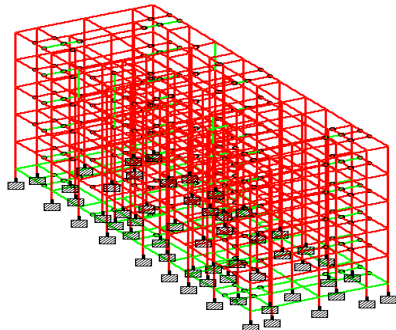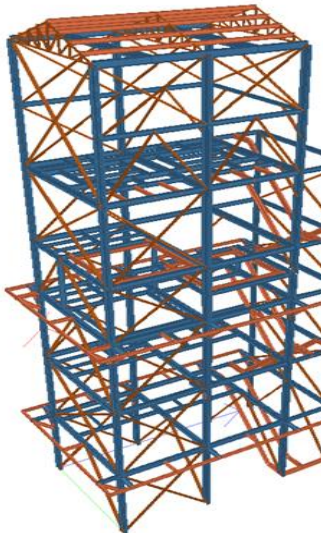# INTERNSHIP REPORT

CENS INDIA

JUNE-DEC, 2014

By

RISHABH LALA

VII SEMESTER

CIVIL & STRUCTURAL ENGINEERING

DUAL DEGREE (B.E. + M.TECH), RGPV

CONTENTS

ACKNOWLEDGEMENT

I have taken efforts in this project. However, it would not have been possible without the kind support and help of many individuals and organizations. I would like to extend my sincere thanks to all of them.

I am highly indebted to Civil Engineering Network Systems Pvt. Ltd. for providing me this opportunity. I would like to express my profound gratitude and thanks to Mr. Santosh Kolhe, Director CENS for giving me such priceless attention and his valuable suggestions.

I wish to express my special gratitude for Prof. K. K. Pathak, NITTTR Bhopal and Prof. V. D. Patil, NITTTR Pune for their kind co-operation in arranging this invaluable internship and their encouragement which help me in completion of my internship.

I also wish to acknowledge the positive backing from Dr. R.K. Singhai, Co-Ordinator DDI-PG and Dr.Salim Akhtar, Ex-HOD Civil Engineering Department and my colleagues who have willingly helped me out with their abilities.

My incomparable thanks and appreciations go to my parents for allowing as well as encouraging me to complete this internship with a positive note.

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LOAD  ➡  STRUCTURE  ➡  RESPONSE
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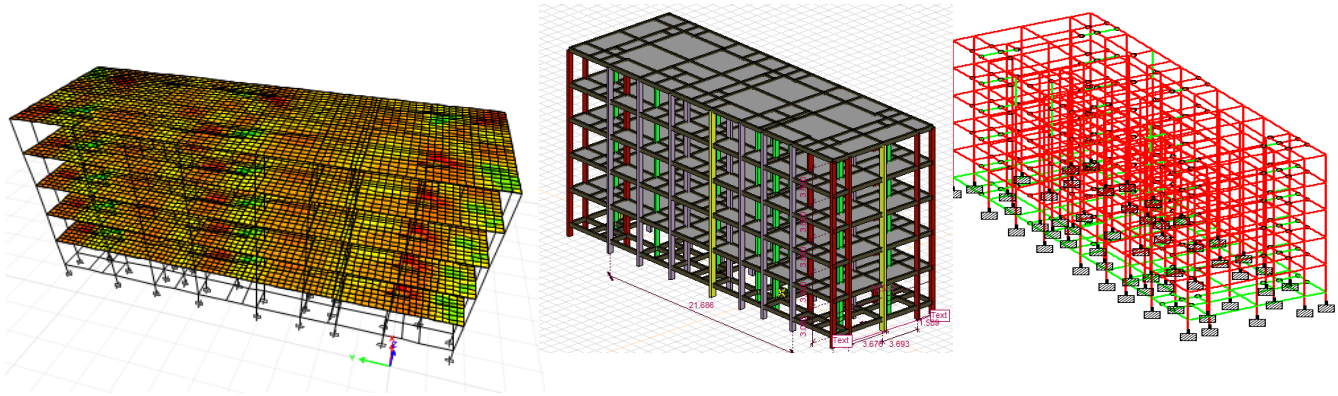
INTRODUCTION

This report is a short description of my six month internship carried out as a compulsory component of my Dual Degree Integrated-PG Programme. This internship was carried out 5 months at Civil Engineering Network Systems, Pune, Maharashtra (India) during the period of July 2014 to November, 2014, starting from 1st July onwards and 1 Month at Heaven's Design, Zone I MP Nagar, Bhopal. Since I have always been interested in Civil Structural Designing, my most of the work was concentrated on Steel and Concrete Designing Projects, which had always been very fascinating for me to learn and hence apply.

At the beginning of the internship I formulated several learning goals, which I wanted to achieve:

- To understand the working and the organizational structure of the Civil Engineering Firms
- To understand the demand of the Structural Designing Industry
- To see if the profession of structural designer can be opted as my future career
- To apply what I have learnt in engineering so far
- To evolve myself into a true structural engineer by learning structural designing skills
- To get experience of working in teams on a single project
- To build my network of worthy people
- To enhance my communication skills
- To build up confidence in my structural designing skills
- Understanding of difference between practical and theoretical work
- Understanding the basics and keys of Building Design and Detailing

This internship report contains description of my activities that have contributed to achieve a number of my stated goals. In the following chapters, a description of the organization i.e. (Civil Engineering Network Systems Pvt. Ltd.) and the activities undertaken during the internship is provided. In these sections, a reflection on my working, the unexpected circumstances and the learning goals achieved during the internship are described.

Finally I have given a conclusion on the internship experience in accordance with my learning goals.

The Appendix I of the report gives the complete description of my project undertaken during my last month at Heaven's Design and the detailed drawings which have been drafted by me individually based on the theoretical design calculations and skills which I have learned during my internship period; whereas Appendix II contains projects on which I I have worked during internship at CENS, Pune. Also Appendix III has been included, giving details about the workshop conducted by me on 'Earthquake Resistant Design of Structures' at NITTTR Bhopal, on 14th January,2015.

VISION

CENS has an expert team of civil & structural engineers having experience on working complex projects globally, supported by young & enthusiastic engineers with a vision of top management for sustainable engineering.

MISSION

Through Engineering Services, my attempt is to deliver superior performance and hence contribute to the growth and welfare of society.

CENS India, a structural engineering consultant firm having a 360 degree approach in civil & structural engineering, CENS India Pvt. Ltd. is a company promoted by companies from relevant business from Germany & India. The Company work as offshore outsourcing solution for engineering firms worldwide. The firm has a team of highly skilled architects, civil & structural engineers who have gained expertise working on different projects all over the world.

Civil Engineering Network Systems Pvt. Ltd. provides a wide range of specialized Engineering Consulting Services. Experience expertise, innovation, knowledge & flexibility allow this company to undertake specialized engineering projects from conception to completion. The firm has a team of highly qualified structural engineers, construction engineers and project engineers who inspect, analyze, design, plan and research structural components and structural systems

All projects are approached by first exploring sustainable & sound engineering solutions. With that the firm is poised to deliver projects that achieve financial, social and environmental objectives.

Service Portfolio:

- Building information modeling (BIM)

- Structural Consultant (RCC & STEEL)

- Structural Engineering Services

- Structural Steel Detailing and Pre Engineering Building Services

- Precast Detailing Services

- Reinforced Concrete Structure Detailing Services

- Finite Element Analysis Consultancy

- Proof Checking of Structural Designs

- Fire Audit, Structural Audit, Energy Audit

- Building Physics - FIRE, ENERGY, NOISE calculation software

- Civil Engineering Manpower Services - contract and staffing

- Civil Engineering Software Development and IT Services

The projects of various range and types have been undertaken by the firm:

•Analysis & Design of Industrial Supporting Structure for Power Plants, Steel Plants, Oil & Gas Refineries etc.

• Analysis & Design of Supporting Structure for Material Handling System

• Analysis & Design of Residential & Commercial Projects.

• Building Information modeling for Industrial Structures as well as commercial/residential Structures.

Some of the recent projects undertaken by the firm are:

- Molkerei Ammerland, Denmark. (Precast)
- Schellerdamm, Germany (Precast)
- Strandtarnet Main, Denmark. (Precast)
- Gehwegbruecke, Ahaus. (Steel Detailing)

Mentors

Mr. Santosh Kohle

Director, Civil Engineering Network Systems
Civil Engineer with Structural Engineering Post Graduation from IIT Powai. He is in the relevant business since last 23 Years.

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Mr. Shashikant Gunde

Senior Structural Engineer at Civil Engineering Network System Pvt Ltd

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Mr. Santosh Padsalge

Structural Engineer at Civil Engineering Network Systems, Pune

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INTERNSHIP ACTIVITIES|THREE

My internship was focused mainly on the learning the skill of structural Modeling, Designing and Drafting. It was planned to work on the live projects of the company and hence get hands on experience of structural designing. During the period of five months in Pune, I got the chance to work on various live projects like – Oman Bungalow Project, Steel Structure Designing Projects, Pune House Designing Project, etc. I got hands on experience of the various structural engineering softwares like – AxisVM, ETABS, STAAD.PRO, AutoCAD, etc.

After five months, I continued my internship at Heaven's Design, Bhopal for one month; which is an architectural drawing firm, hence I was the sole structural designer of the firm. This was the most exiting experience as I was given the responsibility of completing several live projects. Hence, I tested my wits during this period. I have enclosed the designs prepared in Appendix I.

Also, I have organized STAAD.PRO. Workshop at National Institute of Technical Teachers Training Institute on 14th January,2015 on 'Earthquake Resistant Design of Concrete

Structures'. Some of its Handouts prepared by me and the STAAD.Pro. Model are enclosed in Appendix III.

I have categorized my full internship experience starting from my excitement during the application process to my month wise experience and achievements. After that, a timeline of the projects I have worked on, is enclosed followed by individual project descriptions in the Appendix I,II and III:

APPLICATION PROCESS| FOUR

At the end of the sixth semester, it is mandatory to do 6 month long duration internship, according to the curriculum of Rajiv Gandhi Dual Degree Program. Prof. R.K Singhai, coordinator Dual Degree Programme, inspired me to do internship in a multinational firm. I always wanted to work outside Bhopal to learn more about new culture and see if I'm able to acclimatize to the new setting. After several consultations with my colleagues, who were also interested with same vigor, I decided to do internship at Civil Engineering Network Systems, Pune.

Then the paper-warfare began I had to arrange various documents like a letter of application, curriculum vitae, etc. All this was mailed to the firm. I also had few telecons with Mr. Santosh Kolhe, Director CENS and the Mr. Riteysh Patil, H.R. Manager CENS, about my appointment at the firm. Internship was confirmed by my HR Manager way before July 2014. Before leaving on to join on 1 July, I spoke to Mr. Shashikant Gunde, Sr. Structural Engineer, CENS about the details of my work there, which was in coherence with my interest.

FIRST MONTH|FIVE

This month was mainly focused on learning and adopting myself to the organizational setting. The very first day I was interviewed by my supervisors, Er. Shashikant Gunde and Er. Santosh Padsalge, questions related to my technical aptitude were asked.

In the first week, no live project was allotted to me even after several requests to my supervisors. I was given a task of brushing my previous concepts.

First two weeks were only involved in understanding what is structural engineering and what kind of projects are undertaken by the company. I understood how the projects were taken by the company's management team and how were they moved to the structural engineering team. There were more teams like Detailing team, Drawing team in addition to management and Structure designing teams. I was a part of the Structure Designing team.

During this time I studied IS 456-2000, IS 875- Part I, II, III, IV. Then I ourselves took a simple structure of 1 BHK House, and analyzed it manually and also designed it manually. This was a time of great learning for me about the various concepts of civil engineering and how they are applied. "Illustrated Design of Concrete Structures; by Shah and Karve" proved to be of great help for me.

During the first month I got a good grasping on the following topics :

1. Distribution of loads in the structures
   a. Distribution of loads in One way slab
   b. Distribution of loads in Two way slabs
   c. Distribution of loads in beams connected to one way system
   d. Distribution of loads in beams connected to two way system
   e. Distribution of loads in continuous slabs
2. Spacing of main and transverse reinforcement in various structural elements
3. Grouping of columns based on the axial loads coming on them
4. Factors of safety's and other safety measures taken
5. Effect of Orientation of columns in structure
6. Structural design in AutoCAD and grasping various commands of AutoCAD
7. Understanding the concepts of Finite Element Modeling
8. Understanding the various results produced by the modeling softwares based on the following factors like – Displacements and Forces involved in structure i.e. reactions, internal forces, Moment Diagrams, etc.
9. I was introduced to the concepts of Stiffness of structures, Mode-shifts, etc. by my supervisors.

10. I was also introduced with the concepts of how moment varies in beams depending on the height of the column.
11. I also learnt various concepts to maintain the economy of the structure like larger diameter bars are of lower cost and hence largest diameter bars should be prescribed to save steel and hence money of the client.

In short, I understood what is structural analysis i.e. structural analysis is the process of predicting the response (in terms of forces and displacements) of the given structure (Existing or proposed) subjected to specified loads. The major aspects of the structural analysis are (in accordance with their priority are):

- Stability
- Strength
- Stiffness
- Economy
- Aesthetics

First three are the safety related issues. There is always a tradeoff between economy and safety.

During this time, I have been educated about the importance and necessity of 'Analysis' prior to designing. I also tried to develop my AxisVM, AutoCAD, ETABS, and STAAD.Pro Expertise. I learnt how to verify the software calculations by hand calculations. Hence I realised that, I was rightly

oriented towards my goal i.e. evolving myself as Structural Design Engineer. Further I aspired to develop full command over the software namely AxisVM, AutoCAD, etc. so that I can prove myself to be fruitful for the organization.

The **PROCESS APPROACH FOR STRUCTURAL ENGINEERS is**

LOAD → STRUCTURE → RESPONSE

I was also allotted some tasks to involve me in the live projects like:

a. Report Preparation
b. Cutting Section and hence drawing them on AutoCAD of the Oman Bungalow
c. I was also given a task of finding out the differences between Shell, Membrane and Plate analysis.
d. I was assigned a task of understanding level differences between the changes in the levels of the Oman Bungalow project

SECOND MONTH|SIXTH

During my second month I shifted my focus to software modeling of the structures. I started modeling previously completed projects of the firm on ETABS 2013, and then I was asked to learn AxisVM by my director Mr. Santosh Kolhe as my firm being the only reseller of AxisVM in India. I also worked on STAAD.PRO and learned various concepts of modeling. During the free time, I got the chance of learning architectural modeling software called Google-Sketchup.

I modeled a industrial steel structure in three different structural analysis softwares namely –

AxisVM, ETABS and STAAD.Pro, and hence compared the results of all the three.

I found some interesting conclusions which were also guided by my supervisors.

    a. Reasons for the minor variation of the results in different softwares like – the lower value of the moments in case of AxisVM Beams compared to the ETABS Beams for same model, was due to the consideration of the flange action of the beams in case of AxisVM.

During this practice I understood the following concepts:

1. The concept of providing bracings in steel structures
2. The concept of secondary beams

3. The concept of providing 'releases' of forces at joints

4. The concept of sway and non-sway buildings

5. The concept of clad and unclad buildings

6. The concept of purlins and girts

7. The concept of slenderness

8. I was introduced to the wind load calculations by my supervisors

9. I learned niches of the these softwares like importing a model from AutoCAD in ETABS, STAAD.Pro, AxisVM, understanding results of vibration analysis and mode-shifts, shortkeys of softwares, etc.

10. I learnt a concept that – softwares are for analysis and Design of members is done manually.

11. I was also assigned the responsibility of suggesting questionnaire for the Junior Engineer Examination of MHPWD, which also gave me a boost to my knowledge of civil engineering concepts

The overall conclusion of the second month was that I had developed my command over various structural engineering softwares and have understood the application of the results produced by them. The understanding of proper modeling of the structures and application of various loads on them was a major achievement. I understood which software would be suited for a particular condition.

The third month was quite interesting as the company officials started relying on me. The beginning was marked with a task of making a power presentation for the company for the purpose of marketing of the company owned structural designing software i.e. AxisVM. While making this presentation I learnt about various differences between other structural engineering softwares and AxisVM, and I got on a conclusion about in what respects this software is better over other software and what are its shortcomings. (Presentation Enclosed)

I got a clear view of the software and understood AxisVM thoroughly, like grasping over the short-keys, changing the colors according to my convenience, exporting and importing other models, making the analyzing the mode shapes of the structures and application of various types of loads, in all softwares. I understood that AxisVM has a better User Interface and even walls can be modeled in it helping in getting correct stiffness results of the structure.

In later half I focused on the advanced load applications like Wind Load and Earthquake (Seismic) loads. I learnt how to calculate them based on IS 875 part III and IS 1296 respectively. I have also prepared notes for remembering these calculations during this period.

CALCULATIONS (Earthquake Loads):

Now the following steps may be taken:

(a) Estimate fundamental time period Ta using empirical expressions given in the Code IS: 1893- 2002.

Ta= 0.075 $H^{0.75}$,

IS: 1893 Cl.7.6.1 for bare frame along each axis

Tax= 0.09h/√d along x-axis IS: 1893 Cl.7.6.2 for frame with substantial infills

Ta z = 0.09h/√b, along z-axis, IS: 1893 Cl.7.6.2 for frame with substantial infills

where h is the height of the building and d and b are the base dimensions of the building along x and z axis respectively.

(b) Calculate the design horizontal Seismic coefficient Ah

Now compute the fundamental time periods T/x and T/z for the bare frame along the two axes by

dynamic analysis. These are generally found to be higher than Tax and Taz respectively.

The design horizontal coefficient Ah is given by

Ah= (Z/2). (I/R). (Sa/g)

I was also assigned the task of learning CSI SAFE (software) by my supervisors; due to the urgency of their project submission I had modeled the Oman Bungalow's foundation in CSI Safe which was also approved for final submission. The complete modeling including application of loads, supports, etc was done by me. Hence I added CSI SAFE to my skill-set.

I was then allotted a task of application of the wind loads on the Oman Bungalow. Starting from calculations to analysis, I completed this work in 2 days by working late night for the job and even attending the office on Sunday. This involved meshing of the walls, and application of the wind loads on the skeletal frame.

To summarize, this month was a time when I was brought on to the live projects of the firm. During this time I assisted my supervisors in true sense. The key learnings which I got from this experience were:
1. Confidence in my selves
2. Working for the dead lines
3. True industrial experience of working in a team by dividing work
4. Working in Pressure of the seniors
5. Keeping calm
6. Learning new software skills, even when in emergency
7. Communicating with the team
8. Devising new and innovative but correct ways to achieve project completion in a time bound manner

FOURTH MONTH|EIGHT

The fourth month was marked by a project of Concrete Structural Analysis and Designing. It was a Pune Bungalow Project. I started it from beginning i.e. Column Orientation followed by modeling it on AxisVM, Reinforcement Designing of Beams, Columns, Slabs and Footing. Since this was my first project it took me about 2 weeks to complete it. During this project I learnt various concepts of and short tricks and advance concepts from my supervisors like –

1. Eccentric footing designing
2. Column size estimation
3. Curtailment of bars in beams
4. Combined footing designing
5. Modeling for future loads
6. Application of wind loads
7. Application of earthquake loads
8. Application of mode shapes of structures

I also modeled the floor and slabs in CSI SAFE for the Oman Bungalow project and hence analyzed it for various factors like deflection, reactions, etc. This was also approved for final submission to the architectural firm by my supervisors. I got to learn - how many complications are involved in large projects, what is the professional way of communication to put forth project objections to client organization, etc. I also saw Skype Meetings taking place between my organization and client organization.

During this period, another project was assigned to me of Steel Structure Designing of a Lime Stone Preparation Building. This project was industrial supporting structure of Lime Stone preparation Building for cement plant. Structure supports equipment's like Bag filter, Hopper, chimney, screen machine, Duct, Conveyors & mono rails. There were six separate buildings of various capacities and complexities, which were also modeled by us; 2 by each one of us. The complete modeling was done by me on STAAD.Pro.

This was the opportunity to learn, how steel structures are modeled and analyzed and hence designed. Assignment of Wind and Seismic Loads to structure of higher complexity was explained to me by my supervisors. This model was also approved by my supervisors for final submission to the client.

I wish to mention some of the unforgettable concepts which I learnt working on the live projects:

1. Earthquake resistant design is not earthquake proof design.
2. Sufficient lateral stiffness is required to ensure that building does not get damaged under minor shaking.
3. The frame should be consistent under major earthquakes also, although it is allowed to get deformed or have more deflections.
4. Structural designers have the duty to consider that the structure would be subjected to an earthquake atleast once during the life time of the structure for which it is designed.

All things in this universe are created twice. So, before we create structure on ground – i.e. Physically, we make it on software- and this is modeling of structure with all possible future acting forces.

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FIFTH MONTH|NINTH

I worked on the roof steel shade design for my own house. This was a completely different kind of project which my father had assigned me. Although being small in scale but was a great learning source. This project helped me to prepare the notes for choosing the Cross-Sections for our structural columns and purlins, which along with being economical should be stable. It helped me to brain-storm on various limitations of my house and how could I cope-up with them. This project was also important because I had also prepared the estimate of the expenses. In this project I played the role of being the client along with being a designer which helped me to understand requirements and expectations of my future clients.

During this month I studied various aspects of earthquake engineering. What roles the beam plays in maintaining the structural stability and improving the structure's stiffness.

During this time, I studied more about Degrees of Freedom of the structure and some thumb rules used in designing various members of the structure.

I learnt some theoretical basics of structural analysis during this month:

a. **Equilibrium**: The forces in the structure should have to be in equilibrium as these forces need to be balanced to achieve stability.

b. **Kinematics**: Is based on the fact that under the load the structure moves/deforms and takes an equilibrium state.

c. **Stress and strain compatibility**

Some of the many theoretical facts I learnt are:

a. Static determinacy or indeterminacy are the problems that the designer or the analyzer faces to analyses various equations due to the over rigidity of the structure although it is not the problem with the structure. Indeterminate structure means that the structure is too stiff as I have made too many constraints and hence I have to analyze too many constraints.

b. Analysis : For analysis, we have to satisfy the Equilibrium and for displacements we have to satisfy the Compatibility(i.e. sum of all the displacements = total displacements)

c. Beams are primarily subjected to flexure (Bending) and columns are primarily subjected to axial deformation. Although beams are very carefully checked for shear. A truss member is subjected to axial forces and it cannot be subjected to any other kind of force.

d. Girder vs Beam: Girders are basically a type of beam. actually there are two kinds of beam namely 'Primary

Beam' and 'Secondary Beam'. Girders comes under the category of primary beam, its main job is to directly transfer loads coming over it to columns upon which it rests. Now comes the secondary beam, its main job is to first transfer loads on it to Girders or Primary beams which in turn transfer the loads to columns supporting it. (And this is valid in case of one way system of load transfer in slabs).

On 30th November I had returned to Bhopal as per the plan of the course. But on arrival here, I was asked by our coordinator, to continue the internship for another one month. So I joined an Architectural Firm in MP Nagar, Bhopal namely "Heaven's Design".

I was given the job of designing their structures. I was the sole structure designer of this firm, here I had the most wonderful experience of my internship. I was given many projects to design from starting till end. All decisions here about the structure were my sole decisions. The projects on which I worked were

    a. Hostel Plan near DIG Bungalow,Bhopal

    b. Vishal Heights near Airport By-Pass Road, Bhopal

Here I was confronted with the challenge of my Home city i.e. Bhopal. The major challenge in both of these projects was – the design of Pile Foundation as the supporting soil being the Black Soil, which is one of the most expansive soils and foundations on it are subjected to sinking. I went through many books and codes looking for a perfect design for pile foundation. Ultimately I got it in IS-1291_Part_III.

While working on these projects, I faced with many problems like completing the work within the time span of 2-3 days,

which is the demand of the industry. I had to start from scratch as I didn't have previously made AutoCAD Drawings as other competent engineers had in market. It took me a week to complete these projects individually. But I believe, these projects have transformed me into a true civil engineer.

Some of the key learnings of this interesting month were:

1. I learned the code based design of Pile foundation
2. I understood the detailing process using SP34
3. Learned modeling – as I had modeled Vishal Heights Project in three different analysis softwares- AxisVM, STAAD.Pro, ETABS
4. Understood the advantages and limitations of all the three
5. Got good experience of – analyzing the software produced results
6. Understood the proper usage of these results for the purpose of structural designing
7. Learnt code based design concept of – biaxial bending of columns
8. Understood earthquake loads effect and diaphragm action of the softwares.
9. Understood the behavior of the structure during an earthquake
10. Understood the level of perfection required by the industry

ANALYSIS AND EVALUATION|ELEVENTH

The whole internship of 6 months was a great experience for me, which helped me and promoted me to do continuous learning and do mature thinking. The organization is very supportive to the interns and allows them to learn in a comfortable environment. Organization has a vision for the interns and looks at them as an asset to the organization. They always took care and sometimes even separate lunch was organized for me, as in during my meetings at MH-PWD office.

Organization always promoted me to learn hardwork and goal accomplishment habits by allowing me to work on live projects and always taking interest in allotting work aimed at achieving organizational objectives. Separate cabins and computer systems were always allotted to me inspite the fact there were space limitations in office.

I worked with dignity at the organization. I was given same respect as that of my supervisors, by other employees of the organization. I learnt organization culture very well and also participated well in festivals like Ganesh Chaturthi Celebrations, etc. with my supervisors.

The overall learning experience at CENS India Pvt. Ltd. had been great and invaluable. It also helped me to understand life in metro and I was lucky to face life's circumstances individually, which also taught me various invaluable lessons of life.

Weekly Progress Report

Month	Week	Task/Project	Status
July	**2014**		
	Week1	Study of IS Codes IS 875, IS 456-2000, IS 800	Done
	Week2	Theoritical Study of Designing Concepts	Done
	Week3	Study of Loading Distribution Patterns in Beams and Slabs	Done
	Week4	1 BHK Design by Hand Analysis and Calculations	Done
August	**2014**		
	Week1	Studied Axis VM	Done
	Week2	On Leave	
	Week3	Comparision of results of AxisVM and Etabs of Same Structures	Done
	Week4	Thorough study of Oman Resedential Project	Done
September	**2014**		
	Week1	Power Point Presentation on AxisVM	Done
	Week2	Learned SAFE and Modelled Foundation of Oman Project	Done
	Week3	Learned Wind Load Calculations and applied in Oman Project	Done
	Week4	Learned Seismic Load Calculations	Done

October	2014		
	Week1	Modelling and Design of Pune Bunglow Project	Done
	Week2	Slab and Footing Modelling for Oman Project	Done
	Week3	Diwali Leave	
	Week4	Steel Structure Modelling in STAAD PRO.	Done
November	2014		
	Week1	Roof Shed modeling and designing of my own house	Done
	Week2	Studying of basics of Steel Desiging	Done
	Week3	Studied Concepts of Earthquake Engineering	Done
	Week4	Attended Meetings with Maharashtra PWD, on Juniour Er. Examination Paper Setting related issues	Done
December	2014		
	Week1	Worked on a Old Bhopal Hostel Modeling (STAAD Model) and Designing Project	Done
	Week2	Modeling(STAAD,ETABS,AxisVM Model) Vishal Heights MultiStorey Resedential Building, Bhopal	Done
	Week3	Designed all structural components except Pile Foundation	Done
	Week4	Learned Pile Foundation Designed and Completed drafting on AutoCAD	Done

TIMELINE
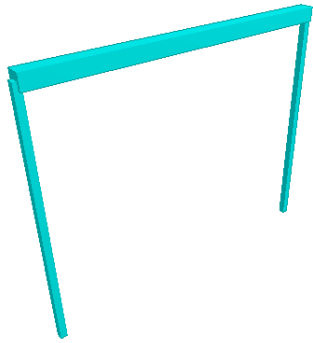
BEAM ANALYSIS I

Understood variation of moments in mid-span of beam and at support on changing the beam length.

BEAM ANALYSIS II

Understood orientation of column effect on beam's mid span and support moments.
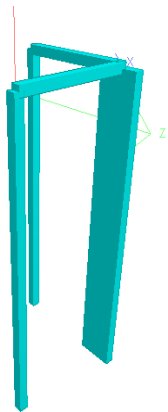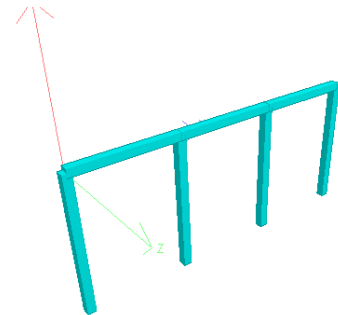
BEAM ANALYSIS III

To analyze support moments, on changing column orientation, size and material.

PLATE ANALYSIS IN STAAD.PRO

To analyze plate's results in STAAD.Pro, so that plate can be used for further analysis.
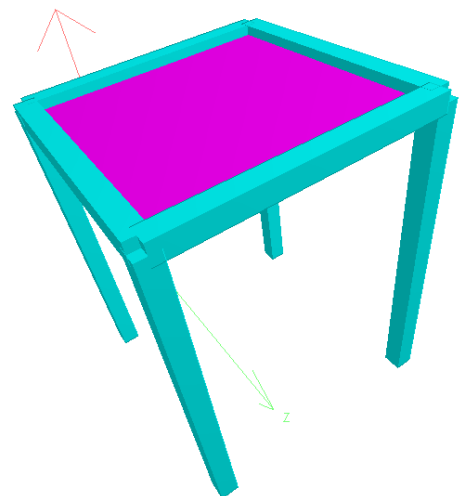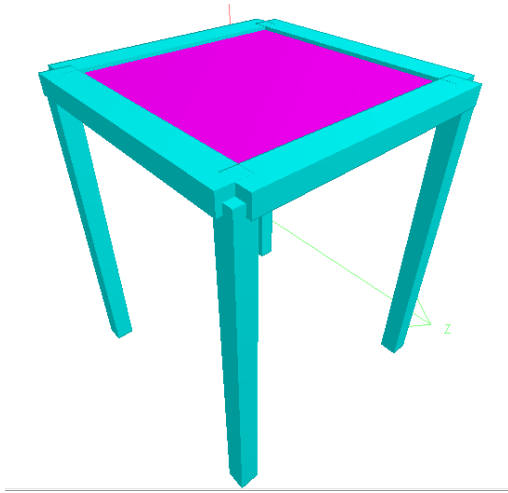
STEEL PROJECT STAAD.PRO MODELING AT CENS

Modeled my first steel structure in STAAD.Pro allotted to me at CENS
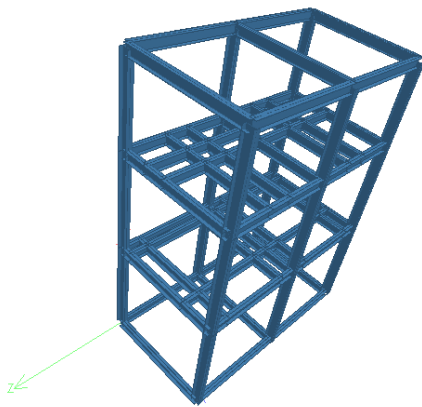
DUST FILTER MODELING IN STAAD- AT CENS

It was a live project allotted during the month of November, completely modeled by me.

PORTAL FRAME ANALYSIS (ANALYSING COLUMN LENGTH EFFECT)

To analyze change in moments in columns in case of space frame.
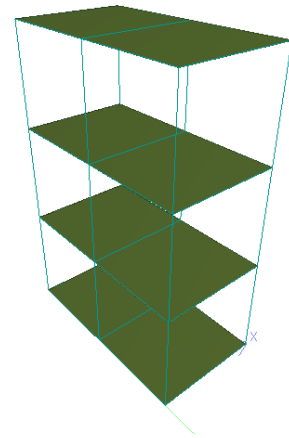
FIRST LIVE PROJECT MODELLED AT CENS

Although it was live project, but it could not be completed on time due to lack of understanding of steel structures
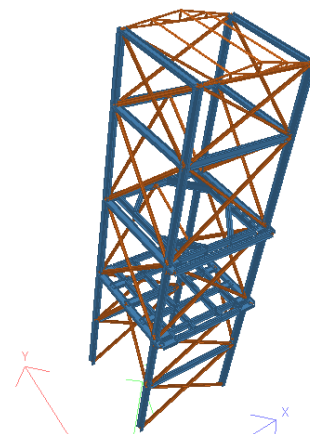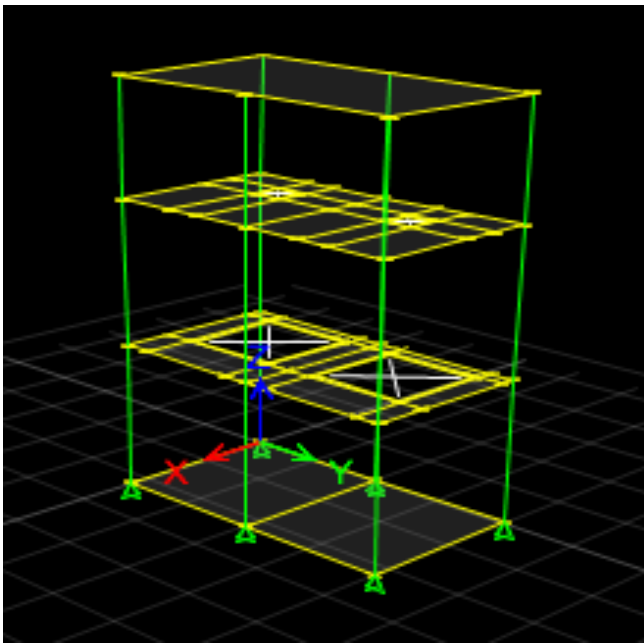
STEEL INDUCTRIAL BUILDING MODEL- ETABS

Another steel analysis model in ETABS to compare the results to develop understanding of ETABS.
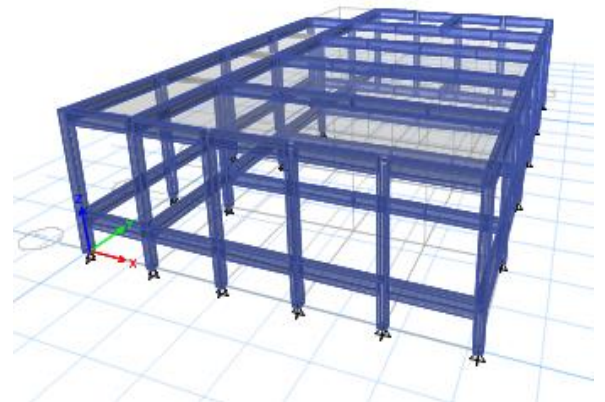
SHAH AND KARVE MODEL

Model to compare the theoretical results from Shah and Karve and ETABS analysis i.e. comparison of results of hand analysis and Software analysis.
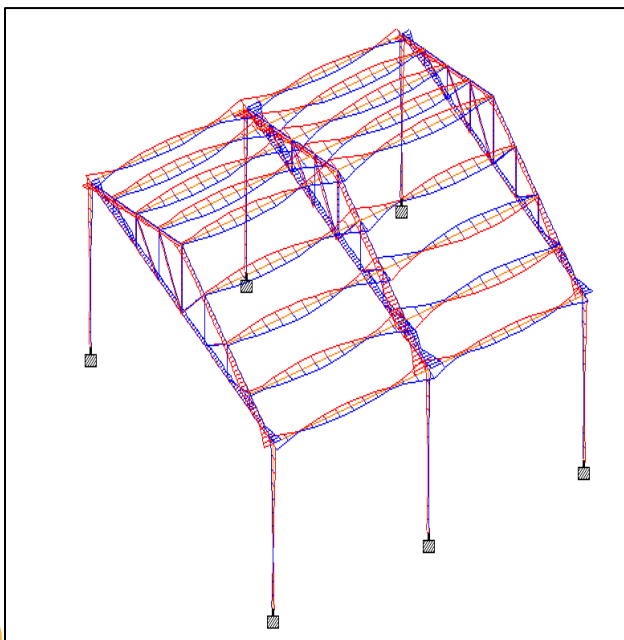
ROOF SHED MODELING IN STAAD.PRO AT CENS

Roof model of my own house, alloted to me by my respected father for the purpose of economic steel structure design.

SKETCH-UP MODEL

Modeling of commercial building for my own plot in Gulmohar area, based on the building bylaws was modeled by me during free time at Pune.

POWERPOINT PRESENTATION ON COMMERCIAL USE OF AXISVM

The complete presentation on AxisVM (structural engineering software) was made by me for the organization. Being the distributer and retailer of same in India, this presentation was a necessity.

OMAN PROJECT – SKETCHUP LAYOUT

This is a layout of Bungalow of Al-Zubair, complete design, detailing was done by CENS, I assisted my supervisors in the same project.

OMAN PROJECT –SKETCHUP LAYOU II

I calculated and assigned wind loads in the ETABS Model of this project.
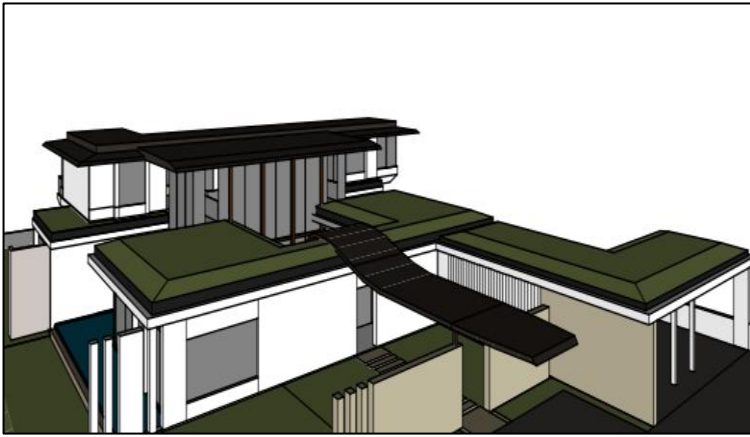
OMAN PROJECT ETABS MODEL

Oman Villa Project – ETABS Analysis Model, made by my supervisors although assisted by me. I have understood many concepts based on this project.
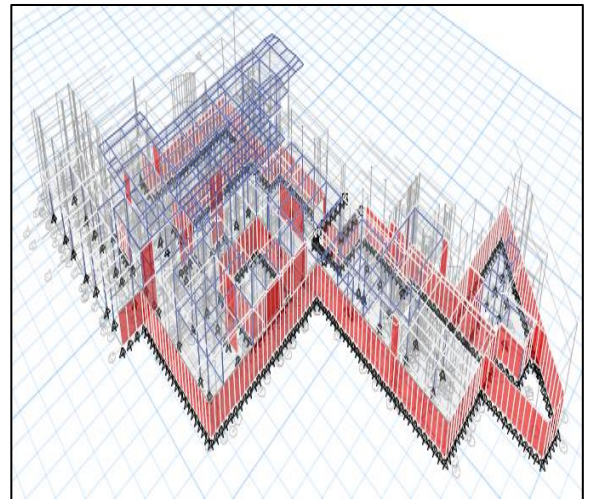

SAFE MODEL RESULTS –GROUND FLOOR SLAB-OMAN VILLA PROJECT

CSI SAFE Modeling was done for the slab as requested by the architect firm, this modeling was also done by me, under the supervision of my project incharge.

SAFE MODEL RESULTS – FIRST FLOOR SLAB- OMAN VILLA PROJECT

CSI SAFE Modeling was done for the slab as requested by the architect firm; this modeling was also done by me, under the supervision of my project in charge.

SAFE MODEL RESULTS– TOP FLOOR SLAB- OMAN VILLA PROJECT

CSI SAFE Modeling was done for the slab as requested by the architect firm; this modeling was also done by me, under the supervision of my project in charge.

FOUNDATION OF OMAN VILLA PROJECT – SAFE MODEL

Complete CSI Safe modeling of the foundation including the assignment of probable loads was done by me.
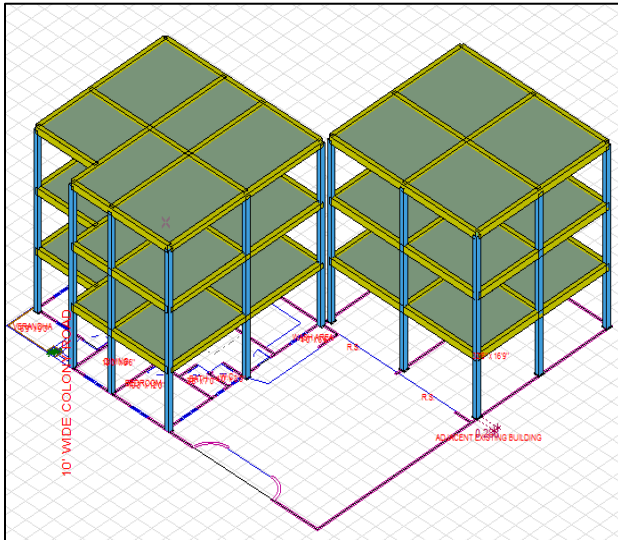
PUNE BUNGALOW MODEL IN AXISVM (RENDERED VIEW)

First R.C.C. complete model of a Pune Bungalow, which was also designed and detailed by me individually in AxisVM.
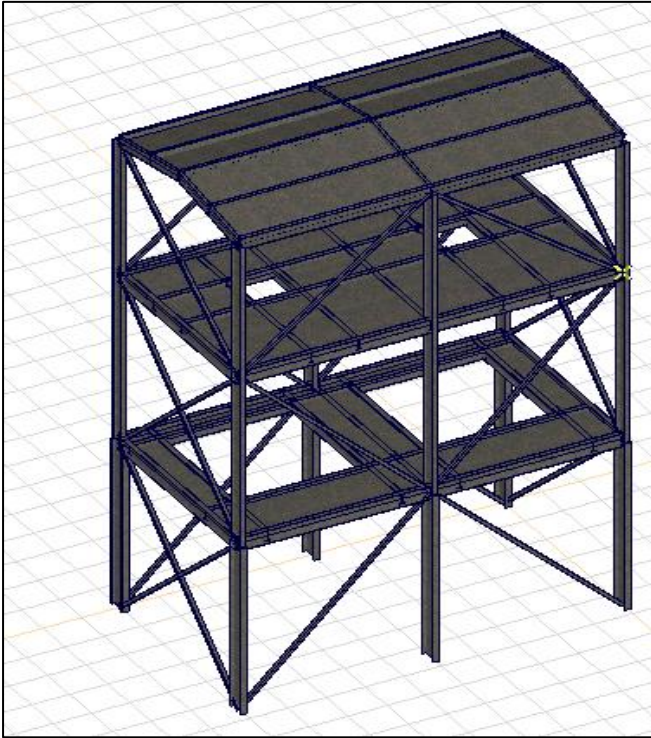

MOMENT COMING ON BEAMS- AXISVM RESULT

Understanding of the frame moment diagrams of Pune Bungalow Project, based on which the designing was done.
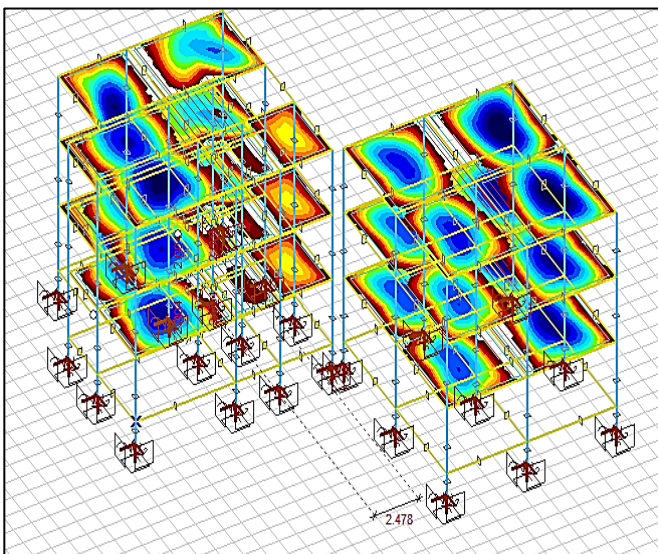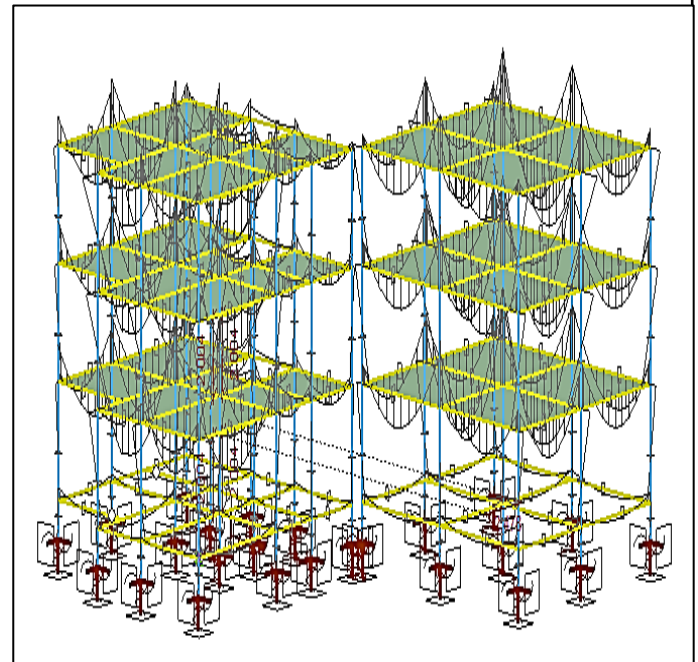
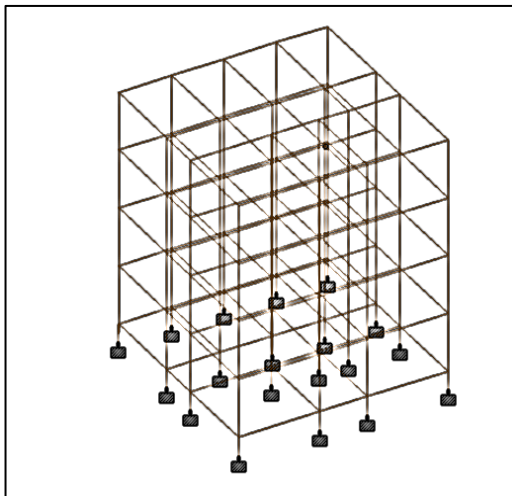## MOMENT COMING ON SLABS- AXISVM REUSLT

Understanding of the slab moment iso-surface results of Pune Bungalow Project, based on which the designing was done.

INDUSTRIAL STEEL BUILDING MODEL- AXISVM

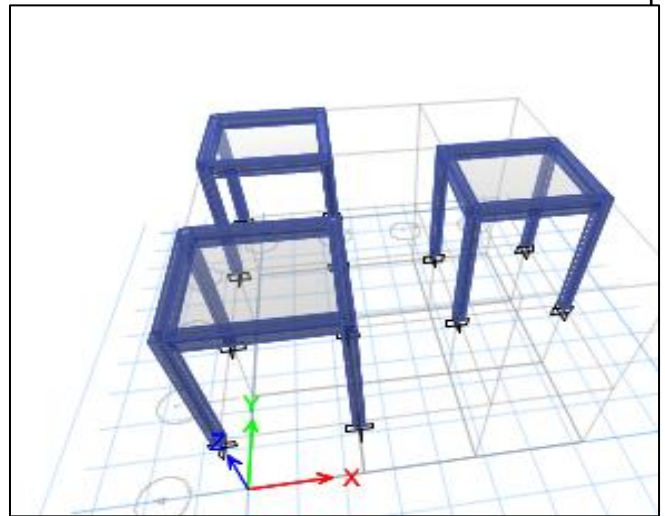Steel Industrial project undertaken by me to compare the results in different softwares.

PLATE, MEMBRANE AND SHELL COMPARISON- ETABS MODEL

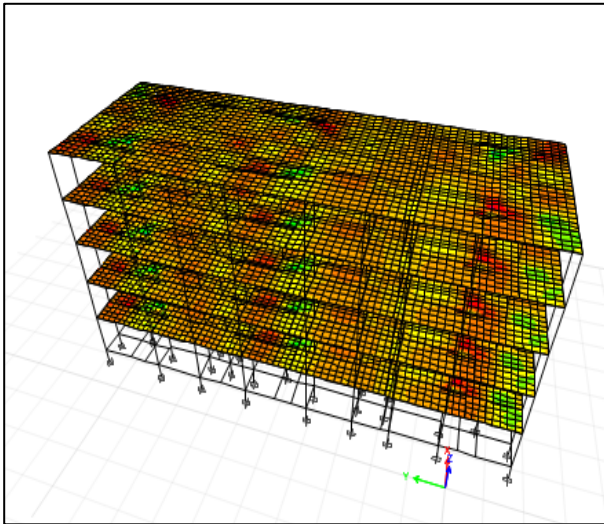To analyze the results of shell, membrane and plate in ETABS conclude them based on their definitions.
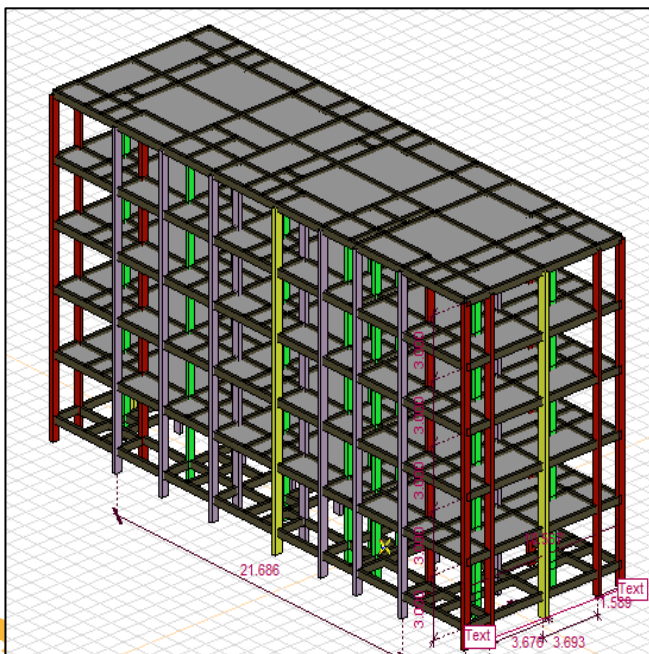

HOSTEL STRUCTURE – STAAD.PRO. MODEL

Hostel structure of Bhopal city, allotted by Heaven's Design Architect, complete modeling, designing and detailing was done

SLAB MOMENTS – VISHAL HEIGHTS – ETABS MODEL

The biggest project undertaken so far. Residential Multistory of Bhopal city, allotted by Heaven's Design Architect, complete modeling, designing and detailing was done individually by me, in December.
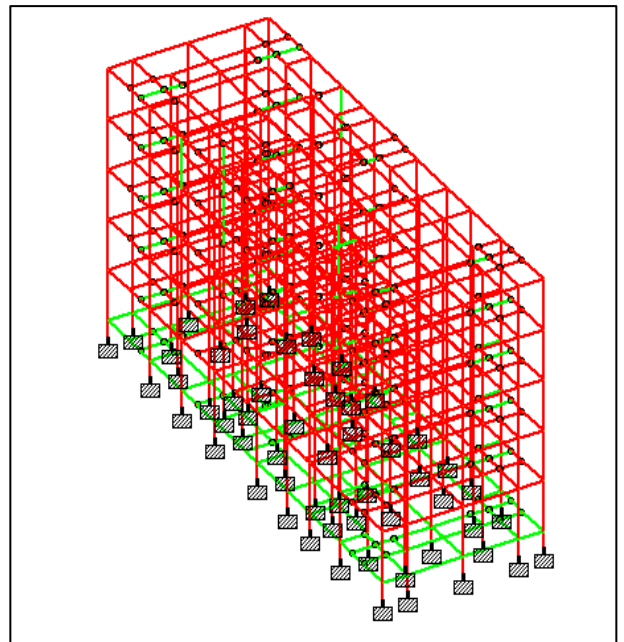

VISHAL HEIGHTS – STAAD.PRO. MODEL

Another model of the same project i.e. Vishal Heights is made in STAAD.Pro; made to compare the results and also to develop deeper understanding of the different analysis softwares

VISHAL HEIGHTS MODEL – AXISVM(RENDERED VIEW)

Another model of the same project i.e. Vishal Heights is made in AxisVM is made to compare the results and also to develop deeper understanding of the different softwares.

WORKSHOP|ELEVENTH

After this 6 month long hardwork, I got a chance at National Institute of Technical Teachers Training Institute, Bhopal to visit there as an expert of STAAD.Pro. and hence deliver STAAD.Pro. tutorial at the Earthquake Resistant Building Design and Analysis Workshop.

I was offered this workshop by Prof. K.K. Pathak, when I went to him for the purpose of showing my project of Vishal Heights-- Structural Designing and Drafting. I was impressed and invited me for the same.

I have prepared Handouts which were distributed to the participants. The work although didn't involve any complexity but it was very close to my heart and also close to my vision of becoming a structural designer.

The workshop was held on 14th January,2015 very successfully and good participation.

Learning during the workshop

1. Learnt about Auto- Earthquake loads in STAAD.Pro
2. Understood difference of Manual and STAAD.Pro calculations
3. Brushed up knowledge of deflection formulas
4. Also compared the model deflections with hand calculations

CONCLUSION|TWELTH

It had been a great internship of 5+1months. In short, it paved a way for the career of my choice of transforming my-selves into a structural engineer. The most important thing to learn for a structural engineer is – to understand the behavior of your structure; during its live span and during earthquake. For quicker delivery of work one needs to be prepared with all the tools and thumb rules which one should adopt only by experience without compromising accuracy.

There is no single way to make structural design as designs vary slightly from engineer to engineer. What's more important is accuracy of calculations and accuracy of understanding its behavior. I wish, this internship would contribute significantly to the career of my choice.

Also I wish to study subjects related to structural designing like Plastic Analysis, FEM, understand non-linear behavior of the concrete and structure as a whole, Time History Functions, etc which would enhance my knowledge of structural behavior and hence help to make more advanced and correct designing of my future structure.

BIBLIOGRAPHY

Books refered during internship –
Shah and Karve –   Illustrated Design of Reinforced Concrete Buildings
S. Ramamrutham –   Design of Reinforced Concrete Buildings
S. S. Bhavikatti   –   Design of Steel Structures
R.C. Hibbeler   –   Structural Analysis

CODES REFERRRED DURING INTERNSHIP:

--> IS 13920:1993 Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces – Code of Practice

--> IS: 4326-1993, "Earthquake Resistant Design and Construction of Buildings - Code of Practice (Second Revision)"

--> IS: 456 -2000 "Code of Practice for Plain and Reinforced Concrete"

-->IS: 1904-1987 "Code of Practice for Structural Safety of Buildings: Foundation

-->IS: 1905-1987, Code of Practice for Structural Safety of Buildings: Masonry

-->IS-NBC-2005: National Building Code of India

-->IS: 875-1987Design loads (other than earthquake) for buildings and structures, Part2 Imposed Loads

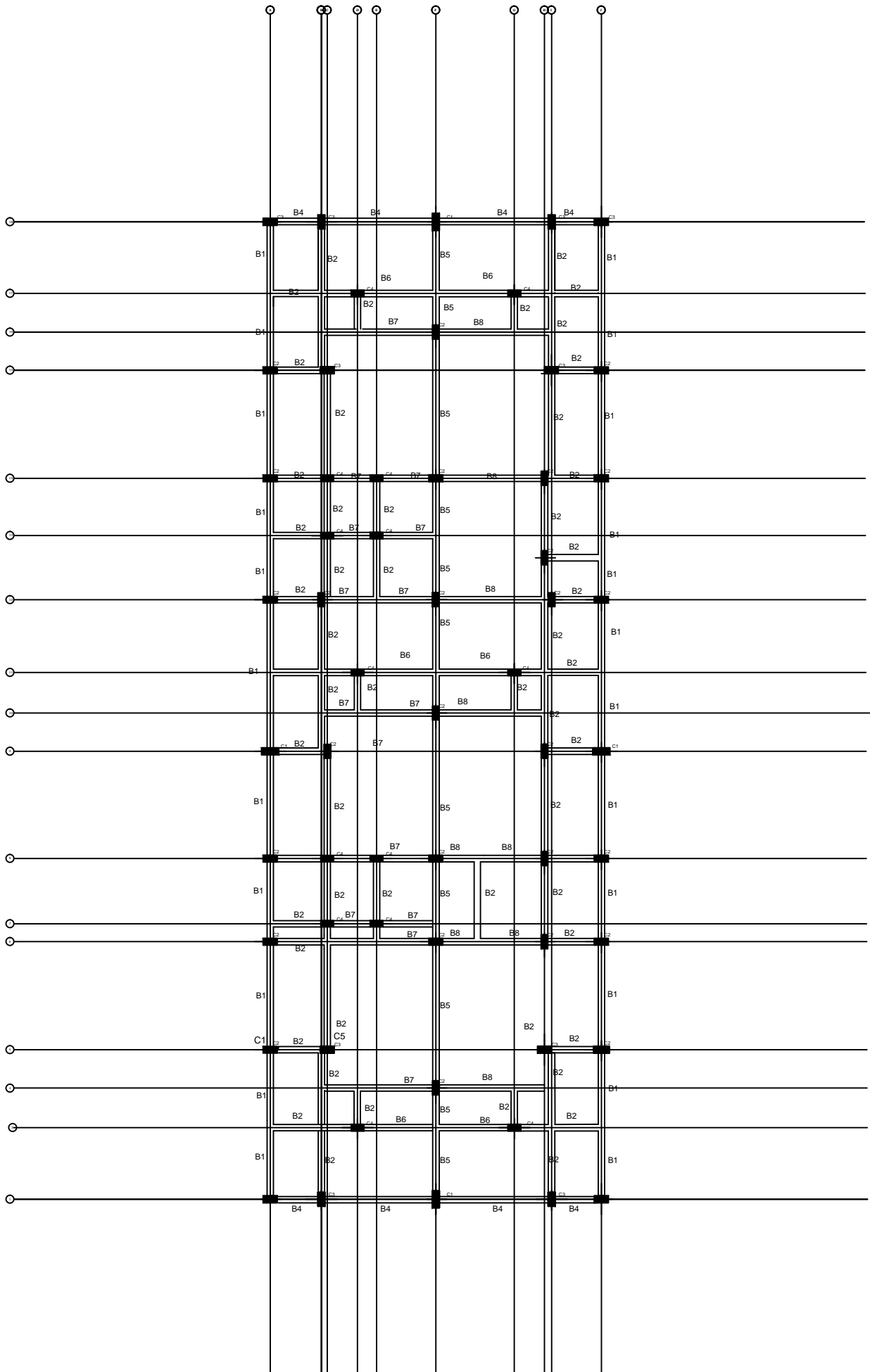--> IS: 875-1987Design loads (other than earthquake) for buildings and structures ,Part 3 Wind Loads
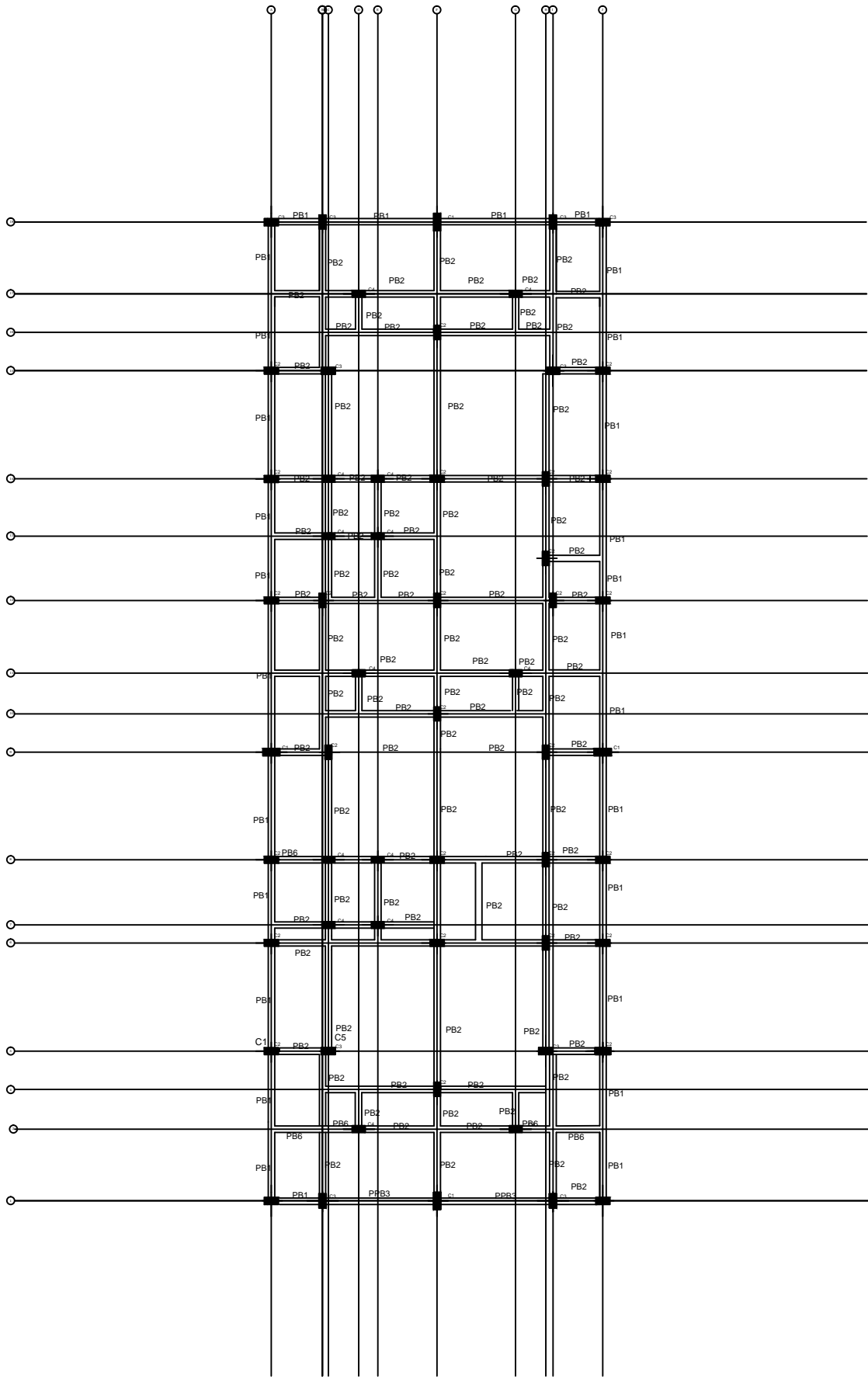
APPENDIX I

VISHAL HEIGHTS, BHOPAL

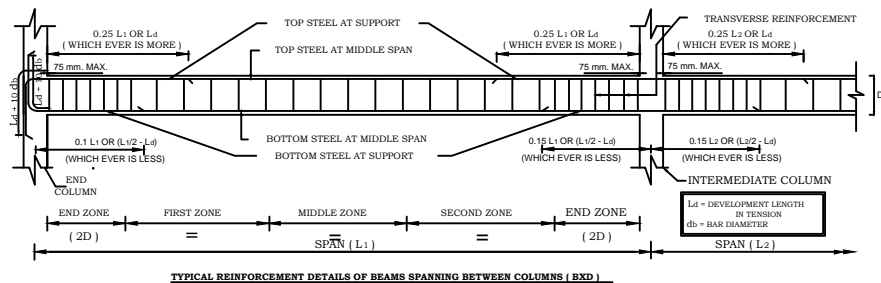# PROJECT VISHAL HEIGHTS
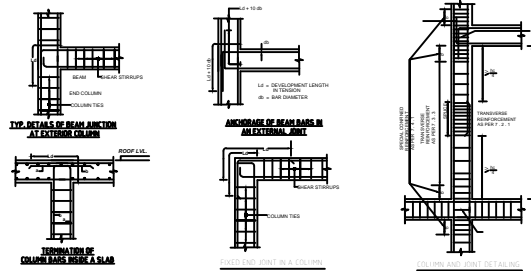
BEAM PLAN

PLINTH BEAM PLAN

COLUMN DETAILS

REINFORCEMENT DETAILS OF BEAMS AT FIRST, SECOND AND THIRD FLOOR LEVEL. :-

S.NO.	BEAM NO.	SIZE (B x D)	LONGITUDINAL REINFORCEMENT						TRANSVERSE REINFORCEMENT				MIX
			LEFT SUPPORT		MIDDLE SPAN		RIGHT SUPPORT		END ZONE	FIRST ZONE	MIDDLE ZONE	SECOND ZONE	
			TOP FACE	BOTTOM FACE	TOP FACE	BOTTOM FACE	TOP FACE	BOTTOM FACE					
1.	PB₁	200 x 350	2#12	2#12	2#12	2#12	2#12	2#12	# 8 @ 100	# 8 @ 150	# 8 @ 150	# 8 @ 150	M-20
2.	PB₂	200 x 350	2#12	2#12	2#12	2#12	2#12+2#12	2#12	# 8 @ 100	# 8 @ 150	# 8 @ 150	# 8 @ 150	M-20
3.	PB₃	200 x 350	2#12	2#12	2#12	2#12	3#12	3#12	# 8 @ 100	# 8 @ 150	# 8 @ 150	# 8 @ 150	M-20
4.	B₁	200 x 400	4#16+2#12	4#12	3#12	3#12	4#16+2#12	4#12	# 8 @ 100	# 8 @ 150	# 8 @ 150	# 8 @ 150	M-20
5.	B₂	200 x 400	3#16+2#12	2#16	3#16	2#16	3#16+2#12	2#16	# 8 @ 100	# 8 @ 150	# 8 @ 150	# 8 @ 150	M-20
6.	B₃	200 x 350	3#12	3#12	3#12	3#12	3#12	3#12	# 8 @ 100	# 8 @ 150	# 8 @ 150	# 8 @ 150	M-20
7.	B₄	200 x 400	4#16+2#12	2#12+2#16	2#12	2#12+2#16	4#16+2#12	2#12+2#16	# 8 @ 100	# 8 @ 150	# 8 @ 150	# 8 @ 150	M-20
8.	B₅	200 x 400	4#16+2#12	3#12	2#12	3#12	4#16+2#12	3#12	# 8 @ 100	# 8 @ 150	# 8 @ 150	# 8 @ 150	M-20
9.	B₆	200 x 350	3#12	2#12	2#12	2#12	3#12	2#12	# 8 @ 100	# 8 @ 150	# 8 @ 150	# 8 @ 150	M-20
10.	B₇	200 x 350	3#12	2#12	2#12	2#12	2#12	2#12	# 8 @ 100	# 8 @ 150	# 8 @ 150	# 8 @ 150	M-20
11.	B₈	200 x 350	2#12	3#12	2#12	3#12	3#12	2#12	# 8 @ 100	# 8 @ 150	# 8 @ 150	# 8 @ 150	M-20

DETAILS OF BARS IN COLUMN

TYP. DETAILS OF BEAM JUNCTION AT EXTERIOR COLUMN

TERMINATION OF COLUMN BARS INSIDE A SLAB

ANCHORAGE OF BEAM BARS IN AN EXTERNAL JOINT

Ld = DEVELOPMENT LENGTH IN TENSION
db = BAR DIAMETER

FIXED END JOINT IN A COLUMN

COLUMN AND JOINT DETAILING

TYPICAL REINFORCEMENT DETAILS OF BEAMS SPANNING BETWEEN COLUMNS (BXD)

Ld = DEVELOPMENT LENGTH IN TENSION
db = BAR DIAMETER

COLUMN SCHEDULE

STOREY	COLUMNS	SIZE a	SIZE b	LONGITUDINAL STEEL	TRANSVERSE STEEL	MIX DESIGN
G	C1	550	230	16Ø - 8, 20Ø-6 Bars	8 mm Ø Detail A	M-30
G	C2	230	450	20Ø- 4 Bar+16Ø-8 bars	8 mm Ø Detail- B	M-30
G	C3	220	450	16Ø - 12 Bars	8 mm Ø Detail- B	M-30
G	C4	210	410	16Ø - 6, 20Ø-4 Bars	8 mm Ø Detail- C	M-30
I	C1	550	230	16Ø - 12 Bars	8 mm Ø Detail- B	M-20
I	C2	230	450	20Ø- 4 Bar+16Ø-8 bars	8 mm Ø Detail- B	M-30
I	C3	220	450	16Ø - 12 Bars	8 mm Ø Detail- B	M-20
I	C4	210	410	16Ø - 4, 20Ø-4 Bars	8 mm Ø Detail- D	M-30
II	C1	550	240	16Ø - 10 Bars	8 mm Ø Detail- C	M-20
II	C2	230	450	20Ø-2 + 16Ø -8 Bars	8 mm Ø Detail- C	M-25
II	C3	220	450	16Ø - 8 Bars	8 mm Ø Detail- D	M-20
II	C4	210	410	16Ø - 10 Bars	8 mm Ø Detail- C	M-30
III	C1	550	240	16Ø - 6 Bars	8 mm Ø Detail- E	M-20
III	C2	230	450	16Ø - 8 Bars	8 mm Ø Detail- D	M-20
III	C3	220	450	12Ø - 6 Bars	8 mm Ø Detail- E	M-20
III	C4	210	410	16Ø - 8 Bars	8 mm Ø Detail- D	M-25
IV	C1	550	240	16Ø - 6 Bars	8 mm Ø Detail- E	M-20
IV	C2	230	450	16Ø - 6 Bars	8 mm Ø Detail- E	M-20
IV	C3	220	450	16Ø-4 Bars	8 mm Ø Detail- F	M-20
IV	C4	210	410	16Ø - 6 Bars	8 mm Ø Detail- E	M-20

16Ø - 8, 20Ø-6 Bars   20Ø- 4 Bar+16Ø-8 bars   16Ø - 8 +20Ø-2 Bars   16Ø - 8, 20Ø-2 Bars

10 -16變   450mm   8 -16變   6 -12
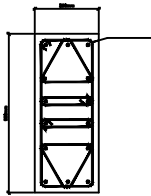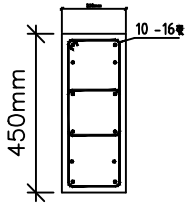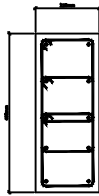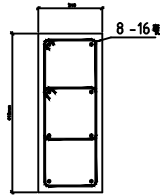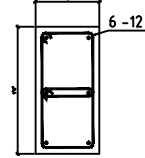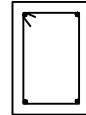
DETAIL – A   DETAIL – B   DETAIL – C   DETAIL – D   DETAIL – E   DETAIL – F

PILE CAPS PLAN
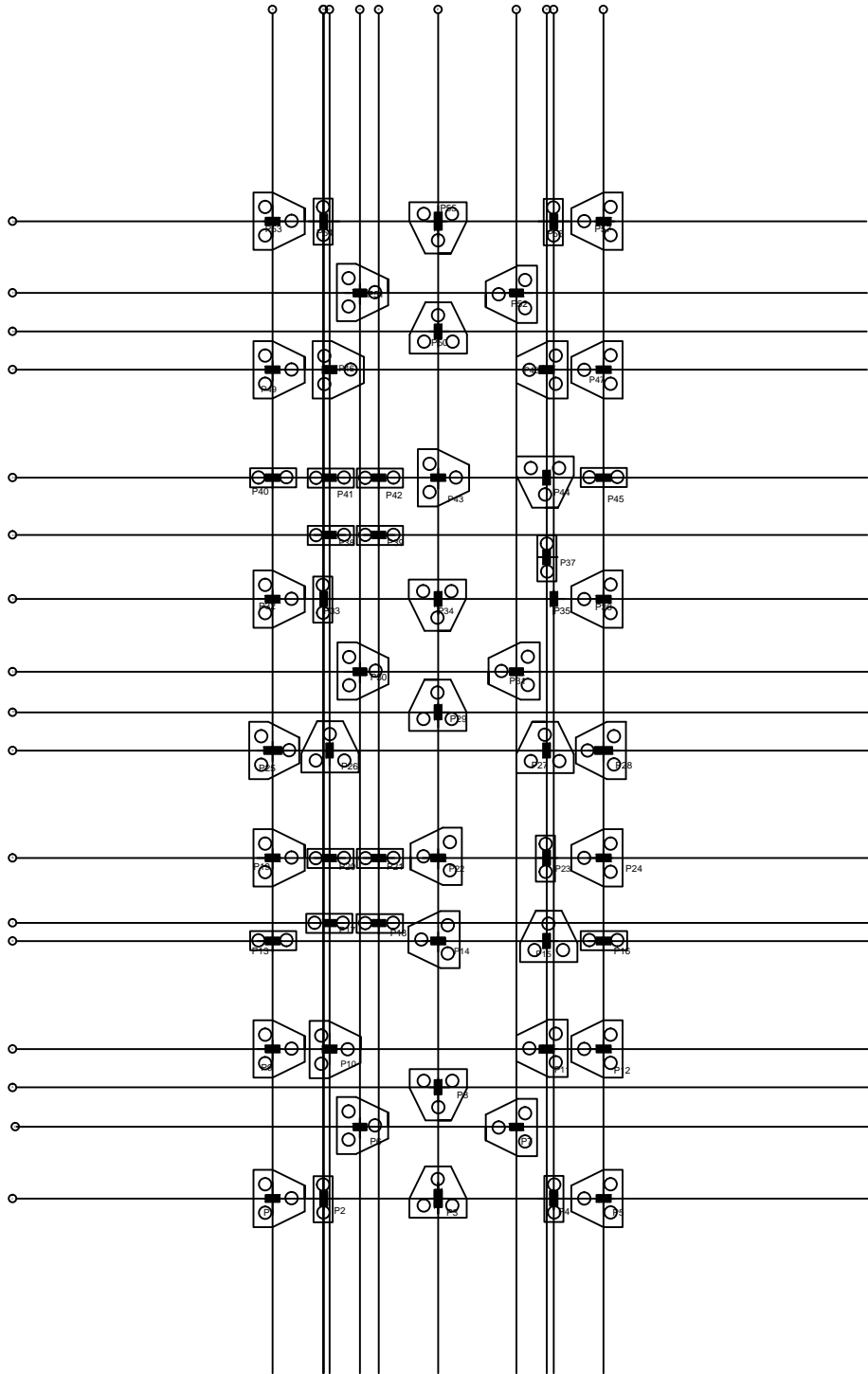
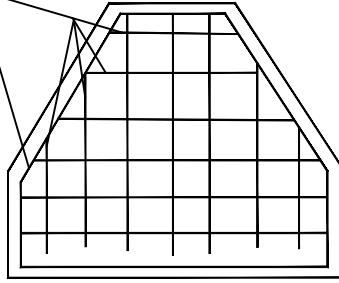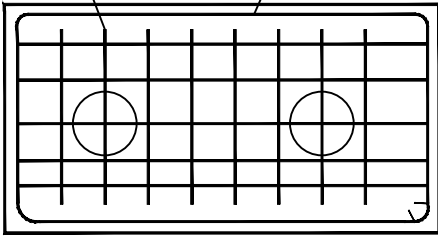| PILES	DIMENSIONS
50,8,29,14,44	DETAIL A
28,43,3,47,55,36,10,25,49	DETAIL B
54,2,35,56,4,16,13,24,40,45,5,57	DETAIL C
11,6,30,46,51,31,52,32,15,23,44,33	DETAIL D
17,18,19,37,39,53,1,41,20,21,42,38	DETAIL E
9,48,12,27,26,22,7,	DETAIL B

PILE DETAILS

Sl. NO.	PILE	PILE SIZE	No. OF BULBS	DIA OF BULBS	REINFORCEMENT	TIES
1.	P1	DIA 15.75"	2		6-12Ø	8Ø @ 12" C\C
2.	P2	DIA 14.76"	2		5-12Ø	8Ø @ 12" C\C

Sl. NO.	PILE CAP	OVERALL DEPTH
1.	PC1(3 Pile)	800MM
2.	PC2(2 Pile)	800MM

HORIZONTAL TIES NOMINAL REINFORCEMENT(10Ø AT 150 MM C/C)
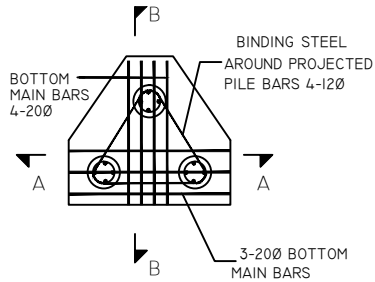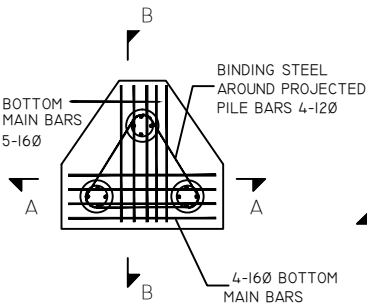
HORIZONTAL TIES TO PREVENT BURSTING
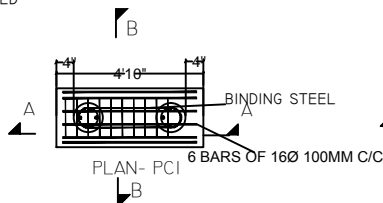
FOR THREE PILES (REINFORCEMENT PLAN)
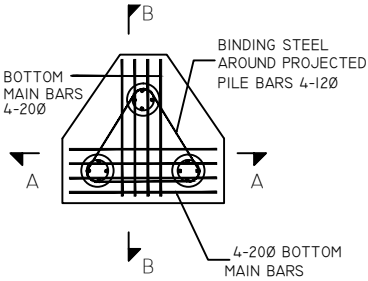
BINDING STEEL AROUND PROJECTED PILE BARS 4-12Ø

BOTTOM MAIN BARS 4-20Ø

4-20Ø BOTTOM MAIN BARS

BOTTOM PLAN -PC2
DETAIL -A

BINDING STEEL AROUND PROJECTED PILE BARS 4-12Ø

BOTTOM MAIN BARS 4-20Ø

3-20Ø BOTTOM MAIN BARS

BOTTOM PLAN -PC2
DETAIL -B

BINDING STEEL AROUND PROJECTED PILE BARS 4-12Ø

BOTTOM MAIN BARS 5-16Ø

4-16Ø BOTTOM MAIN BARS

BOTTOM PLAN -PC2
DETAIL -C

BINDING STEEL

PLAN- PC1

6 BARS OF 16Ø 100MM C/C

4'10"

TWO PILES (PILE CAP)
FOR DETAIL D

BINDING STEEL

PLAN- PC1

5 BARS OF 16Ø AT 120MM C/C

4'10"

TWO PILES (PILE CAP)
FOR DETAIL E

80MM COVER

5-16Ø
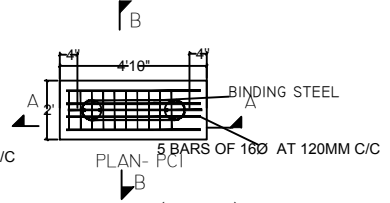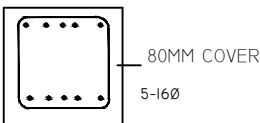
SECTION-BB

DETAIL -E

2-12Ø

80MM COVER

6-16Ø
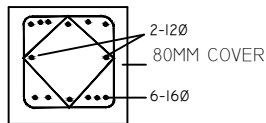
SECTION-BB

DETAIL -D

PILE DETAILS

8MMØ RINGS
@ 200 MM C/C

STARTER BAR

HORIZONTAL TIES

AT I50MM C/C

BARS BENT AT 90°

SECTION-AA

GRADE BEAM

SHEAR REINF.

STIRRUPS

MAIN BARS

FIRST BULB

SECOND / LAST BULB

STIRRUPS

MAIN BARS

FIRST BULB

SECOND / LAST BULB

P1

1.2M

P1   P1

COLUMN

80MM COVER

SECTION-BB

SECTION-BB(TWO PILES)
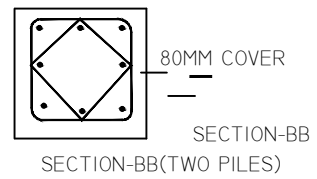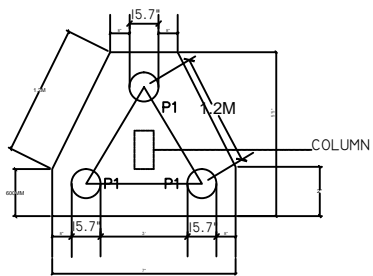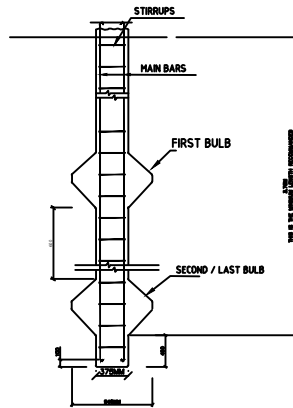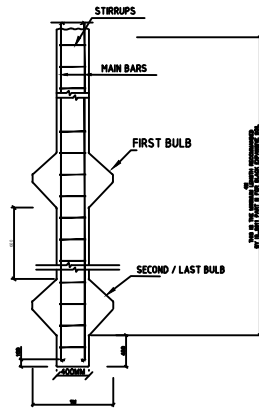
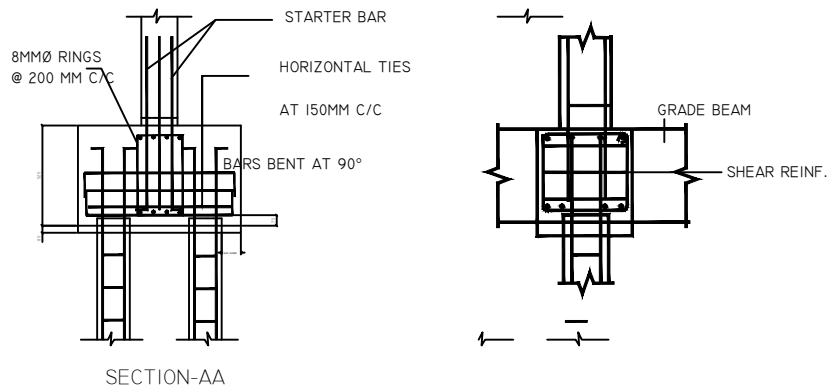| Sl. NO.	SLAB	TYPE OF SLAB	SLAB THK. (MM.)	REINFORCEMENT ALONG SHORT SPAN	REINFORCEMENT ALONG LONGER SPAN	GRADE
1.	S1	ONE WAY	120	8 ∅ @ 200 mm C/C	8 ∅ @ 150 mm C/C	M−20
2.	S2	ONE WAY	120	8 ∅ @ 150 mm C/C	8 ∅ @ 150 mm C/C	M−20
3.	S3	TWO WAY	120	10 ∅ @ 90 mm C/C	10 ∅ @ 90 mm C/C	M−20
4.	S4	ONE WAY	120	8 ∅ @ 150 mm C/C	8 ∅ @ 200 mm C/C	M−20
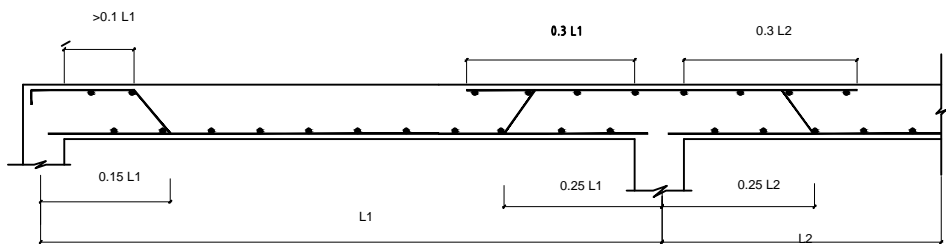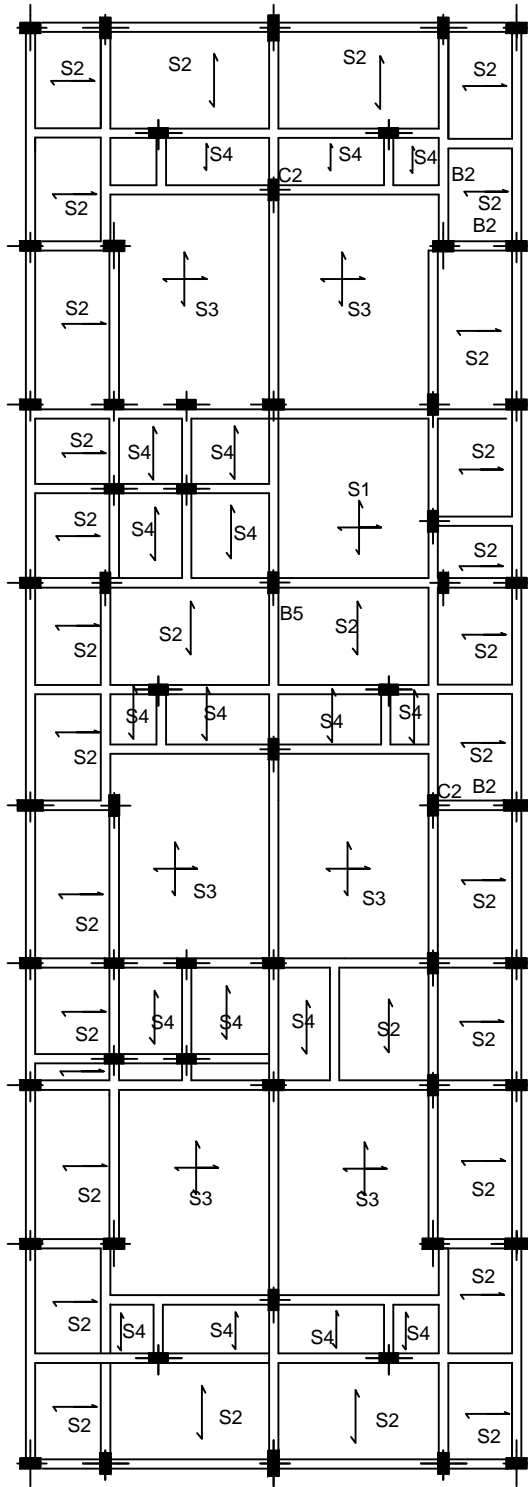
OVERALL SCHEDULE

GENERAL CONCRETE NOTES

1. THIS DESIGN IS BASED ON THE DUCTILITY REQUIREMENT OF THE
   EARTHQUAKE RESISTANT STRUCTURES, AS SPEECIFIED BY IS_13920

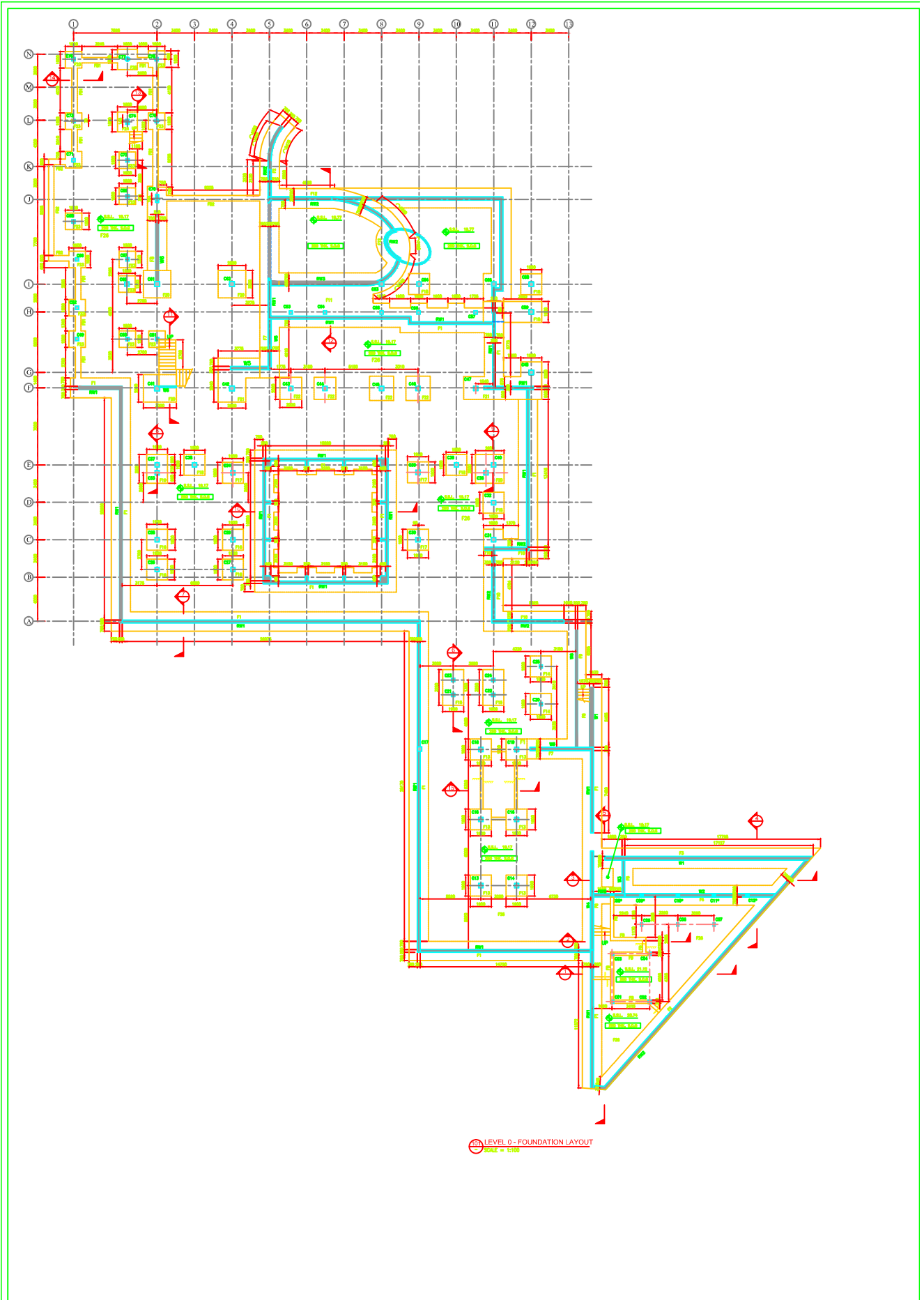2. MIX DESIGN AS PRESCRIBED SHOULD BE STRICTLY ADHERED TO.

3. ANY DISCREPANCY IN THE ARCHITECTURAL AND STRUCTURAL
   DRAWING SHALL BE INTIMATED TO THIS OFFICE AND GOT
   RECONCILED BEFORE EXECUTION.

4. CLEAR COVER TO ALL MAIN REINFORCEMENT IN PILE
   SHAFT SHALL BE NOT LESS THAN 50 MM.

5. A LEVELLING COURSE OF PLAIN CONCRETE OF ABOUT
   80 MM THICKNESS MAY BE PROVIDED UNDER THE PILE CAPS.

6. THE CLEAR COVER FOR THE MAIN REINFORCEMENT FOR THE
   BOTTOM OF CAP SHALL NOT BE LESS THAN 80 MM.

7. CONCRETE GRADE SHALL BE M-20 WITH
   53 GRADE CEMENT.

8. REINFORCEMENT SHALL BE HIGH STRENGTH DEFORMED BARS OF
   GRADE Fe 415 CONFORMING TO IS 456-2000

9. LAP LENGTH IN REIN FORCING BARS SHALL CONFORM TO
   CLAUSE 25.2.5.1 OF IS 456 1978 GENERALLY USED 57 DIA.

10. NOT MORE THAN 50% OF TOTAL COL. BARS SHALL BE LAPPED
    AT ANY SECTION OF COLUMN. LAPS SHALL BE STAGGERED AND
    AVOIDED AT THE PLACES OF MAX. STRESS. A LAP SHALL BE
    CONSIDERED STAGGERED IF THE CENTRE TO CENTRE DISTANCE
    OF THE LAP IS NOT LESS THAN 1.3 TIMES .THE DEVELOPMENT
    LENGTH AS MENTIONED IN NOTE NO. (7).

11. S.B.C OF SOIL HAS BEEN TAKEN AS 10 TON /SQUARE METRE
    AT A DEPTH OF 2.70 MET., AS PER INFORMATION PROVIDED.

12. BUILDING HAS BEEN DESIGNED FOR (P+4 STOREIES) SEISMIC
    ZONE II AS PER IS:1893 (PART I) : 2002

MIX	IN TENSION (Ldt)	IN COMPRESSION (Ldc)
M-20	47Ø	38Ø

13. CONCRETE SHOULD BE PROPERLY VIBRATED, 28 DAYS CURING
    TO BE DONE AS PER IS SPECIFICATION.

MEMBER	CLEAR COVER
SLABS	25 MM
COLUMNS	30 MM
BEAMS	30MM
PILE CAP	100 MM
PILES	50 MM

APPENDIX B

DETAILS OF OTHER PROJECTS DURING INTERNSHIP

GLIMPSE OF OMAN PROJECT SECTIONAL VIEW

LEVEL 0 - FOUNDATION LAYOUT
SCALE = 1:100

GLIMPSE OF OMAN PROJECT SECTIONS I

SECTION 1
SCALE = 1:50

SECTION 2
SCALE = 1:50

SECTION 4
SCALE = 1:50

SECTION 3
SCALE = 1:50

SECTION 5
SCALE = 1:50

SECTION 6
SCALE = 1:50

SECTION 7
SCALE = 1:50

SECTION 8
SCALE = 1:50

SECTION 9
SCALE = 1:50

SECTION 10
SCALE = 1:50

SECTION 11
SCALE = 1:50

SECTION 12
SCALE = 1:50

SECTION 13
SCALE = 1:50

SECTION 14
SCALE = 1:50

SECTION 15
SCALE = 1:50
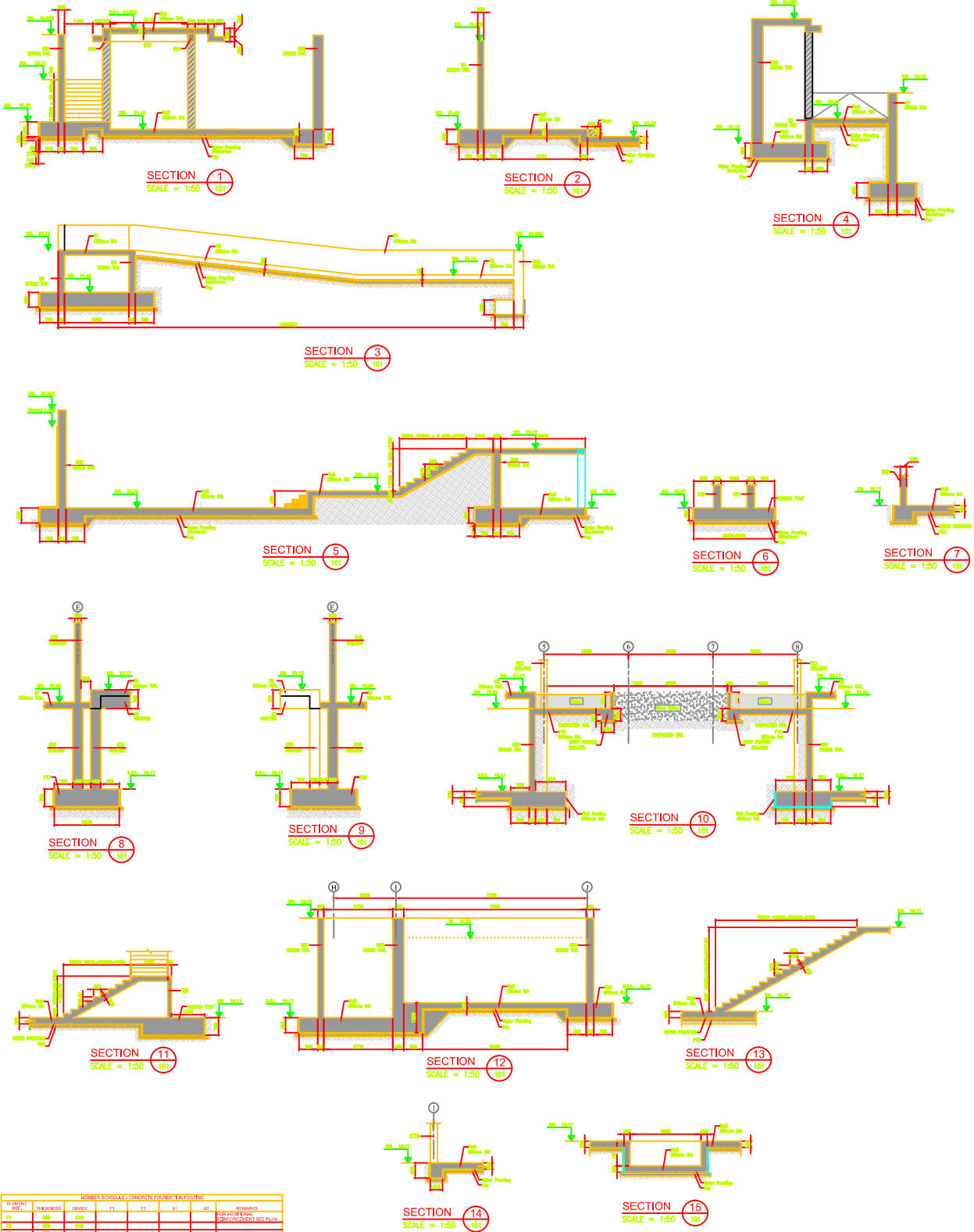
MEMBER SCHEDULE - CONCRETE FOUNDATION FOOTING

MEMBER SCHEDULE - CONCRETE COLUMNS

MEMBER SCHEDULE - CONCRETE WALLS

MEMBER SCHEDULE - RAMP

GLIMPSE OF OMAN PROJECT SECTIONS II

LEVEL 1 - GROUND FLOOR LAYOUT
SCALE = 1:100

LEGENDS:
RC Column / Wall
RC Column / Wall Stop at this floor

GLIMPSE OF OMAN PROJECT SECTIONS III

SECTION 1 — SCALE = 1:50

SECTION 2 — SCALE = 1:25

SECTION 3 — SCALE = 1:25

SECTION 4 — SCALE = 1:50

SECTION 5 — SCALE = 1:50

SECTION 6 — SCALE = 1:25

SECTION 7 — SCALE = 1:50

SECTION 8 — SCALE = 1:50

SECTION 9 — SCALE = 1:25

SECTION 10 — SCALE = 1:25

SECTION 11 — SCALE = 1:25

SECTION 12 — SCALE = 1:50

SECTION 13 — SCALE = 1:50

CONCRETE BEAM MEMBER SCHEDULE

BEAM MARK	SIZE WIDTH (MM) x DEPTH (MM)	GRADE (CUBE)	REMARKS
B1	300 X 600	C40	
B2	300 X 600	C40	
B3	400 X 600	C40	
B4	300 X 600	C40	
B5	300 X 600	C40	
B6	300 X 400	C40	
B7	400 X 700	C40	
B8	400 X 400	C40	
B9	300 X 700	C40	
B10	300 X 700	C40	
B11	400 X 400	C40	
B12	300 X 700	C40	
B13	300 X 700	C40	
B14	300 X 700	C40	
B15	300 X 600	C40	
B16	300 X 600	C40	
B17	300 X 400	C40	
B18	300 X 400	C40	
B19	300 X 600	C40	
B20	300 X 600	C40	

CONCRETE SLAB SCHEDULE

SLAB MARK	THICKNESS (MM)	GRADE (CUBE)	TYPICAL REINFORCEMENT
S1	200	C40	
S2	300	C40	
S3	250	C40	
S4	200	C40	
S5	225	C40	
S6	200	C40	
S7	300	C40	
S8	400	C40	
S9	300	C40	
S10	225	C40	

CONCRETE FLAT SLAB SCHEDULE

SLAB MARK	THICKNESS (MM)	GRADE (CUBE)	TYPICAL REINFORCEMENT
C01	300	C40	
C02	300	C40	
C03	300	C40	
C04	300	C40	
C05	300	C40	
C06	300	C40	
C07	300	C40	
C08	300	C40	
C09	300	C40	
C10	300	C40	
C11	300	C40	
C12	300	C40	
C13	300	C40	

MEMBER SCHEDULE - CONCRETE COLUMNS

ELEMENT REF.	SIZE (Width x Depth)	GRADE	REMARKS
FC1	250X250	C40	START FORM WALL
FC2	250X250	C40	START FORM WALL
FC3	250X250	C40	
FC4	250X250	C40	
C15,16	400X400	C40	
C17	300X300	C40	
C24	300X300	C40	
C26,27,28,29	300X300	C40	
C30	300X300	C40	
C31,32,38,39	300X300	C40	
C37,40	300X300	C40	
C41,42,61,62	450X450	C40	
C43,44,45,46,47	400X400	C40	
50,80	300X300	C40	
C53,54,55,56,57	300X300	C40	
C48,58,59	400X400	C40	
C63,64,65	400X400	C40	

20' WIDE ROAD

10' WIDE COLONY ROAD

VERANDHA
6'9" x 9'3"

TOILET
5'8" x 7'0"

BEDROOM
12'0" x 14'0"

LIVING ROOM
12'0" x 14'0"

WARDROBE
5'8" x 6'6"

PUNE BUNGALOW PROJECT

UP

DINING
18'0" x 8'6"

OPEN TO SKY

BEDROOM
10'3" x 12'0"

KITCHEN
10'3" x 12'0"

ADJACENT EXISTING BUILDING

BATH
3'6" x 7'0"

W.C.
4'0" x 3'0"

WASH AREA
4'0" x 3'6"

R.S.

STORE - 1
32'6" x 16'9"

R.S.

STORE - 2
32'6" x 16'9"

LAYOUT PLAN OF COLUMNS

C1　　C2　　C3　　C4　　C5

C6　　C7　　C8　　C9　　C10

C11　　C12　　C13　　C14　　C15

C16　　C17　　C18　　C19
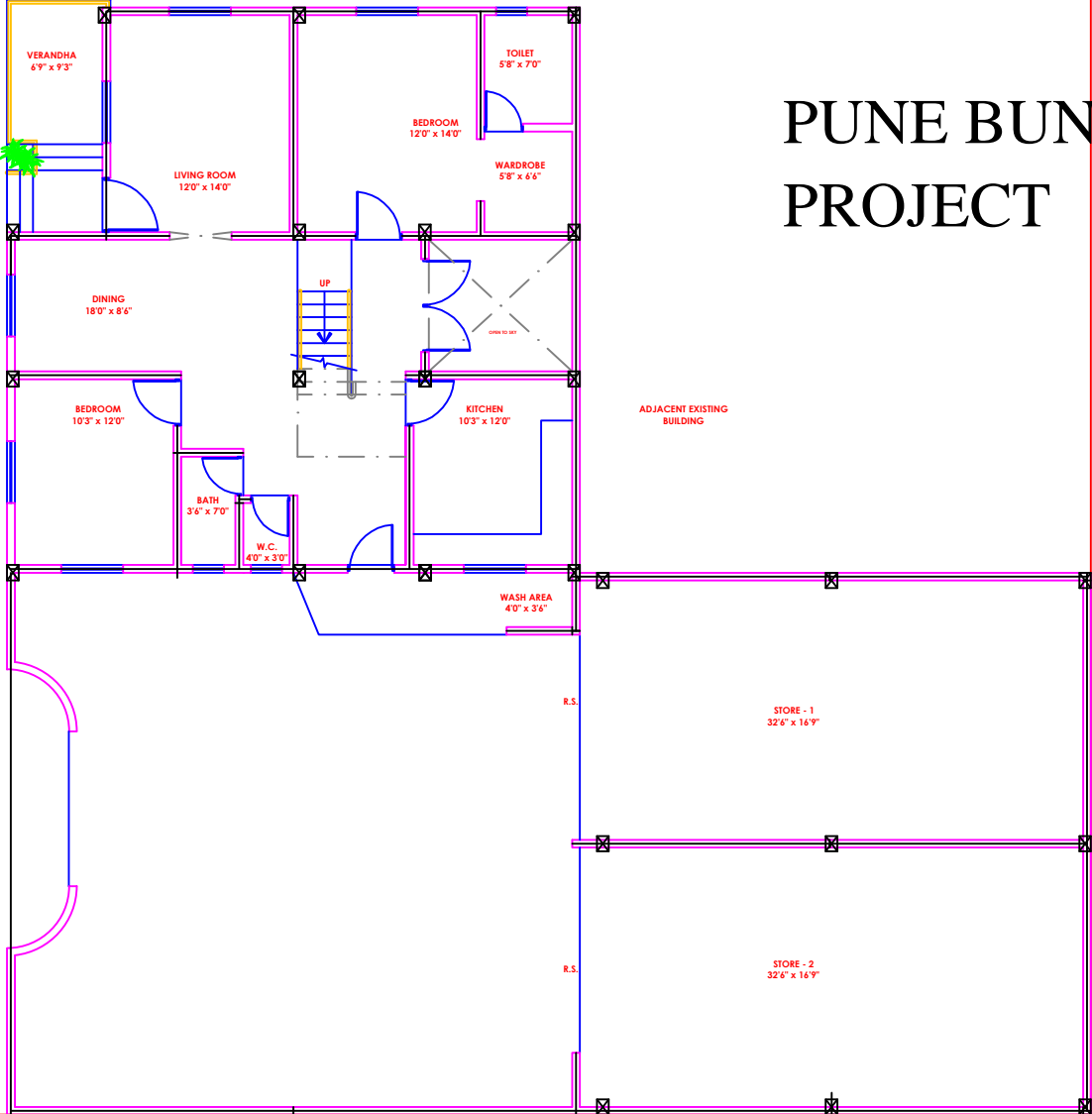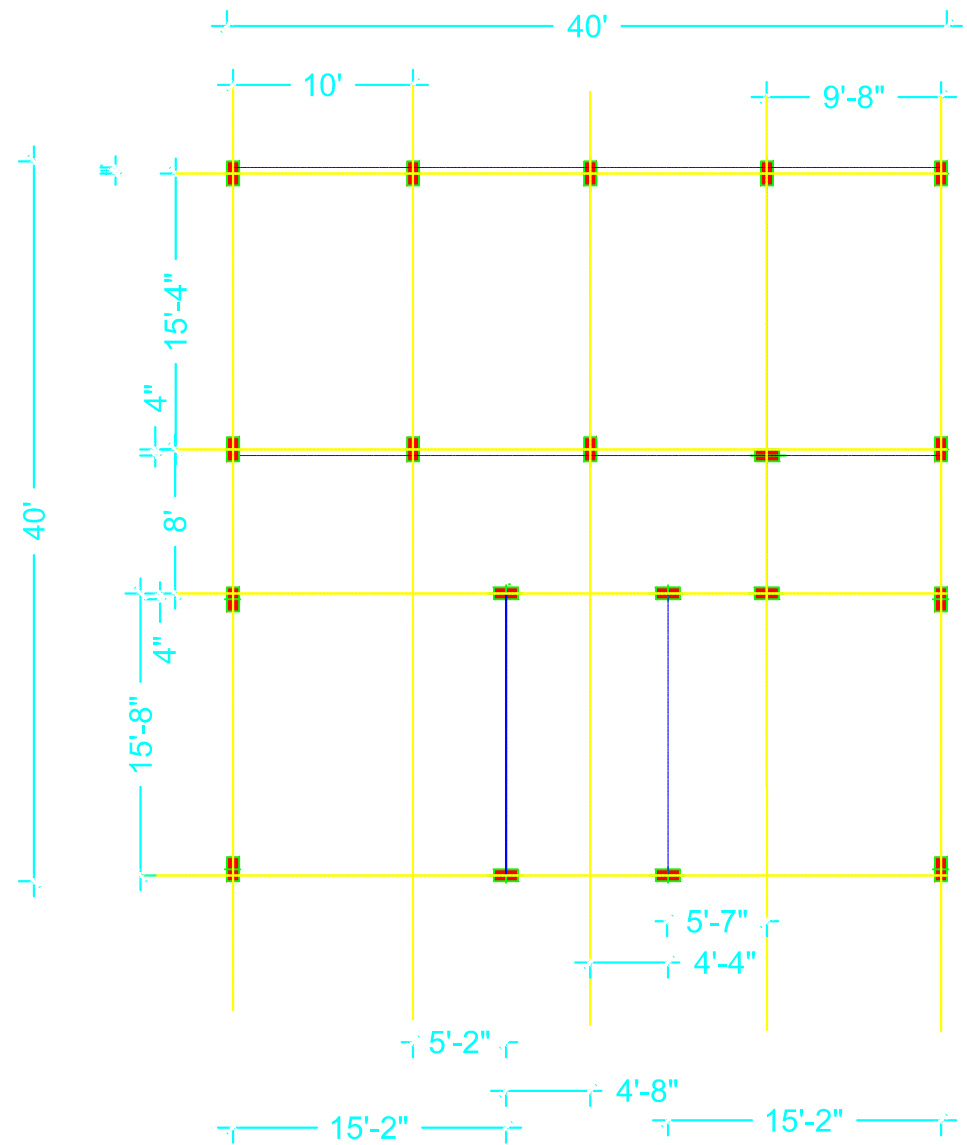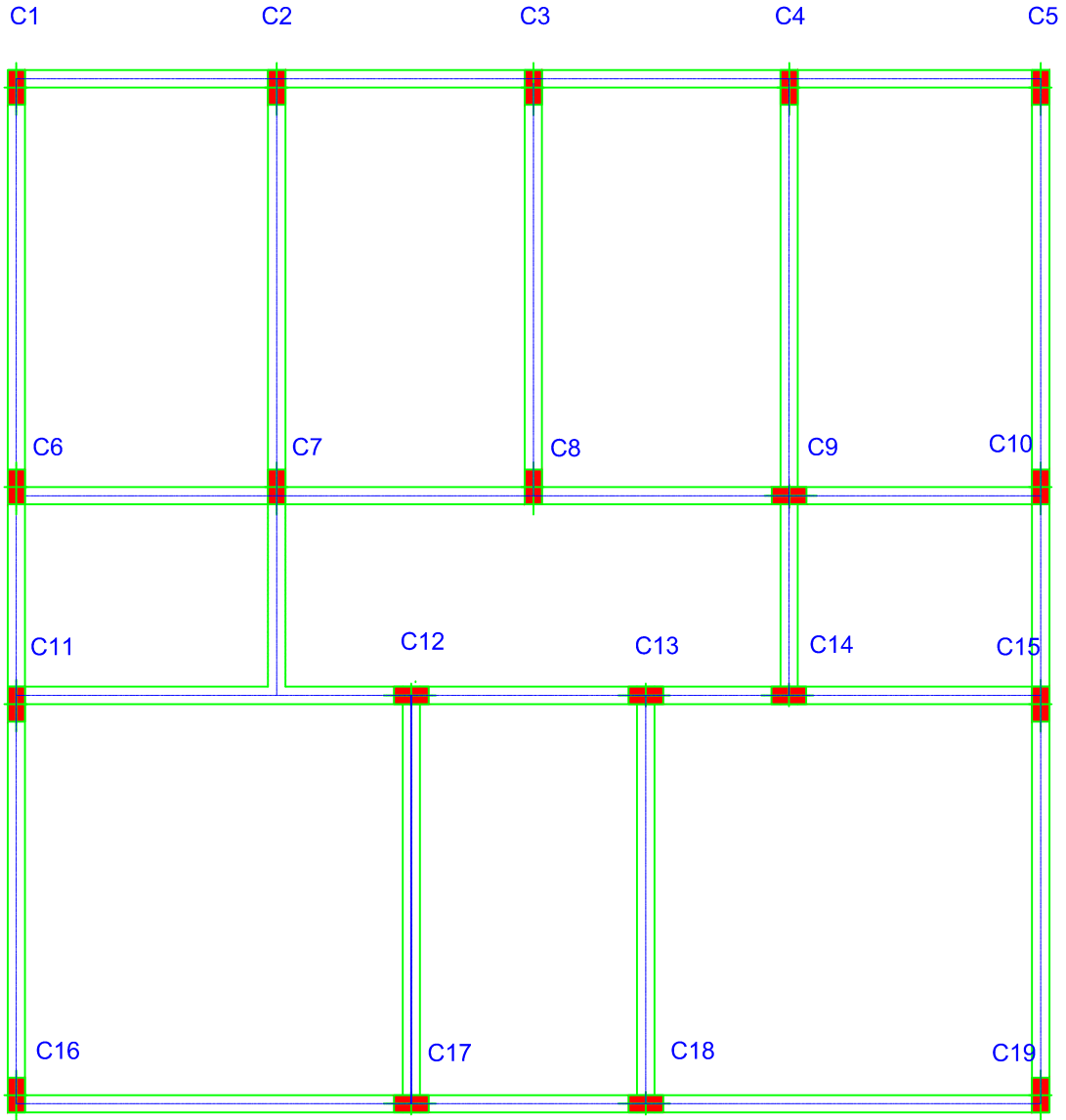
Beam Plan

OMAN PROJECT PLAN VIEW   (BASEMENT)

BASEMENT PLAN   1: 150

0   5   10   15   20M
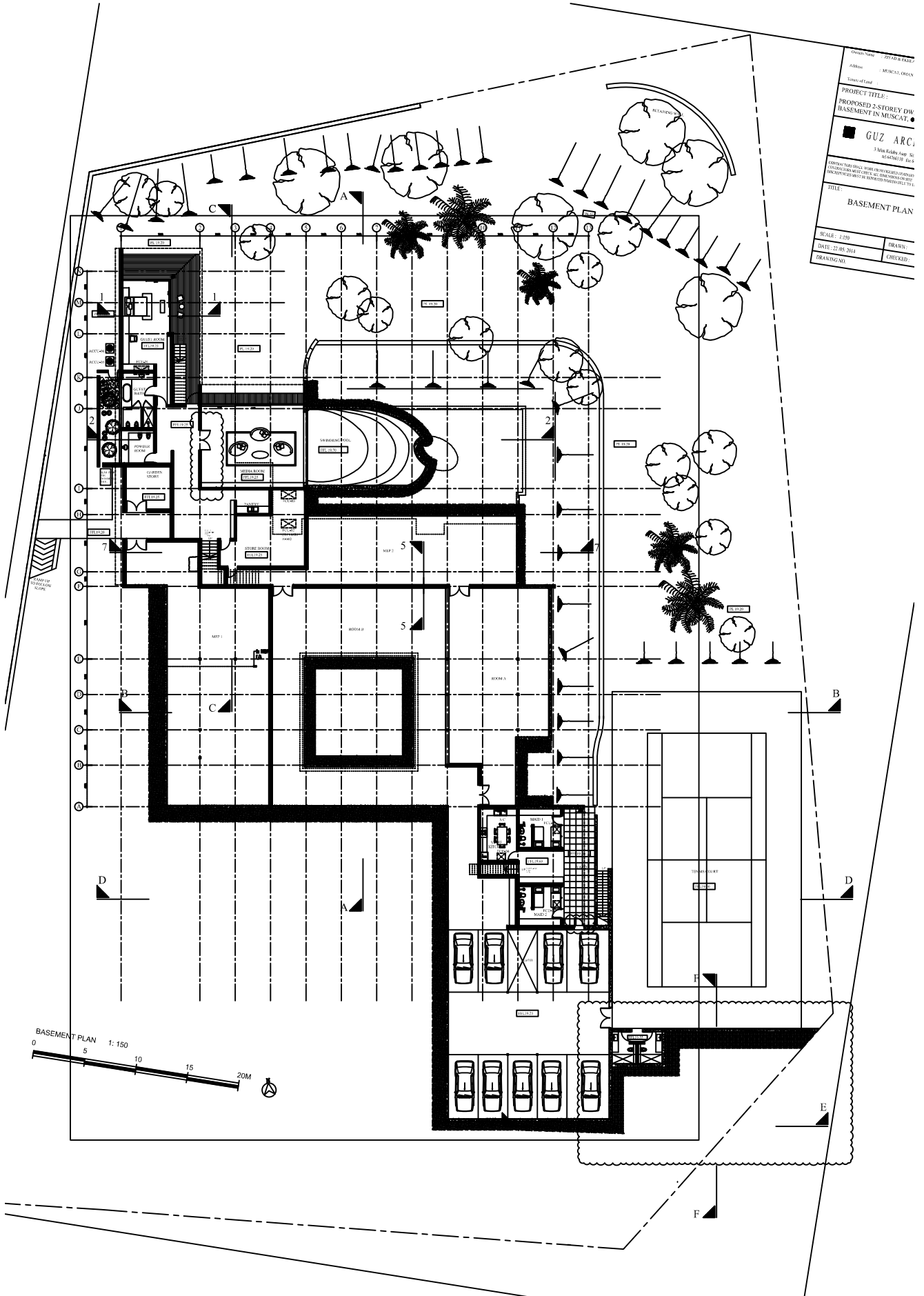
OMAN PROJECT PLAN VIEW   (TOP FLOOR)

FIRST FLOOR PLAN   1: 150

0   5   10   15   20M

OMAN PROJECT PLAN VIEW   (BASEMENT)

RETAINING WALL

SWIMMING POOL

MEDIA ROOM

PANTRY

STORE ROOM

GUEST ROOM

GUEST BATH

POWDER ROOM

GARDEN STORE

ROOM B

ROOM A

MEP 1

MEP 2

RAMP UP TO FUTURE SLOPE

MAID 1

MAID 2

KITCHEN

TENNIS COURT

YARD

BASEMENT PLAN   1: 150

0   5   10   15   20M
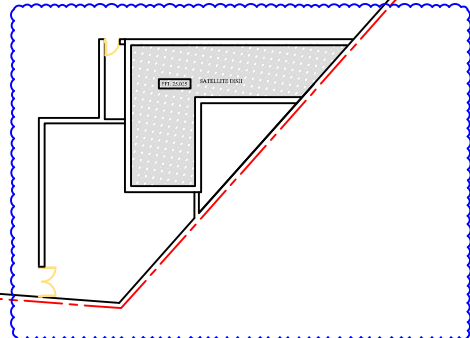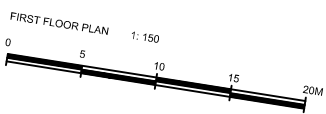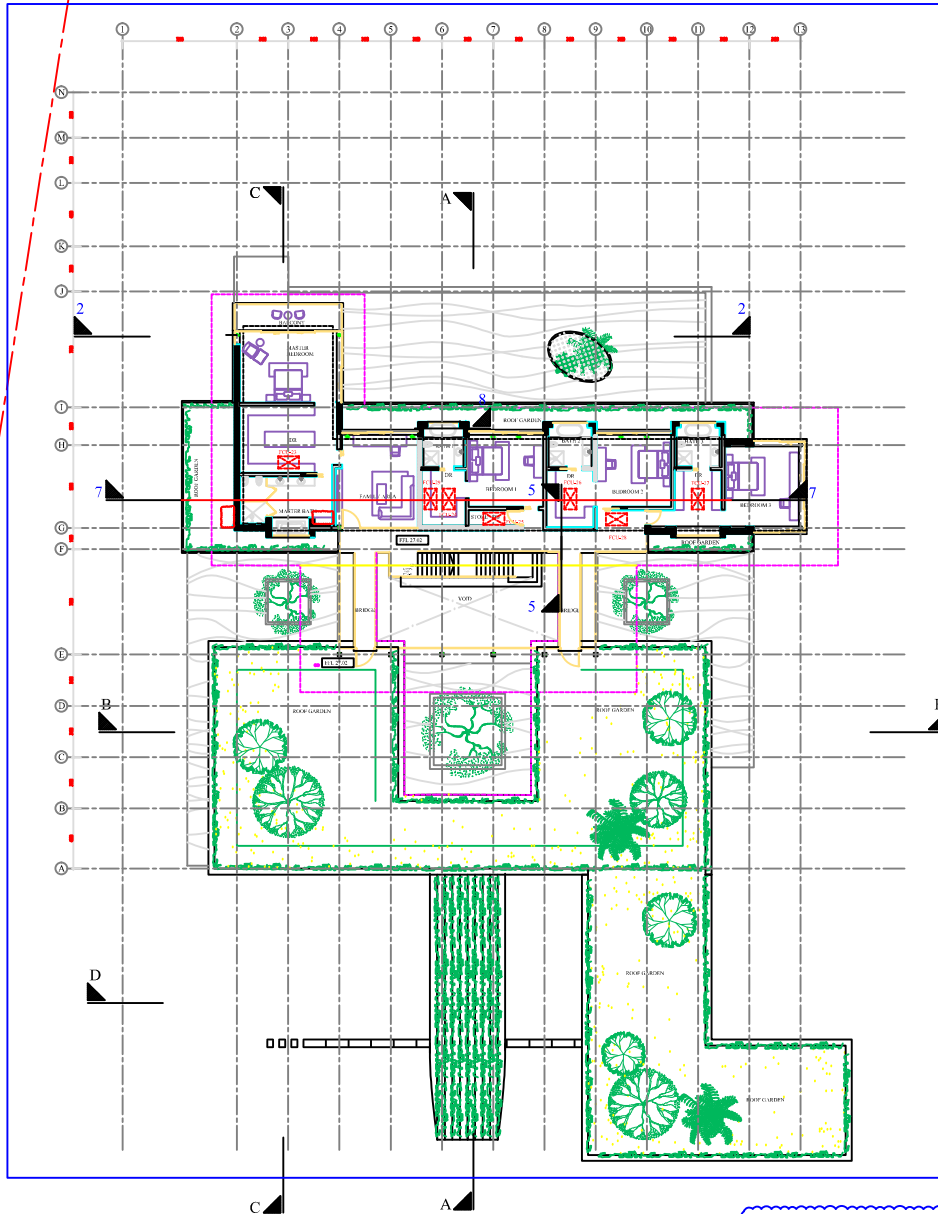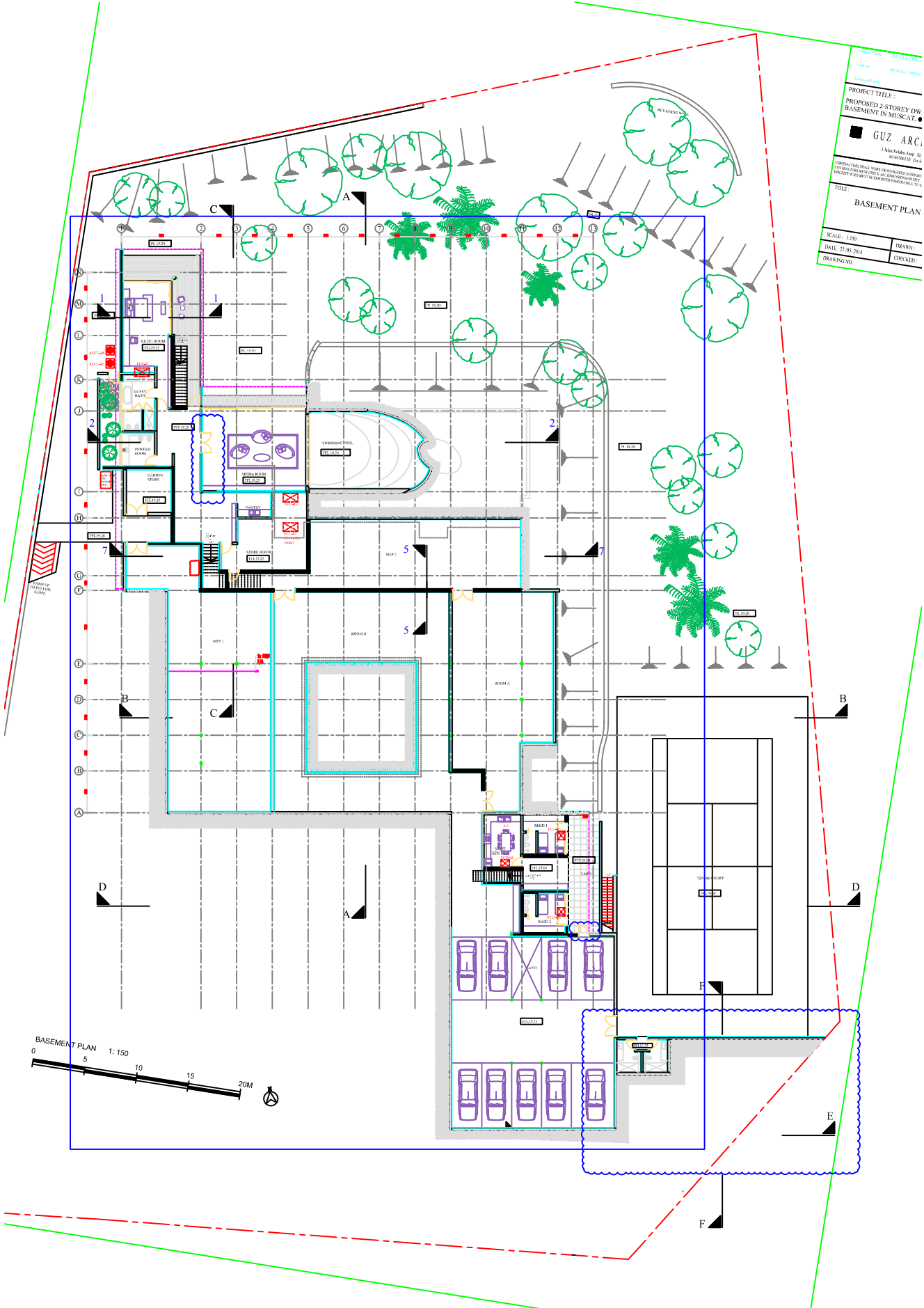
APPENDIX III

EARTHQUAKE RESISTANT STRUCTURE WORKSHOP,NITTTR Bhopal

1893 LOAD X -1
L 3 : EQ+Z
1893 LOAD Z 1
L 4 : EQ-Z
L 5 : LIVE
L 6 : DEAD
C 7 : Generated Indian Code Genral_Structures 1
C 8 : Generated Indian Code Genral_Structures 2
C 9 : Generated Indian Code Genral_Structures 3
C 10 : Generated Indian Code Genral_Structures 4
C 11 : Generated Indian Code Genral_Structures 5
C 12 : Generated Indian Code Genral_Structures 6
C 13 : Generated Indian Code Genral_Structures 7
C 14 : Generated Indian Code Genral_Structures 8
C 15 : Generated Indian Code Genral_Structures 9
C 16 : Generated Indian Code Genral_Structures 10
C 17 : Generated Indian Code Genral_Structures 11
C 18 : Generated Indian Code Genral_Structures 12
C 19 : Generated Indian Code Genral_Structures 13
C 20 : Generated Indian Code Genral_Structures 14

New...   Add...   Edit ...   Delete...
☐ Toggle Load
Assignment Method
○ Assign To Selected Entities   ◉ Use Cursor To Assign
○ Assign To View   ○ Assign To Edit List

Assign   Close   Help

STAAD.PRO MODEL