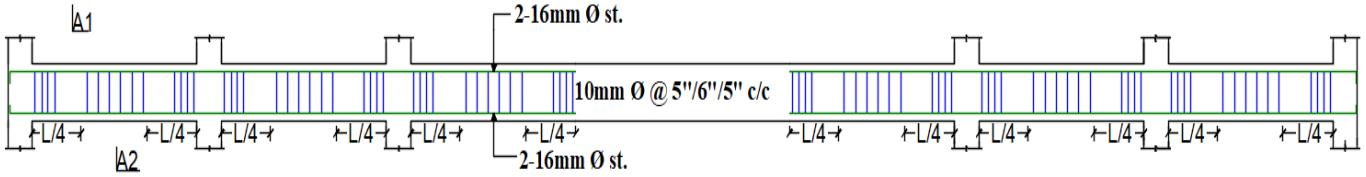
Exhibit A4- Ground Floor (Parking)



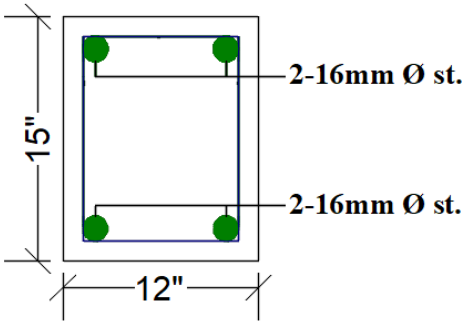
Note

A. 10mm Ø @ 10" c/c alt ckd
B. 2-10mm Ø ext top
C. 1-12mm Ø ext top

Exhibit A5- Slab Detailing



Long section of GB-1



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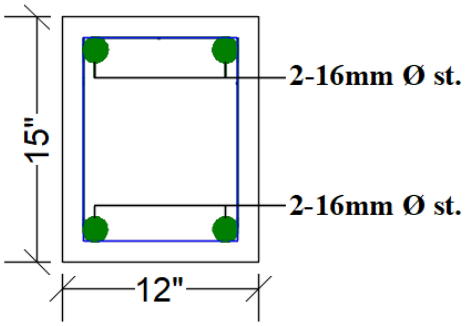

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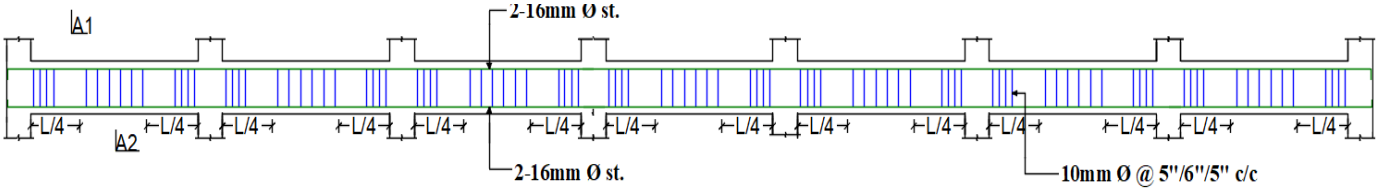
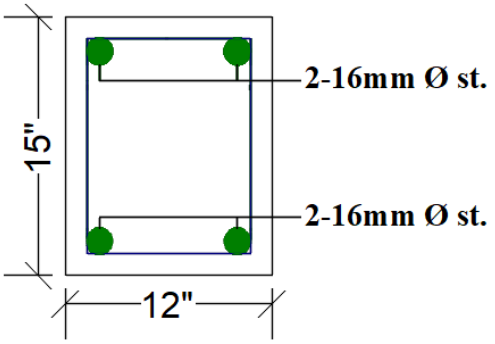


Long section of GB-3



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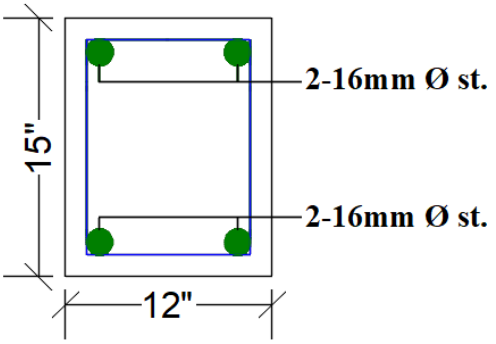

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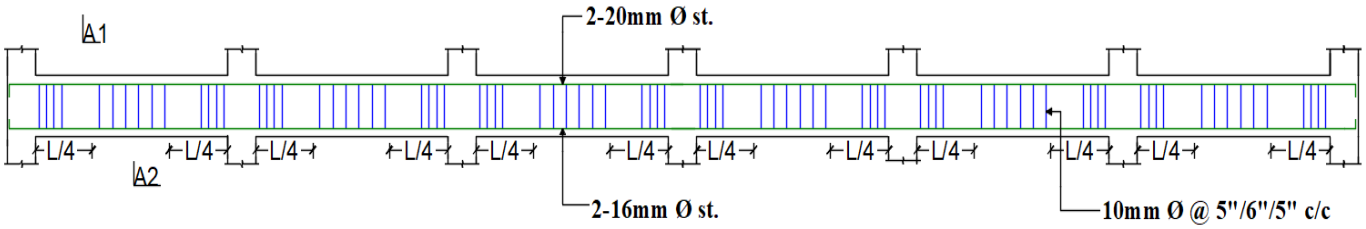

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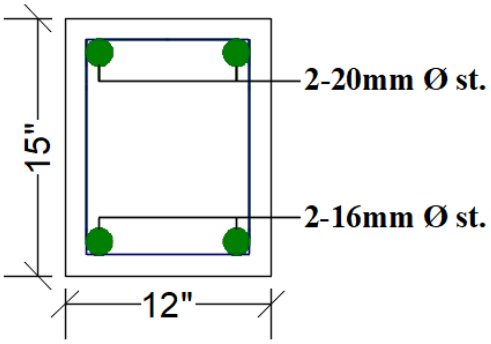

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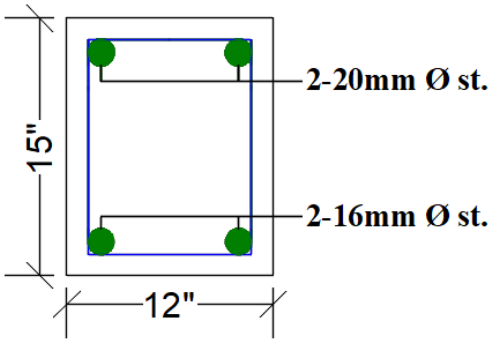

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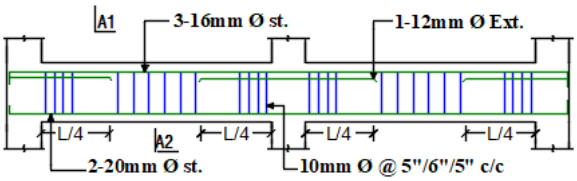
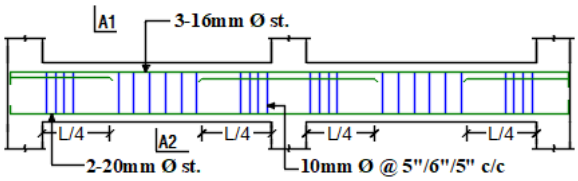
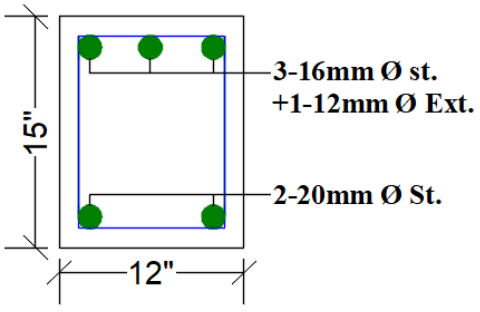
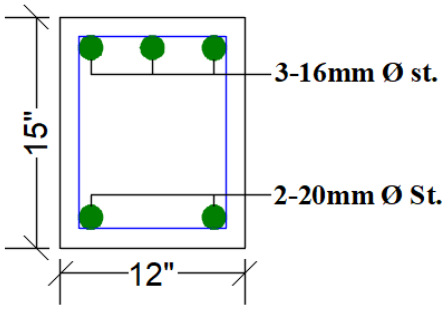




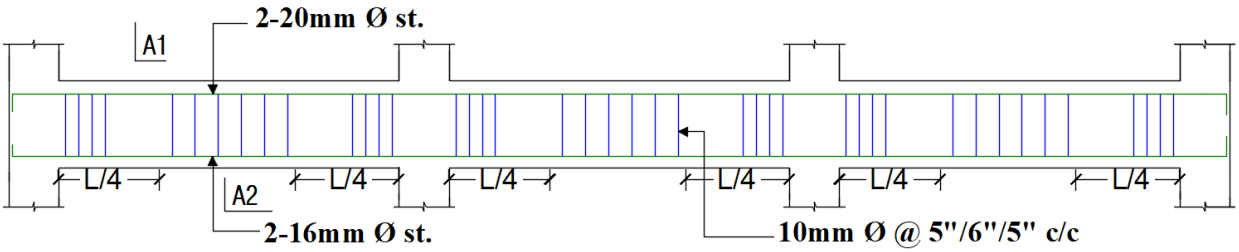
Long section of GB-5



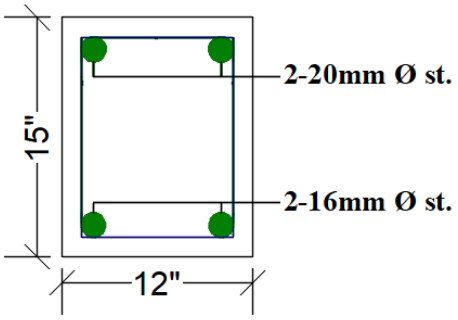
SEC OF GB-5(A1)



SEC OF GB-5(A2)



Long section of GB-A



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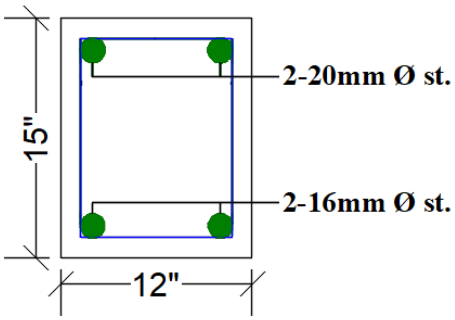

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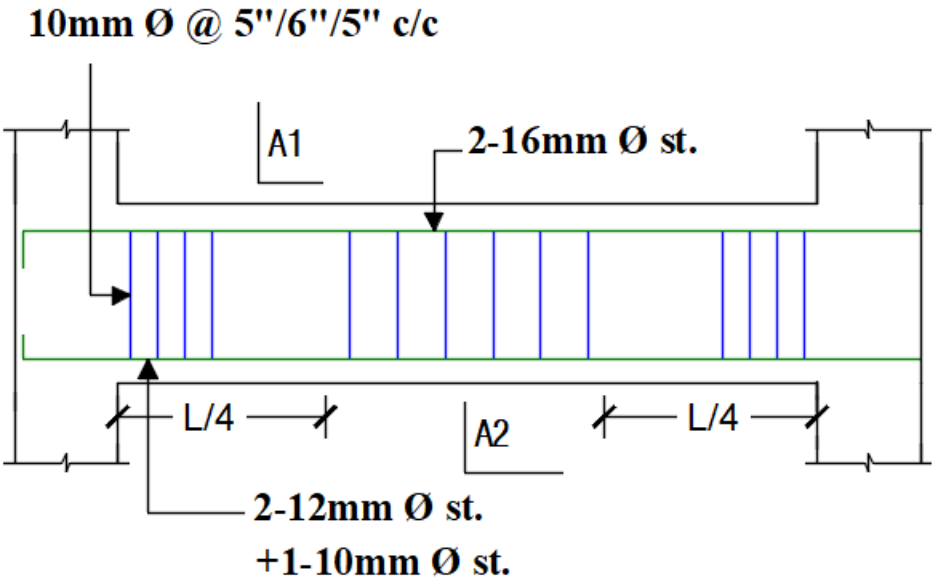
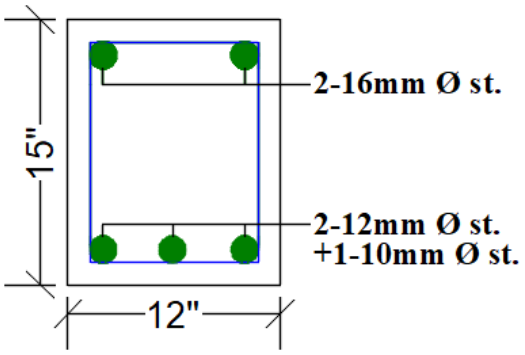


Long section of GB-B



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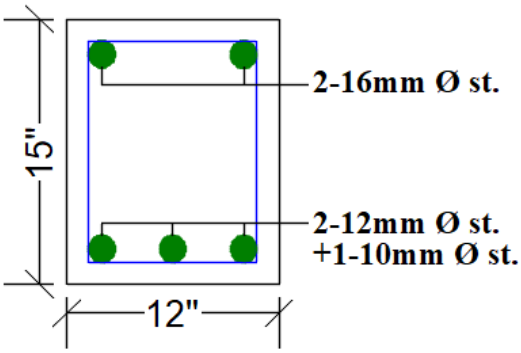

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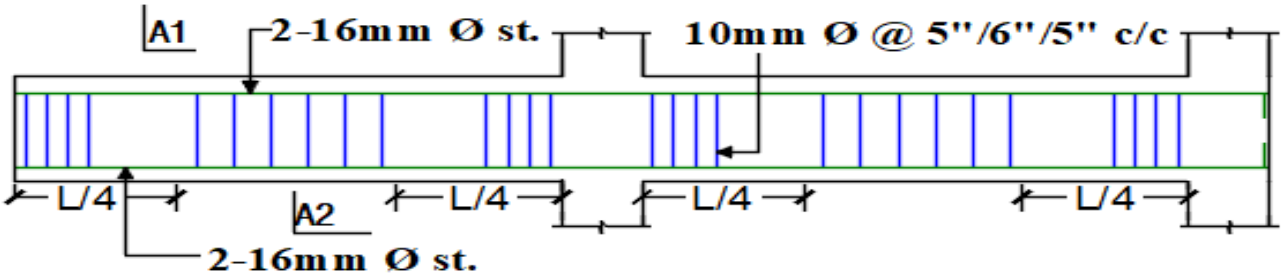
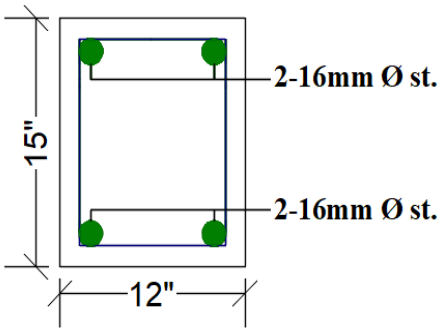
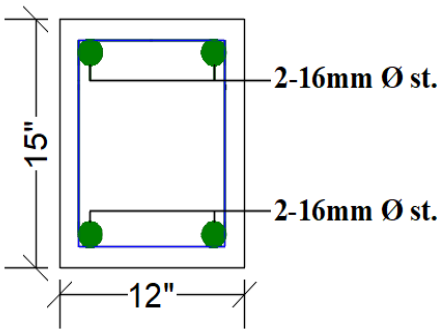


Long section of GB-C



SEC OF GB-C(A1)



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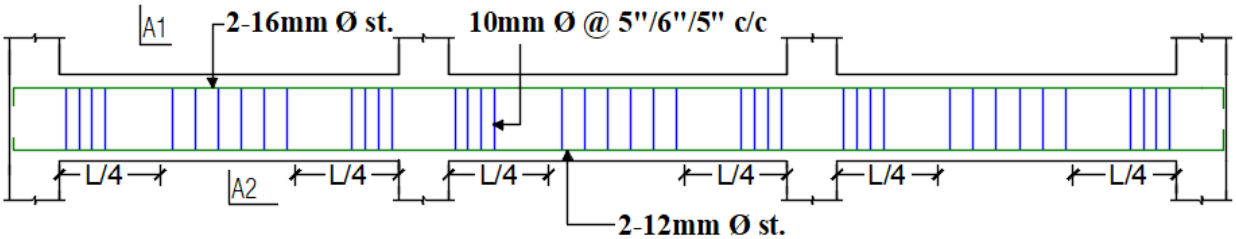
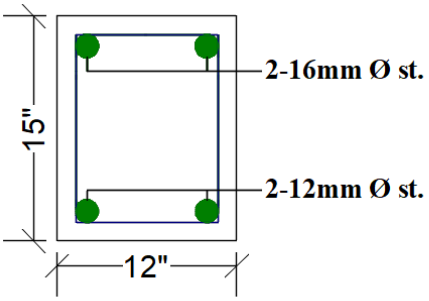
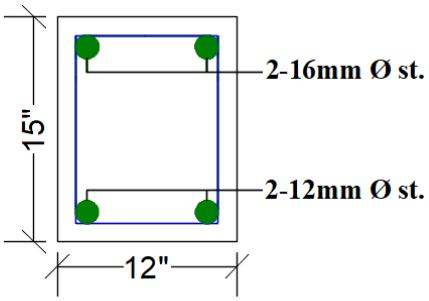


Long section of GB-D



SEC OF GB-D(A1)



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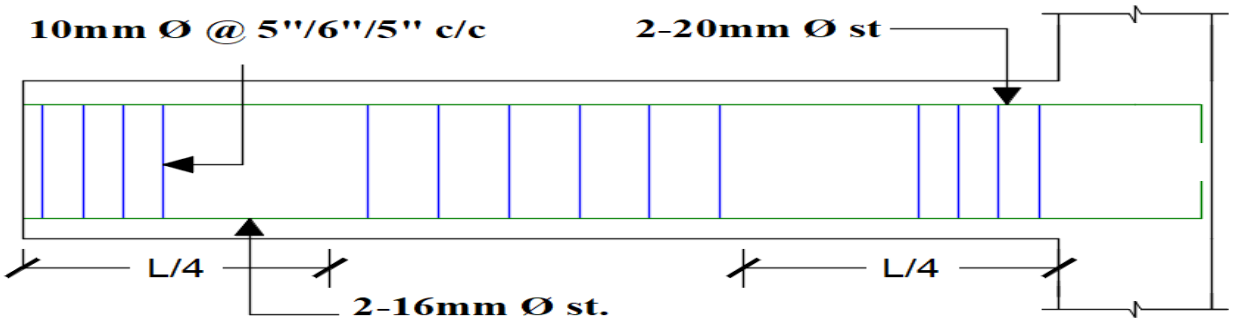
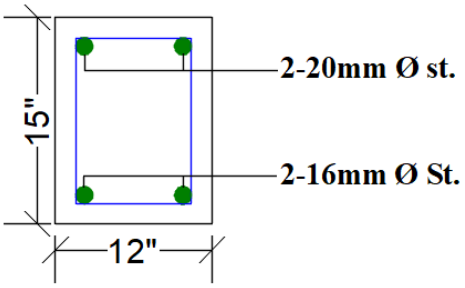
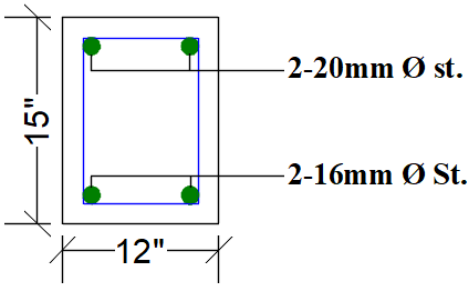


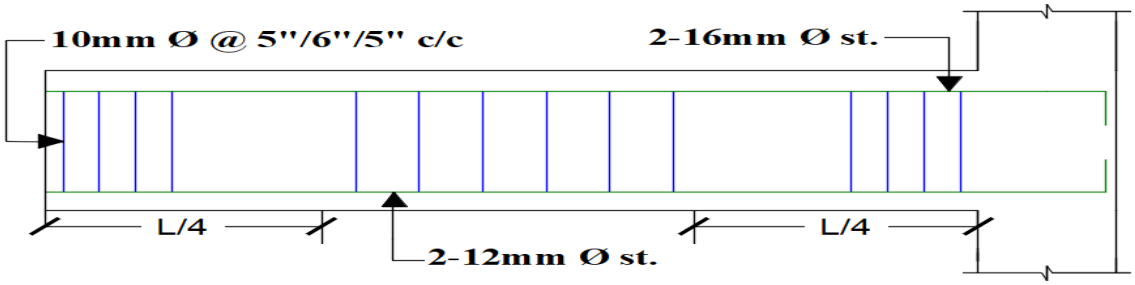
Long section of GB-E



SEC OF GB-E(A1)



SEC OF GB-E(A2)



Long section of GB-F

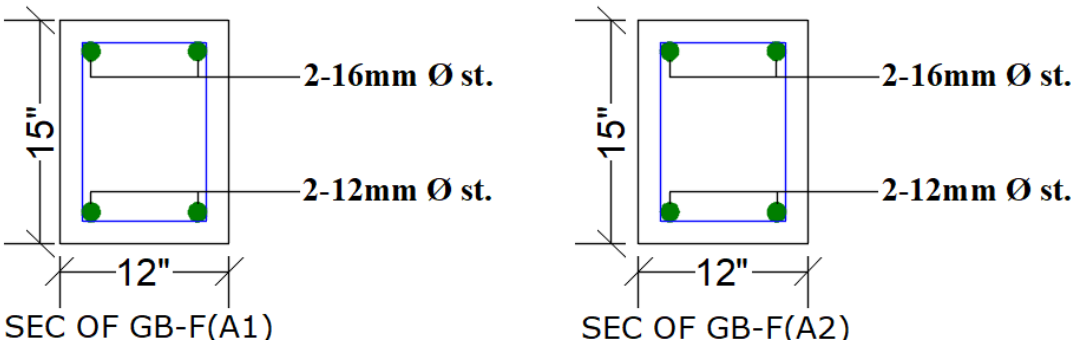
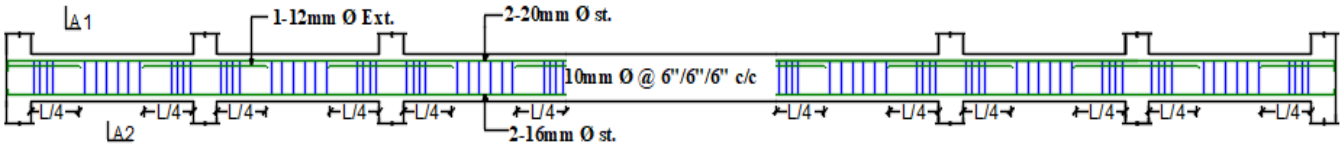
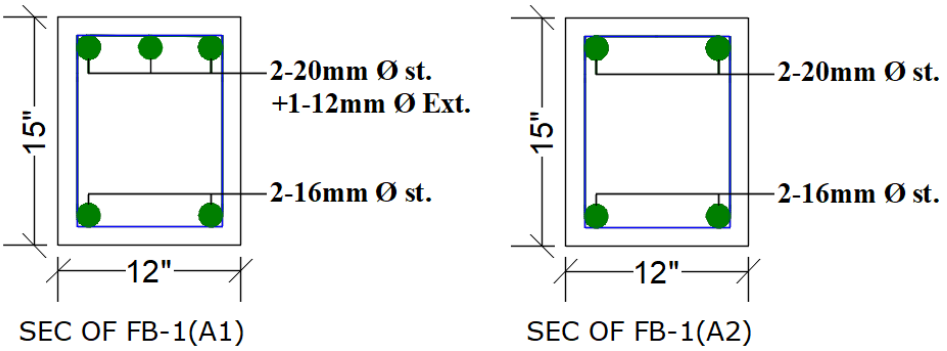
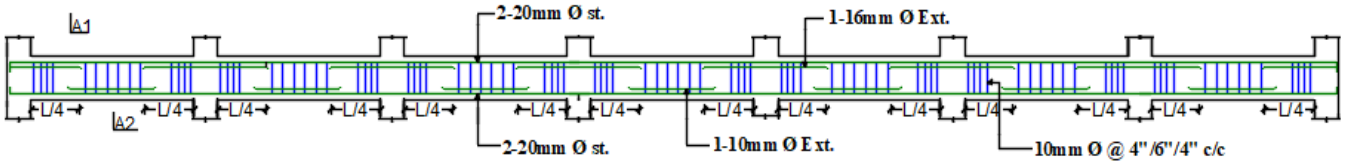


Exhibit A6- Grade Beam Detailing

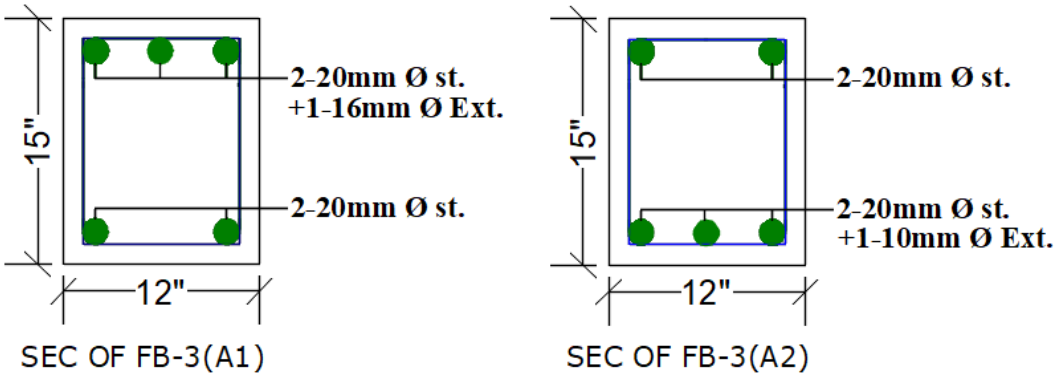


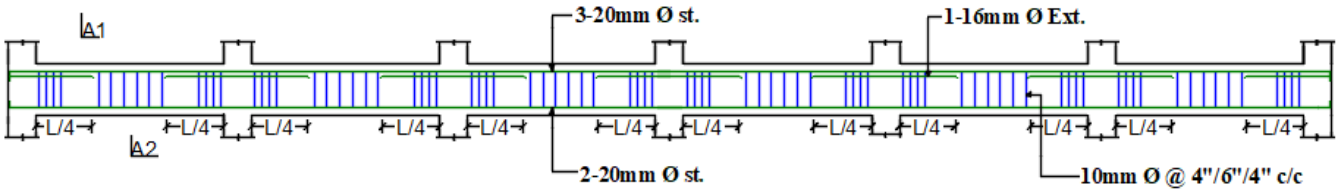
Long section of FB-1



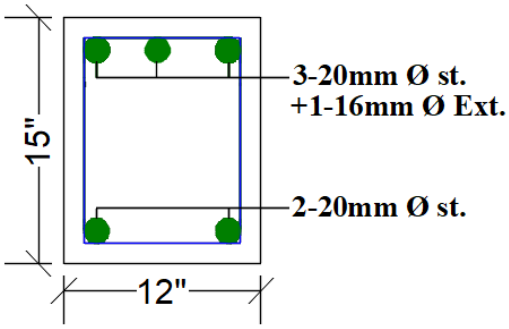


Long section of FB-3





Long section of FB-4



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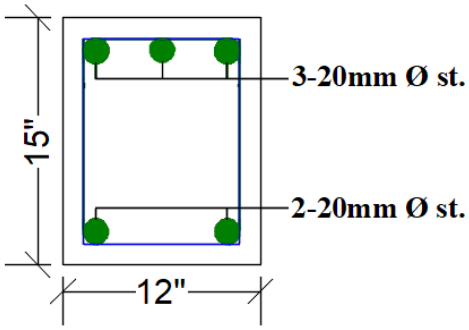

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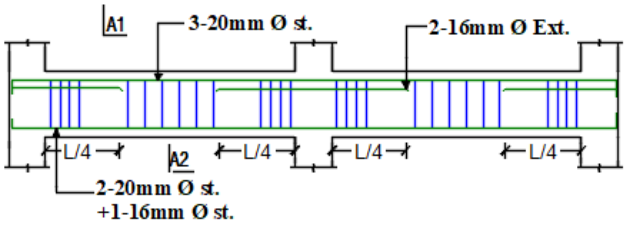

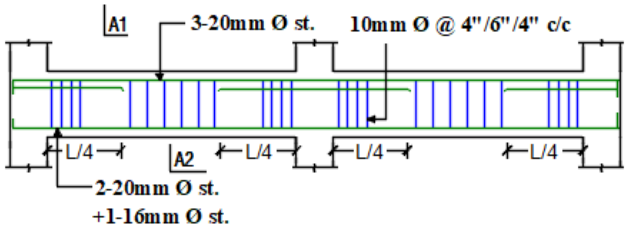

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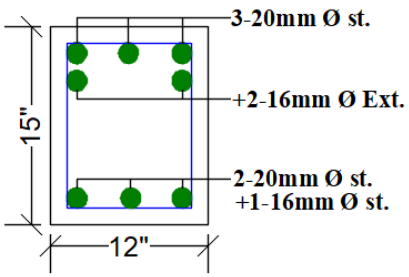

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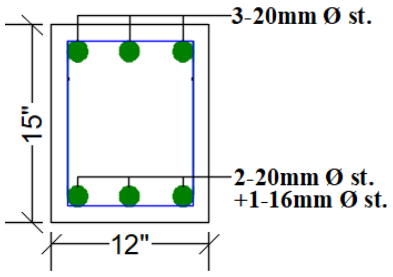

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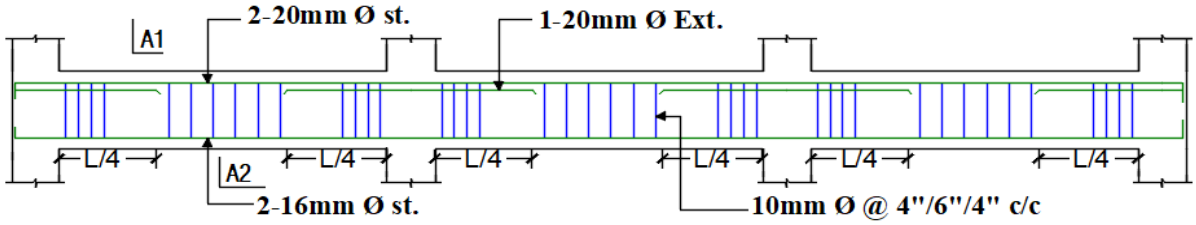
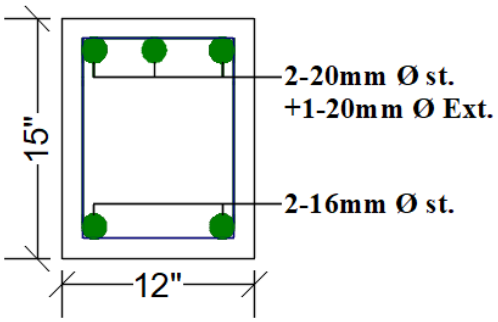


Long section of FB-A



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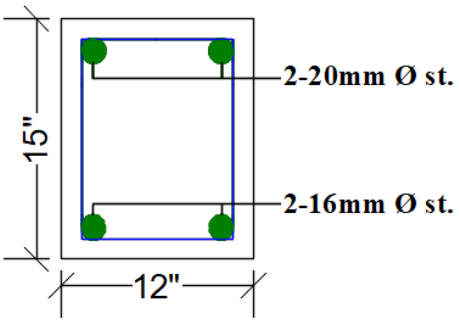

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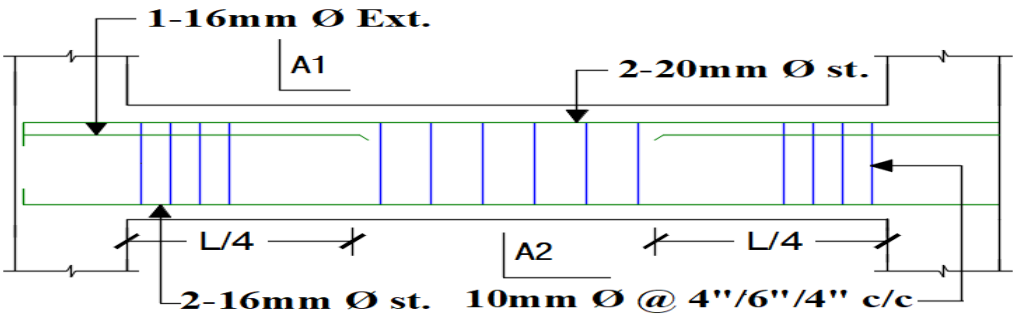
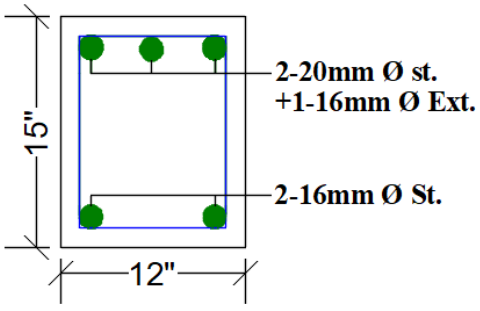


Long section of FB-B



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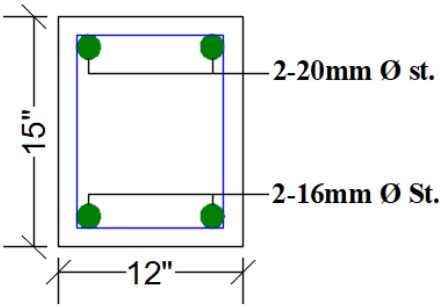

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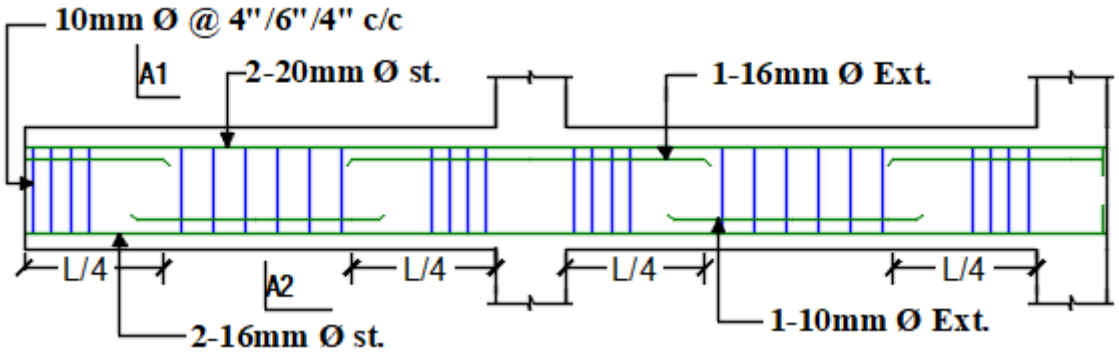
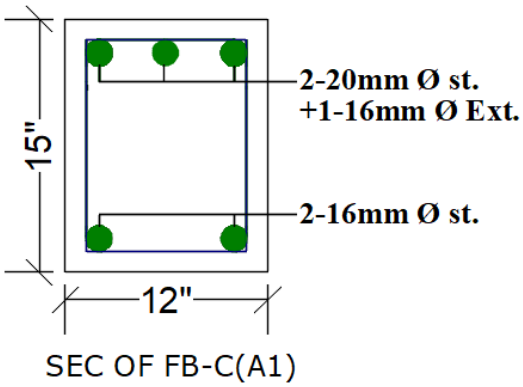
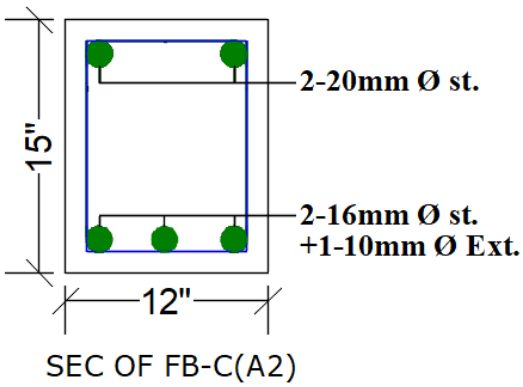


Long section of FB-C



SEC OF FB-C(A1)



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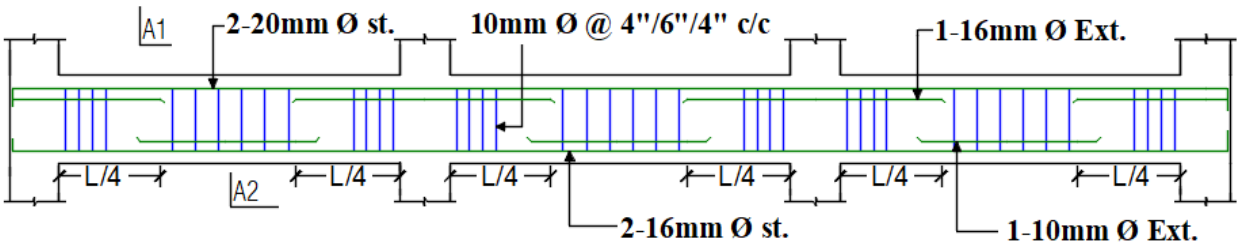
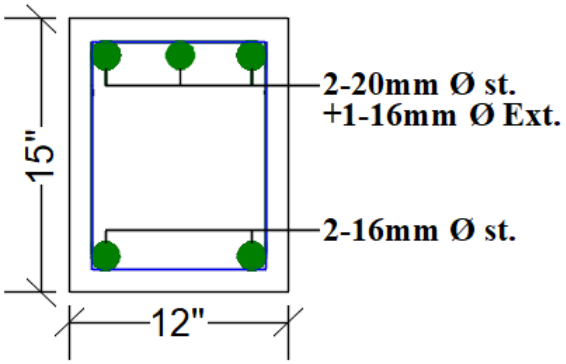
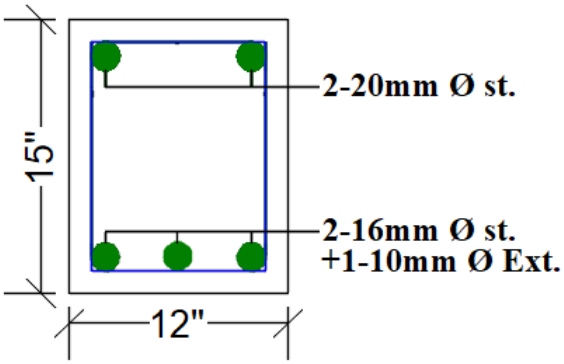


Long section of FB-D



SEC OF FB-D(A1)



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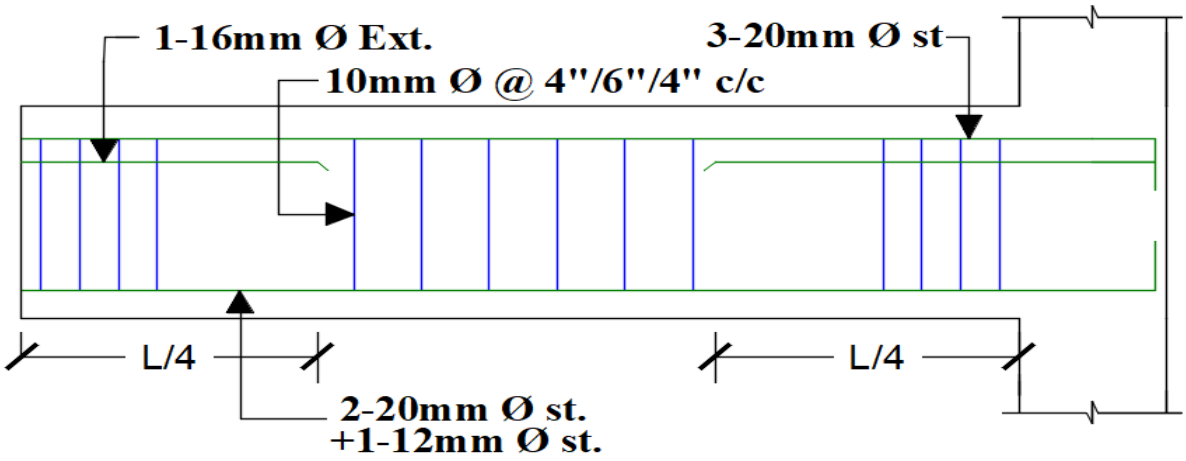
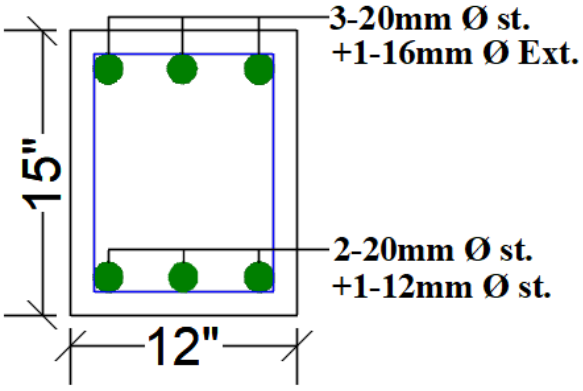
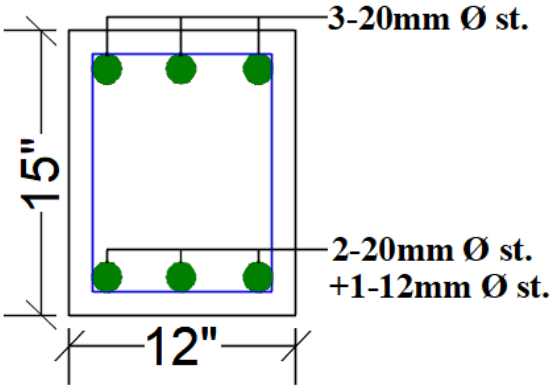


Long section of FB-E



SEC OF FB-E(A1)



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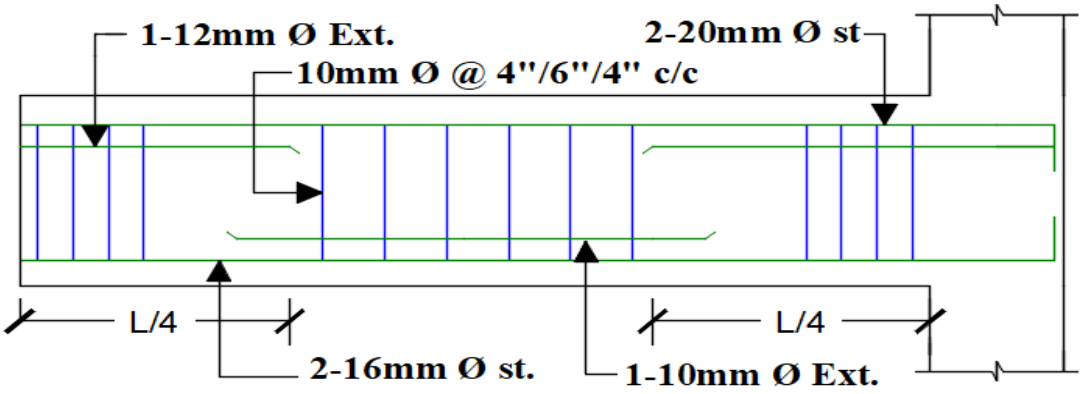


Long section of FB-F

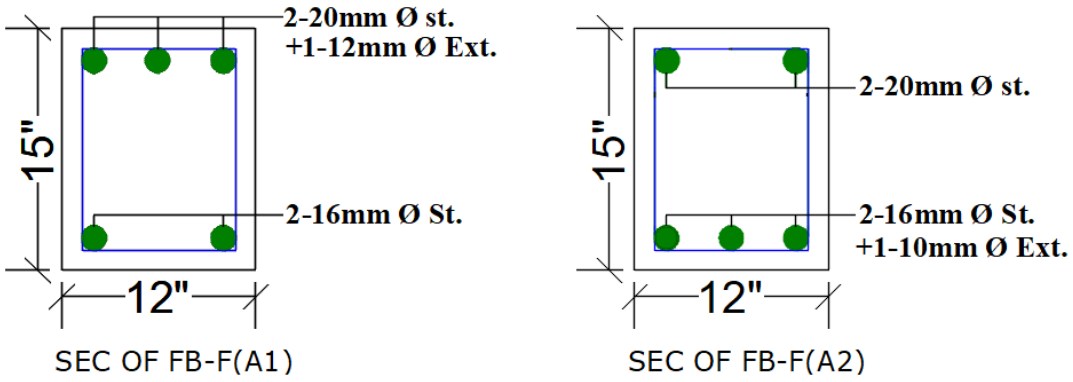


Exhibit A7- Floor Beam Detailing

SCHEDULE OF COLUMN SIZE AND REINFORCEMENT DETAILS

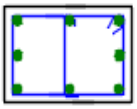
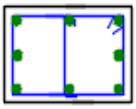
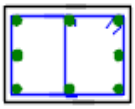
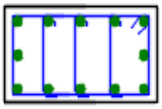
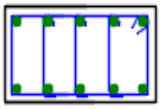
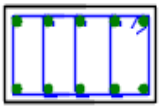
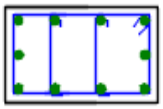
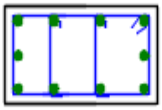
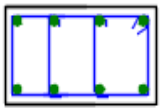
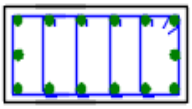
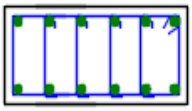
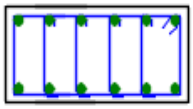
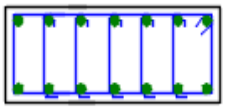
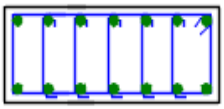
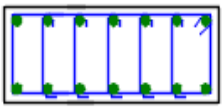
COL.NO.	QTY.	Base to 3rd Floor	4th to 7th Floor	8th to Roof
C1	Size	12"x18"	12"x18"	12"x18"
	Clear Cover	1.5"	1.5"	1.5"
		 8-20mmø	 4-20mmø,4-12mmø	 6-16mmø,2-12mmø
	Tie	10mmø @ 4"~6"~4" C/C	10mmø @ 4"~8"~4" C/C	10mmø @ 4"~8"~4" C/C
C2	Size	12"x20"	12"x20"	12"x20"
	Clear Cover	1.5"	1.5"	1.5"
		 12-20mmø	 4-20mmø,6-16mmø	 6-16mmø,4-12mmø
	Tie	10mmø @ 4"~6"~4" C/C	10mmø @ 4"~8"~4" C/C	10mmø @ 4"~8"~4" C/C
C3	Size	12"x22"	12"x22"	12"x22"
	Clear Cover	1.5"	1.5"	1.5"
		 10-22mmø	 4-22mmø,6-16mmø	 2-20mmø,6-16mmø
	Tie	10mmø @ 4"~6"~4" C/C	10mmø @ 4"~8"~4" C/C	10mmø @ 4"~8"~4" C/C
C4	Size	12"x28"	12"x28"	12"x28"
	Clear Cover	1.5"	1.5"	1.5"
		 10-22mmø,4-16mmø	 12-20mmø	 10-16mmø,2-12mmø
	Tie	10mmø @ 4"~6"~4" C/C	10mmø @ 4"~8"~4" C/C	10mmø @ 4"~8"~4" C/C
C5	Size	14"x28"	14"x28"	14"x28"
	Clear Cover	1.5"	1.5"	1.5"
		 14-22mmø	 12-20mmø,2-16mmø	 12-16mmø,2-12mmø
	Tie	10mmø @ 4"~6"~4" C/C	10mmø @ 4"~8"~4" C/C	10mmø @ 4"~8"~4" C/C

Exhibit A8- Column Detailing

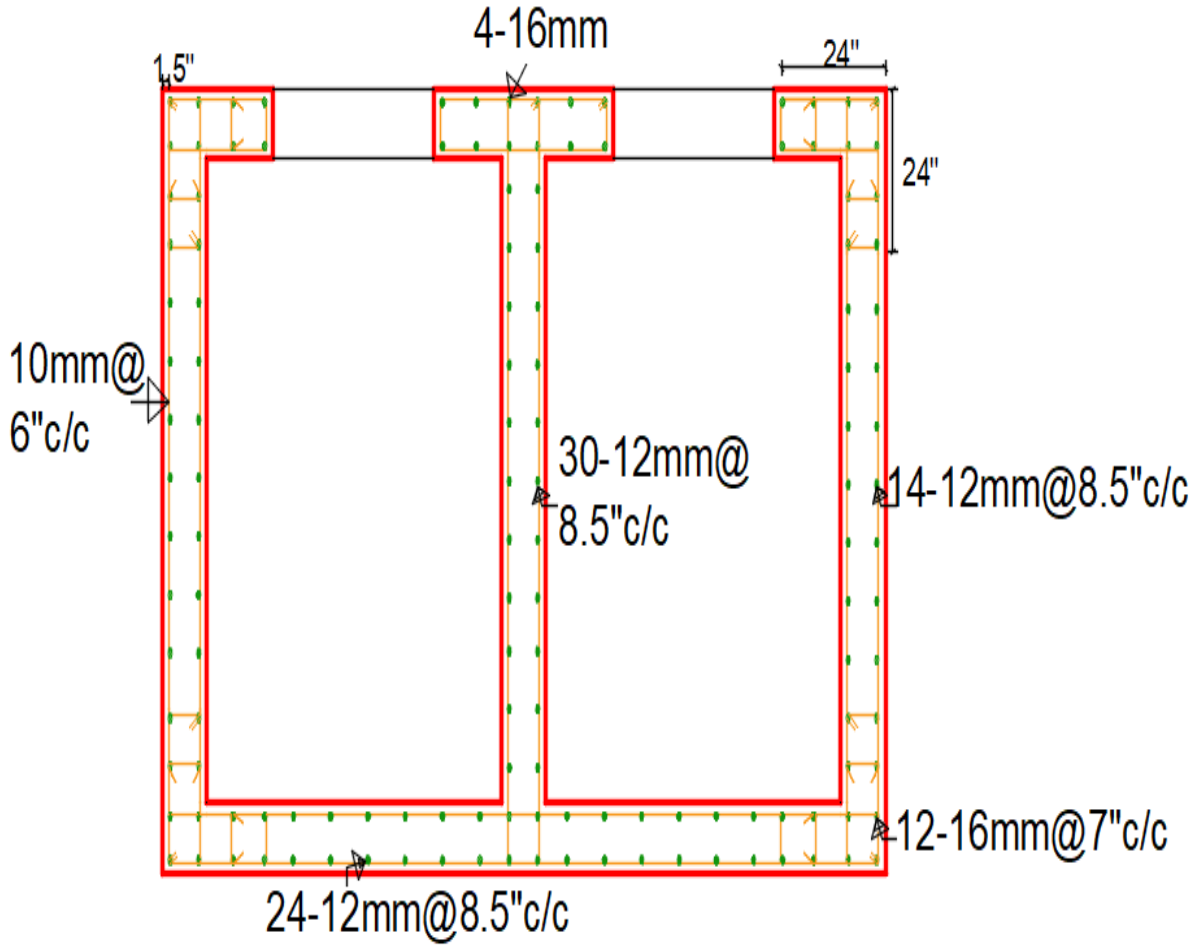


Exhibit A9- Shear Wall Detailing

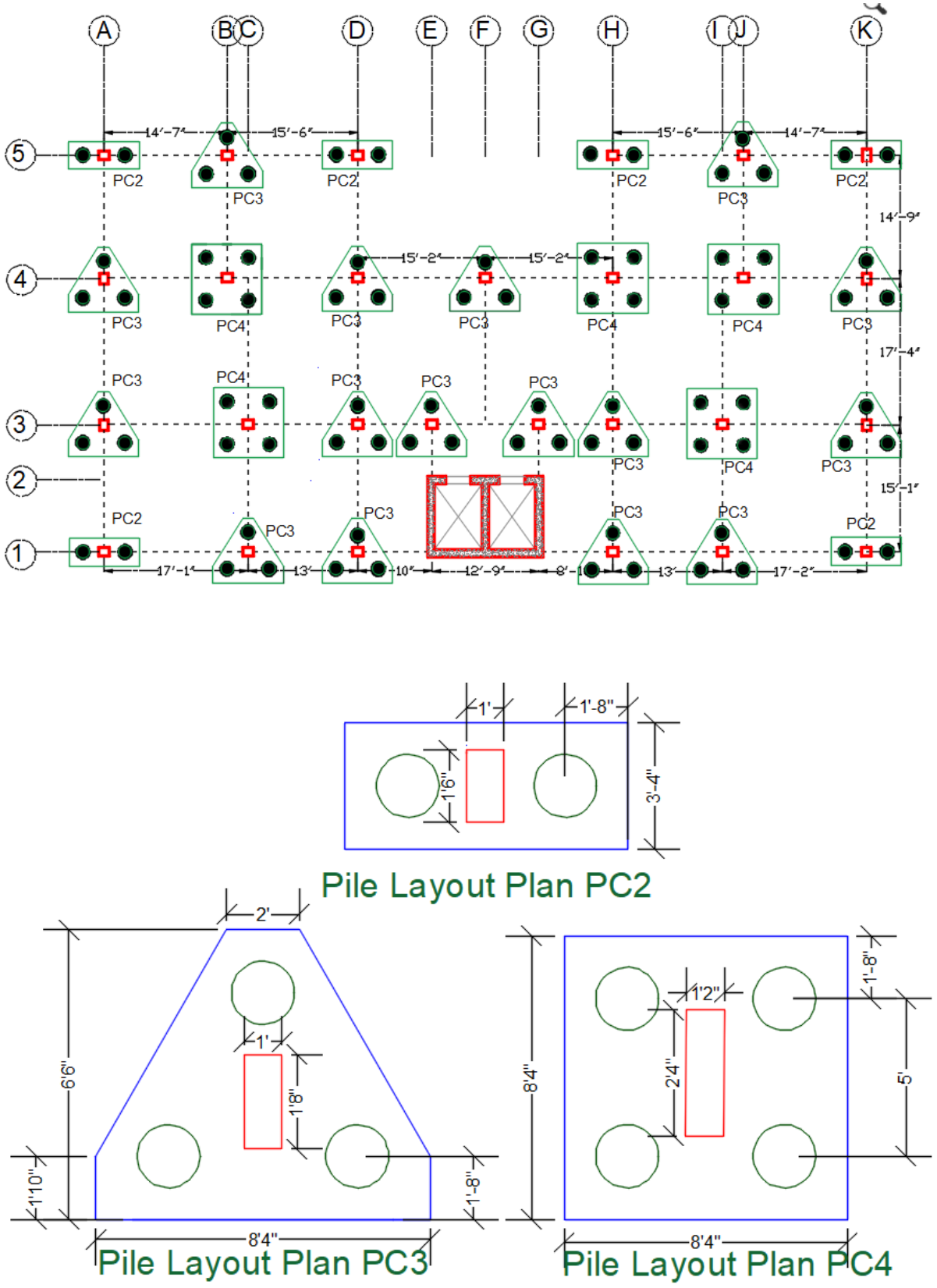
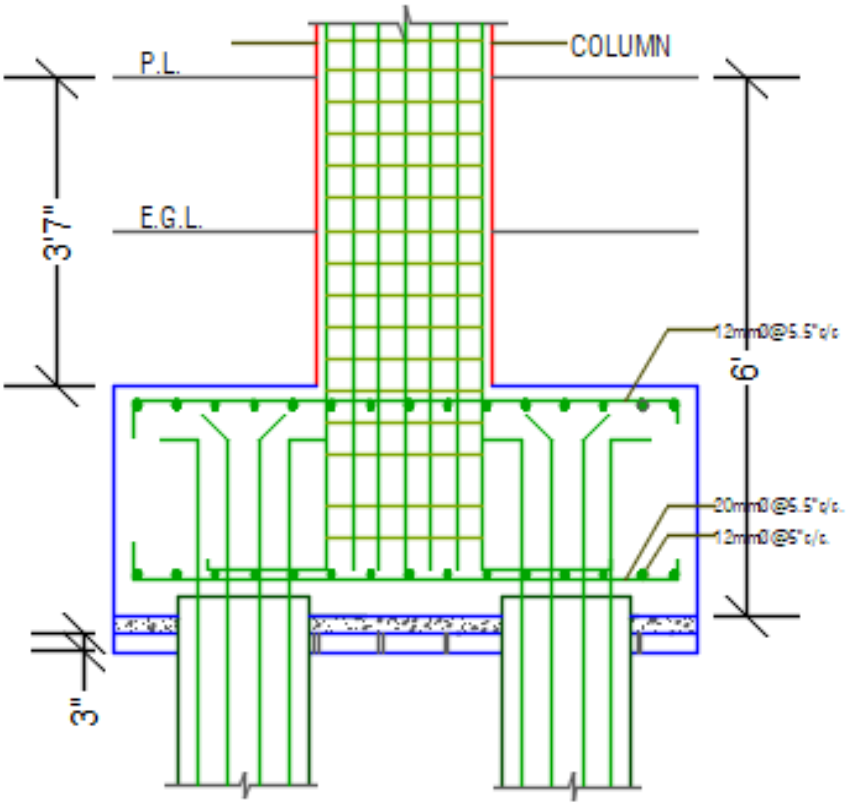
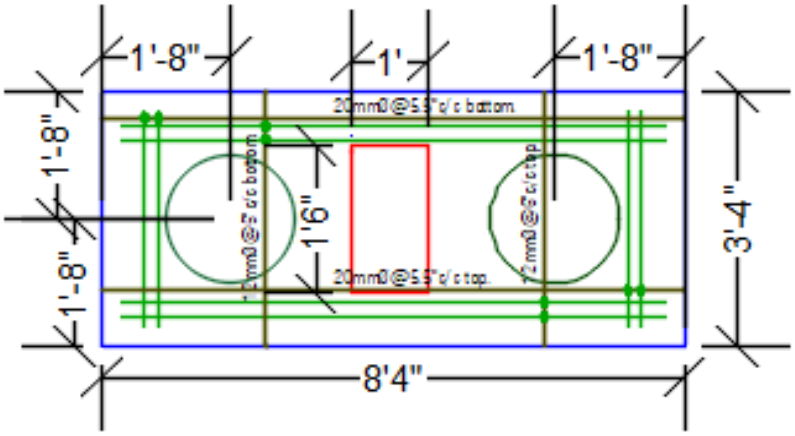


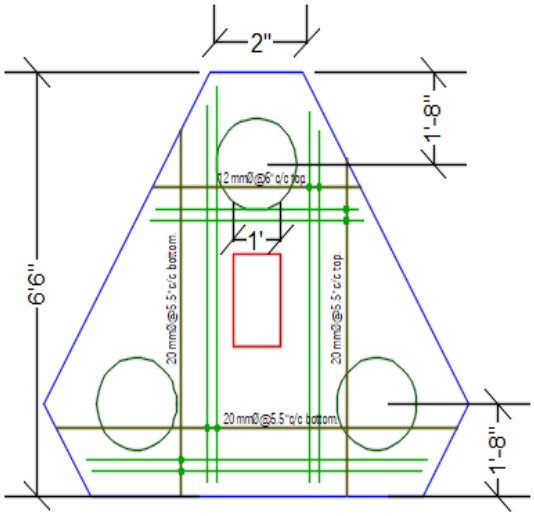
Exhibit A10- Pile Cap Layout Plan



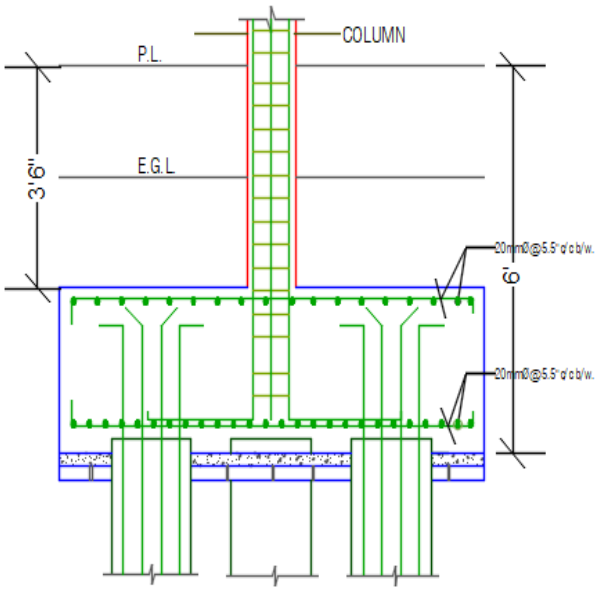
SEC. ON-(A-A)



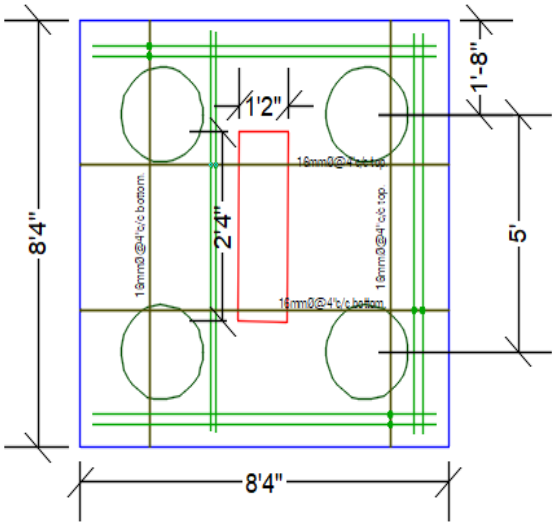
REINFORCEMENT DETAILS PC-2



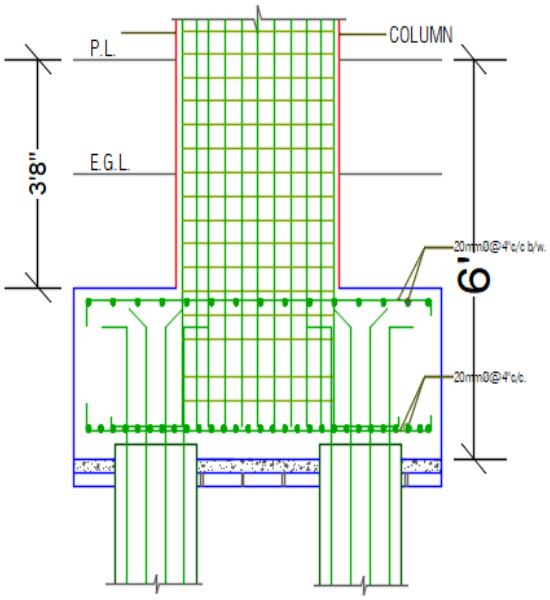
REINFORCEMENT DETAILS PC-3



SEC. ON-(B-B)



REINFORCEMENT DETAILS PC-4



SEC. ON-(C-C)

Exhibit A11- Pile Reinforcement Detailing

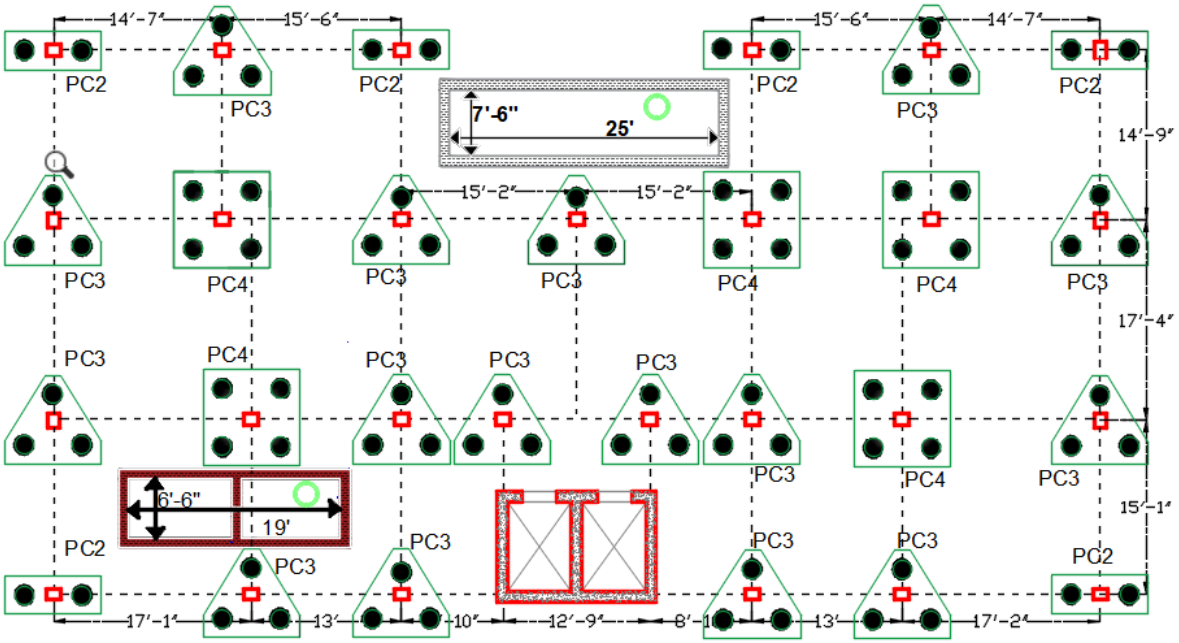
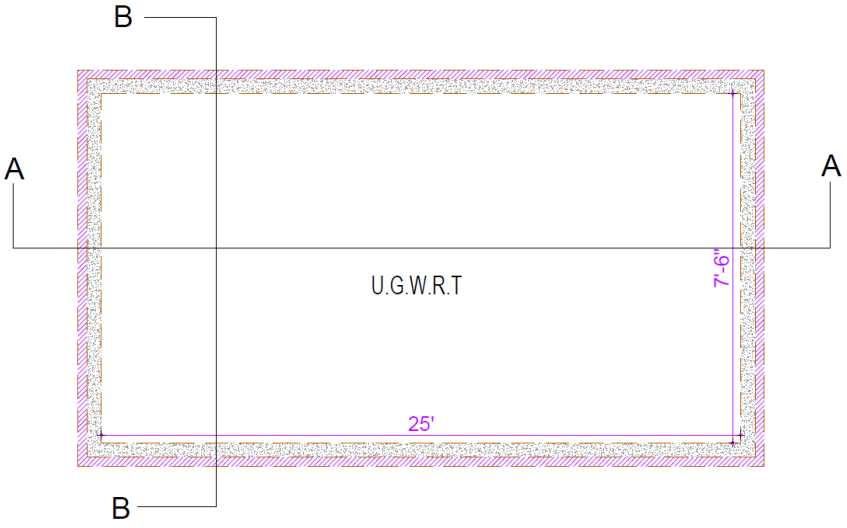
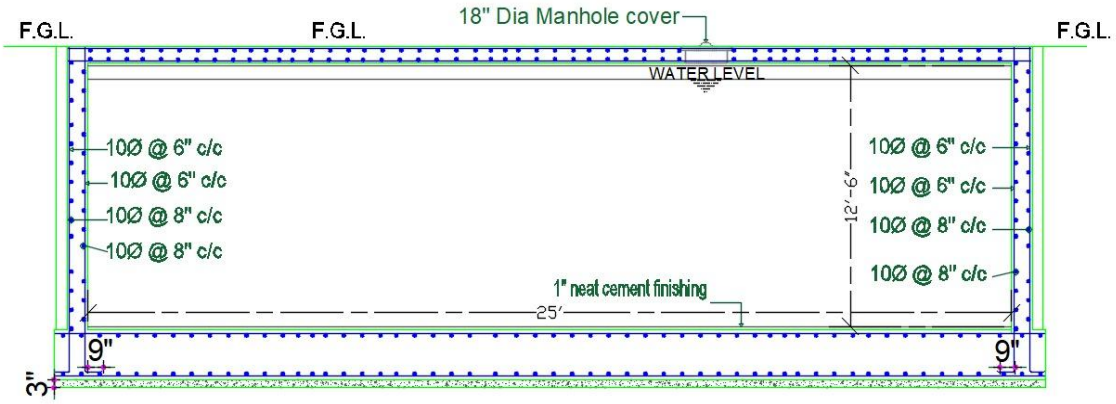
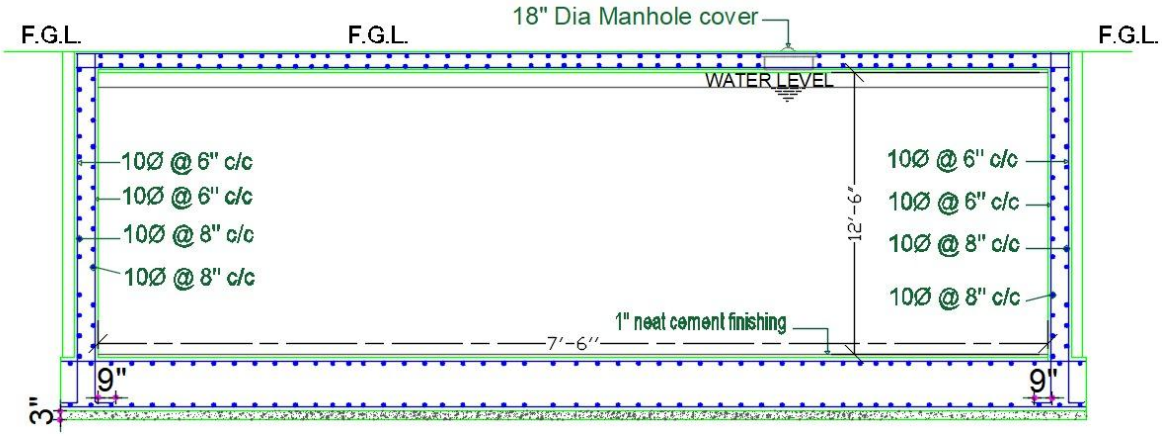


Exhibit A12- Location of underground water tank and septic tank





Section A



Section B

Exhibit A13- Underground Water Tank Detailing

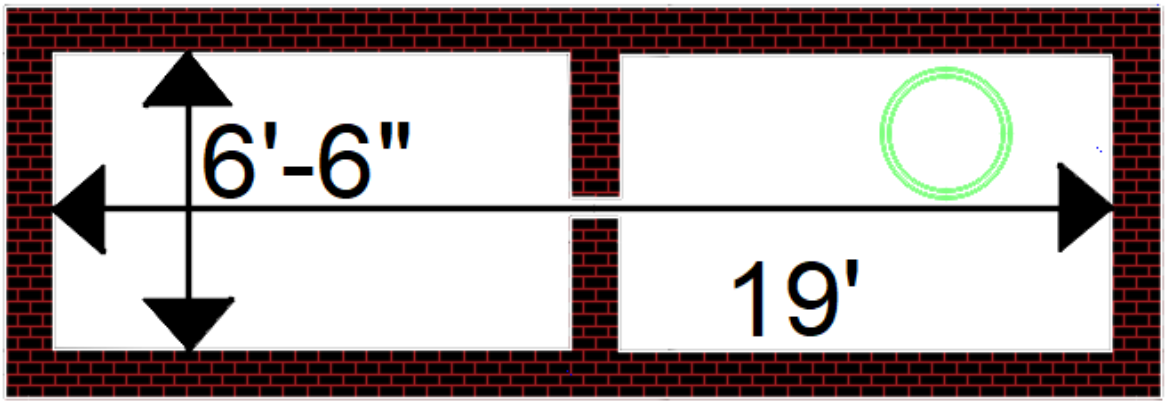


Exhibit A14- Septic Tank Detailing

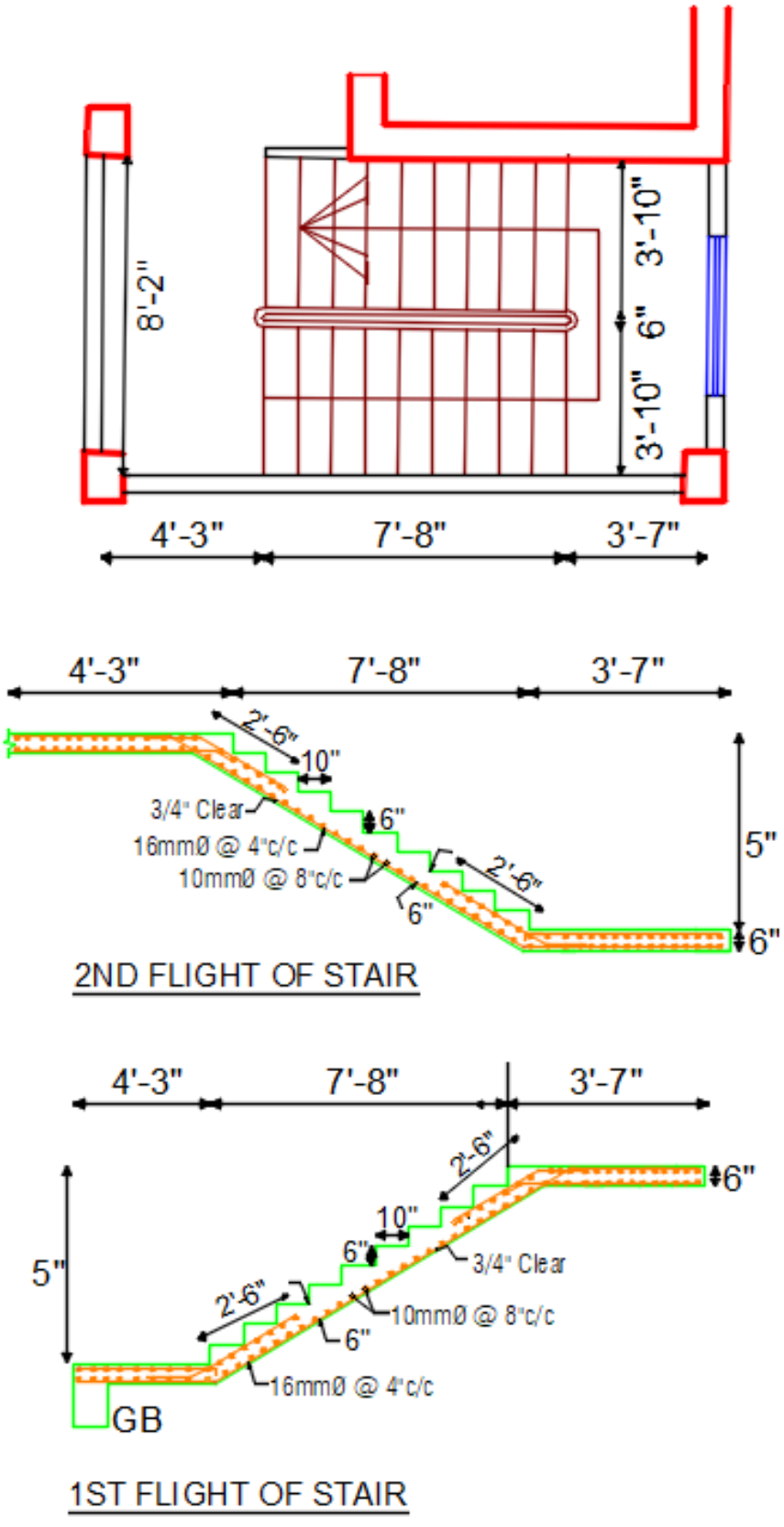


Exhibit A15- Stair Detailing

Appendix B

Contribution Statement

DEPARTMENT OF CIVIL ENGINEERING

Faculty of Sciences and Engineering

FINAL YEAR PROJECT ACTIVITY CHART

Course Code	CE498
Project Title	Structural and Foundation Design for G+9-Storied Residential Building at Banasree, Dhaka
Project Duration	Fall 2022- Summer 2023

Sl. No.	Chapter Name	Section Name	Name of Contributor	Remarks
1.	**Introduction**	Project Background	Sudipto Goon	
		Project Requirement	Nila Ishrat Priya	
		OBJECTIVE	Nila Ishrat Priya	
		REVIEW OF SUPPLIED DOCUMENTS	Nila Ishrat Priya Nishat Tasnim Shama	
		PROJECT IMPACTS	Nishat Tasnim Shama Nila Ishrat Priya Sudipto Goon	
		PROJECT SCHEDULE	Sudipto Goon Nila Ishrat Priya	
2	**ANALYSIS AND DESIGN**	DESIGN CONSIDERATION	Nishat Tasnim Shama	
		PRELIMINARY DESIGN	Nila Ishrat Priya Khobir Mia	
		ANALYSIS OF ALTERNATE SOLUTIONS	Nishat Tasnim Shama Nila Ishrat Priya	
		PERFORMANCE EVALUATION	Nila Ishrat Priya Nishat Tasnim Shama	
		FINAL DESIGN	Nishat Tasnim Shama	
		FOUNDATION DESIGN	Sudipto Goon	
		OTHER DESIGN	Khobir Mia Sudipto Goon	
		DRAWING DETAILS	Nishat Tasnim Shama Nila Ishrat Priya Sudipto Goon	

			Khobir Mia	
		USE OF MODERN ENGINEERING TOOLS	Nishat Tasnim Shama	
3	**PROJECT PLANNING**	BILL OF QUANTITIES	Khobir Mia	
		PROJECT SCHEDULE	Khobir Mia Nila Ishrat Priya	
		ETHICAL ISSUES RELATED TO THE PROJECT	Nila Ishrat Priya	
4	**CONCLUSIONS**	CONCLUSIONS	Nila Ishrat Priya	

Appendix C

Code of Ethics of IEB

The Code of Ethics of IEB are mentioned below.

THE INSTITUTION OF ENGINEERS, BANGLADESH (IEB)
CODE OF ETHICS

(Approved in the 476th Central Council Meeting, IEB, held on 6.8.2003)

1. I solemnly promise that as a member of The Institution of Engineers, Bangladesh I shall uphold and advance the integrity, honor and dignity of the engineering profession using my knowledge and skill and shall hold paramount the safety, health and welfare of the public and shall try to comply with the principles of sustainable development in the performance of my professional duties.
2. I shall be honest and impartial and serve with complete fidelity the public, employer and clients. I shall not accept remuneration for services rendered other than that form my employer or with my employer's permission.
3. I shall perform services only in areas of my competence.
4. I shall build my professional reputation on the merit of my services and shall not complete unfairly with others.
5. I shall act in professional matters for my employer or client as faithful agent or trustee and shall avoid conflict of interest and avoid deceptive acts.
6. I shall issue public statements only in an objective and truthful manner, and shall not in a self-laudatory language or in any manner derogatory to the dignity of the profession or professional bodies, neither advise or write articles for publication, nor shall authorize such advertisements to be written or published by any other person.
7. I, without disclosing the fact to my employer in writing shall not be director of or have a substantial financial interest in, nor be an agent for any company, firm or person carrying on any contracting consulting or manufacturing business which is or may be involved in the work to which my employment relates, nor shall I receive directly or indirectly any royalty, gratuity or commission or any article or process used in or for the purpose of the work in respect of which I am employed unless or until such royalty, gratuity or commission has been authorized in writing by the employer.
8. I shall support the professional and technical societies of my discipline.
9. I, in connection with work in country other than my own shall order my conduct according to these rules, as far as they are applicable; but where the country has recognized shandards of professional conduct, I shall adhere to them.
10. I shall not offer, guide, solicit or receive, either directly or indirectly any political contribution in an amount intended to influence the award of a contract by the public authority.
11. I solemnly promise I shall avoid bribery and extortion in any form. If I encounter such acts done by any member. I shall be ethically bound to report it to the Ethical Review Board (ERB) of IEB. (ERB is to be formed)
12. I shall continue my professional development throughout my career, and shall provide opportunities and support for the professional development of the engineers under my supervision
13. A member who shall be convicted by a competent tribunal of criminal offence, which in the opinion of the disciplinary body renders him unfit to be a member, shall be deemed to have been guilty of improper conduct.

Appendix D

Complex Engineering Problem Attributes

The following table summarizes the attributes of complex engineering problem.

Table D1 Range of Complex Engineering Problem Solving

Attribute	Complex Engineering Problems have characteristic P1 and some or all of P2 to P7:
Depth of knowledge required	P1: Cannot be resolved without in-depth engineering knowledge at the level of one or more of K3, K4, K5, K6 or K8, which allows for a fundamentals-based, first principles analytical approach
Range of conflicting requirements	P2: Involves wide-ranging or conflicting technical, engineering and other issues
Depth of analysis required	P3: There is no obvious solution, and abstract thinking and originality in analysis are required to formulate suitable models
Familiarity of issues	P4: Involves infrequently encountered issues
Extent of applicable codes	P5: Are outside problems encompassed by standards and codes of practice for professional engineering
Extent of stakeholder involvement and conflicting requirements	P6: Involves diverse groups of stakeholders with widely varying needs
Interdependence	P7: High level problems including many component parts or sub-problems