Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Volume 13, Issue 02, February 2024

Planning,Analysis and Design of Boys Hostel At Govt Polytechnic College, Naduvil

Ms. Anuragi.P
Assistant Professor
Department of Civil Engineering
Vimal Jyothi Egineering College , Chemperi
(Autonomous) , Kerala, Kannur

Abhinand K , Alan Joshy , Anjali .M.M , Aparnapraveen
UG Students
Department of Civil Engineering
Vimal Jyothi Enginnering College, Chemperi
(Autonomous), Kerala, Kannur

***Abstract*—The principal objective of this project is to providing a comfortable and conducive living environment for students. Due to increase in students from a great distance to the college, they are facing lack of hostel facility by their own. Thus, we decided to propose a hostel plan to Govt.Polytechnical college, Naduvil.The main objective of the project is planning, load calculation, analysis and designing of a three-storey hostel building. The planning of the building is done by laws, safety, serviceability and durability. It also helps to improve the creative thinking, technical knowledge and to study different software's such as AutoCAD and STAAD.Pro. The project is divided into four phases. In the first phase we have collected the relevant data's available about the site. During the second phase surveying, site layout, prepared plan, sectional elevation and elevation of the proposed building. Then in the third phase Staad pro works such as importing CAD files, providing supports, loads, analysis and design of the structure is completed. Finally, all the manual calculations are done. The procedure followed here is in accordance with Indian Standard Codes.**

***Keywords*— Three storey hostel building, National Building codes, Kerala Municipal building rules 2019, IS codes ,AutoCAD , STAAD Pro .**

I. INTRODUCTION

In a world of higher education, many students find themselves far from home, in need of a secure and comfortable place to stay. College hostels play a vital role in providing this essential accommodation.The primary objectives of this project are straightforward: to offer students a safe and convenient place to live, allowing them to focus on their studies while fostering a sense of community and belonging. This report will delve into how we've carefully planned, analyzed, and designed this hostel to achieve these fundamental goals. In a world of higher education, many students find themselves far from home, in need of a secure and comfortable place to stay. College hostels play a vital role in providing this essential accommodation. This project aims at the planning and analysis of a Boys Hostel for Govt Polytechnic College Naduvil.

IV OBJECTIVES

The main objectives of this project are to study about various codal provisions and also to survey the site . It is also used for preparing architectural plans and also designing & analysis is done . The loads actng on it are also estimated .

V SCOPE

Scope of study of this is Surveying of plot using total station. It also helps to assess both plot and sourrounding areas . It helps to develop a architectural plan using AUTOCAD software & it also Helps to designing , analyzing the proposed structure using STAAD pro software.

VI SITE FOR PROPOSED BUILDING

The proposed building is situated in the rural area of Naduvil Grama Panchayat in Kannur District of Kerala. The site is easily access from the road. It has adequate facilities such as transportation, electricity, water supply, drainage facility etc.
Here the building consists of 8.2 m x 7.2 m hall.There are 11 rooms in each floor of size 4 x5 m.Five toilets and 5 bathrooms in each floor of 1.1 x 1.5 m Dog legged stair is provided with 23 stairs in which riser is provided with 15cm and tread is provided with 25 cm.Height of the building from one floor to the anoter floor is 3.4 m.Each floor Area consist of 4656.79 square feet.The hostel building is of 13790 square feet area.

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Volume 13, Issue 02, February 2024

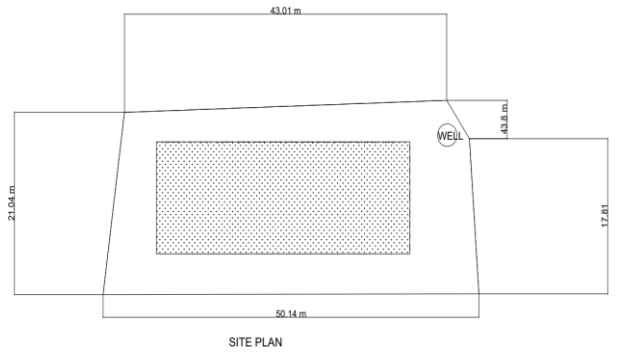


Figure 1 Site Layout

VII GENERAL PROVISIONS REGARDING BUILDING REQUIREMENTS

A Height of the room

Height of the room in any building other than residential occupancy and livestock farm under group 1(1) hazardous occupancy, shall be not less than 3.00 meters; provided that in the case of the air-conditioned room it shall be not less than 2.4 meter.

B. Toilets

The minimum size of the toilet shall be 1.50m x 1.70m Minimum clear opening of door shall be 90 cmWater closet should be 50 cm above the floor level

C. Staircases

1. Any building having more than four floors including basement or sunken floors, shall have at least two staircases, one of which may be an external stairway: Provided that when the second staircase provided as external stair way conforms to the provisions of fire escape staircase, a separate fire escape stair need not be provided.

2. The minimum width of stair shall not be less than 1.20 meters

3.The minimum width of tread shall be 30 cm.

4. The height of the riser shall not exceed 15 cm.

5. The height of handrail shall be not less than 90 cm.

6. The width of passages giving access to the staircase in any building shall not at any point, be less than the width of the stair

D.Ramps

1. The maximum gradient of a ramp approach intended for the physically handicapped persons shall not exceed 1 in 12 and shall be finished with approved non slippery materials. The minimum width of the ramp shall be 1.2metres and provided with handrails of height not less than 80cm.

2. Every part of a building within a floor shall be accessible by a wheelchair and in case of level difference between parts they shall be connected by ramp/slope ways with minimum specifications as above.

E.Corridors, Verandahs and Passageways

The clear width of any corridor, verandah or passageway in any building shall not be less than 1.0 meter at any point.

F.Fire escape stairway

1. Residential building exceeding 3 storeys above ground level.

2. The width of fire escape staircase shall not be less than 75 cm the width of fire stair tread shall not be less than 15 cm height of the fire escape stair shall not exceed 19 cm and the number of risers shall not exceed 16 per flight of stairs.

3. The height of the hand rail shall not be less than 100 cm

4. Fire escape shall have a straight flight

5. Entrance to fire escape shall be separate

G.Fire protection requirements

All the requirements are from the fire protection shall be as in part iv, fire protection in NBC India 1983 and amendment No 3 under Fire protection annexure I

H.Travel distance to emergency exit

1. Every building meant for human occupancy shall be provided with emergency exits sufficient to permit safe escape of occupants in case of fire or whenever other emergency occurs.

2. Emergency exits shall be located in such a way that the travel distance on each floor shall not exceed 30 meters for the occupancy.

3. Exits shall be either horizontal or vertical type.

4. An exit may be a doorway corridor or passageway to an internal staircase or external staircase, ramps to the street or to the roof of a building; it may be a horizontal exit leading to an adjoining building at the same level: Provided that lifts and escalators shall not be considered as exits.

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Volume 13, Issue 02, February 2024

VIII METHODOLOGY

A. Data Surveying

The data's collected during this stage are: -Approximate Area required ,Number and Types of Rooms,Sanitary, Electrical System ,Types of Material to be used and Other facilities required

B.Location

The hostel prposed is at Govt Polytechnic College, Naduvil .It is a Peaceful Area and Presence of educational institute near

C.Survey

We conducted reconnaissance survey at first and prepared a rough key plan of the site. The chain survey was conducted by instruction method. All the details were marked. The linear measurements were taken by a chain of 30m.The key plan was plotted. The information of soil was taken from site.

D. Drawing Using Autocad

We have drawn Site Layout, Plan, Front Elevation and Section of the Hostel that we are implementing on the College, and also the Reinforcement Details will be provided.

E.Structural Analysis And Design

Structural Analysis and Design is done Using STAAD.Pro. Basic step for design structure is layout of structure which is governed by the functions to be performed by the structure. The design should always be made in accordance with the principles of the mechanics, recognized method of design and engineering practice. Some of the factors which will govern the design should have: Adequate Strength,Strong to last the service , Economical and Future extension is also being considered

XI LOAD

A.Dead load

The dead load in building shall comprise the weight of the wall, partitions floor and roofs and shall include the weight of all bother permanent construction on the building.

B. Imposed load

Imposed Load is the total load produced intendent use for occupancy of building, including the weight of movable partitions, distributed concentrated load due to impact and vibration and dust load but including wind, seismic, snow and other loads due to temperature changes, shrinkage, differential settlement etc. Live load for hostel is taken as 3KN/m^2 as per IS 800:1987

C. Seismic load

It is the basic concepts of earthquake engineering which means application of a seismic oscillation to a structure. It happens at contact surface of a structure either with the ground or with the adjacent structures.

In Seismic load calculations Zone is given. We have Chose Zone 3 as it is Kerala. Kerala has Laterite Soil. Also, the Damping Ration is 5%. So, by giving the IS code ie, IS 1893-2002/ 2005 the values will be generated

X.METHOD OF DESIGNING

Reinforced Cement Concrete members can be designed by Limit sate method.

A.Limit State Method

In this method of design based on limit state concept, the structure shall be designed to withstand safely all loads liable to act on it throughout its life; it shall also satisfy the serviceability requirements, such as limitations on cracking and deflection.

The acceptable limit for the safety and serviceability requirements before failure occurs is called a Limit State. The aim of design is the achieves acceptable probabilities that the structure will not become unfit for which it is intended ie, it will not reach a limit state.

All relevant limit state shall be considered in design to ensure the adequate degree of safety and serviceability. In general, the structure shall be designed on basis of the most critical limit state and shall be checked for other limit states.

For ensuring the above objective, the design should be based on characteristic values for material strength and applied loads, which consider the variation in the material strength and in the loads to be supported.

B.Assumptions In The Limit State Method

The design of a RCC section for limit state of collapse in bending on the following assumptions as per IS 456:2000

- Plane sections normal to the axis remain plane after bending.
- The maximum strain in concrete at the outermost compression fiber is taken as 0.0035 in bending.
- The tensile strength of concrete is ignored.
- The stresses in reinforcements are obtained from stress-strain curves of steel. For design purpose safety factor equal 1.15 shall be applied.
- The maximum tensile strain in the tension reinforcement shall not be less than fy/1.15Es + 0.002.
- The relationship between the compressive stress distribution in concrete and strain in concrete is assumed

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Volume 13, Issue 02, February 2024

to be rectangular parabolic. For design purpose the compressive strength of concrete in the structure shall be assumed to be 0.67 times the characteristics strength. The partial safety factor 1.5 shall be applied addition to this.

XI BUILDING PLANS

The building plan are drawn using the software AutoCAD. The main drawings that are drawn using this software are Site Layout (Fig 2), Ground Floor Plan (Fig 3), First Floor Plan (Fig 4), Second Floor Plan (Fig 5), Sectional Elevation (Fig 6) and at last we have drawn Elevation (Fig 7). The Doors, Windows and Ventilations are provided or drawn in this Structure. The no of Students that can be stayed in a room is about 4 or 5. The plans are drawn based on the IS Code provisions. The plans and elevations are the following; -

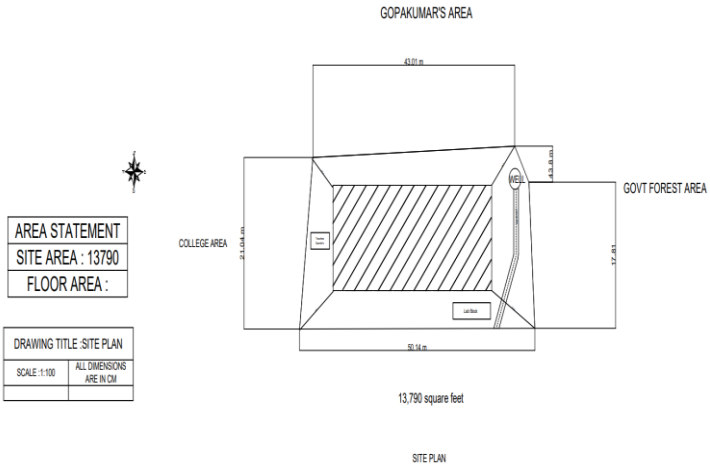


Figure 2 . Site Layout Plan

Figure 3 . Ground Floor Plan

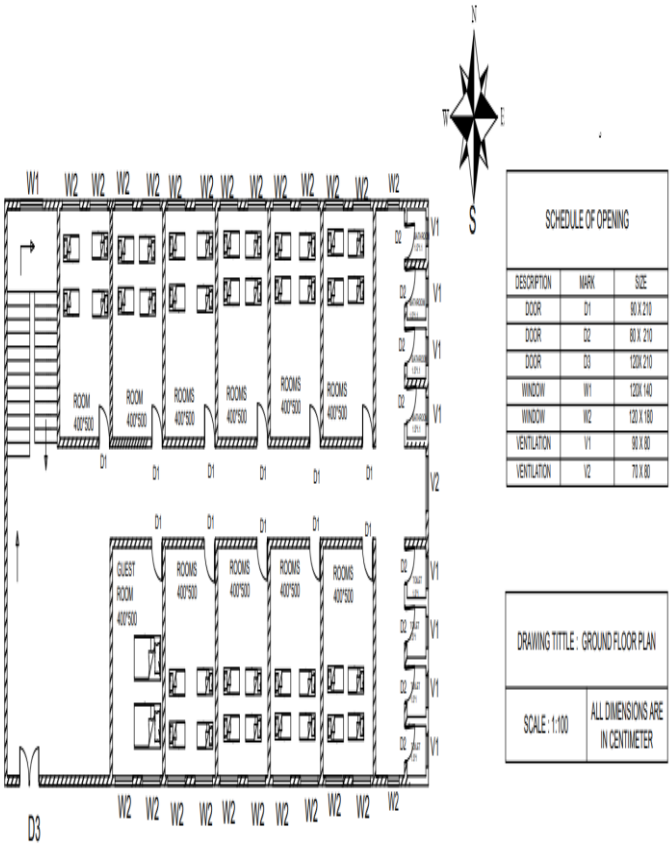


Figure 4. First Floor Plan

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Volume 13, Issue 02, February 2024

Figure 5 . Second Floor Plan

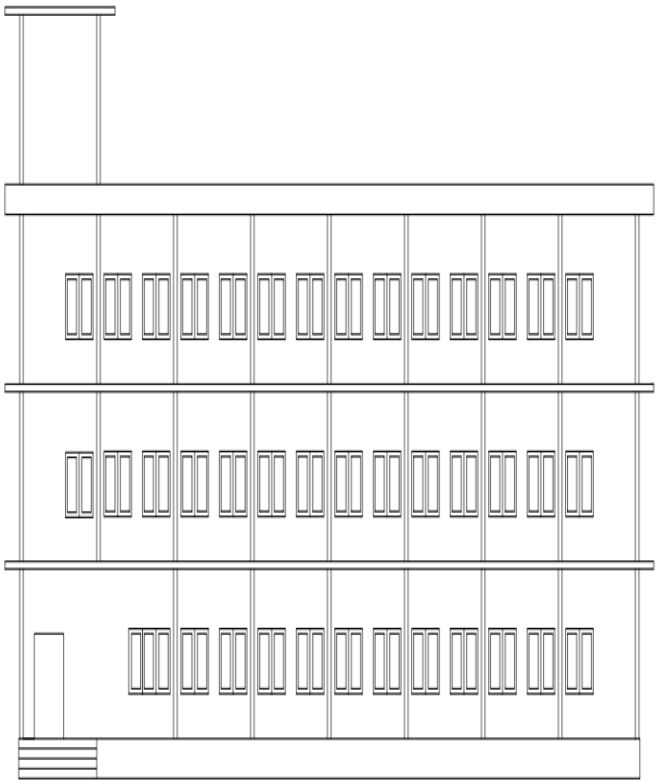


Figure 6. Elevation

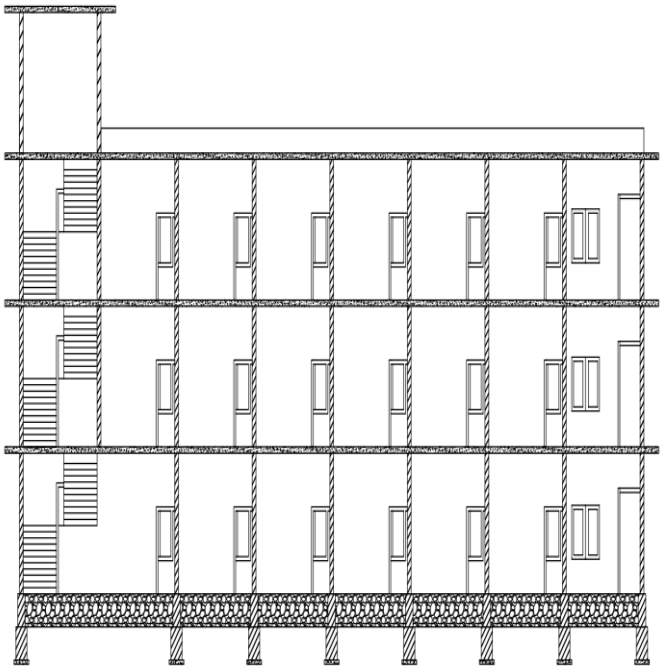


Figure .7. Sectional Elevation

XII LOAD CALCULATIONS

Load are primary consideration of building design they define the nature and magnitude hazards or external forces that a building must resist to provide reasonable performance throughout the structure's useful life. The type and magnitude of design loads effect critical decision such as material selection, construction details etc.. Generally dead load and live load are calculated for the building.

A Dead Load

Dead Load is the self-weight of the concrete member, walls and floor finishes. Dead load shall be calculated on the basis of unit weights which shall be established taking into consideration the material specified for construction. Alternatively, the dead loads may be calculated on the basis of unit weights of materials given in IS 875 (Part 1). The dead load has to be considered in order to make the structural design correctly. Dead loads vary from structure to structure.

a) Wall Load

Unit Weight of Brick Masonry = $2x_{10}$-^{5} kN/cm^{3}
Width of the wall = 23cm
Height of the Building = 340cm
Wall Load = $2x_{10}$-^{5}x 23 x340 = -0.1564 kN/cm

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Volume 13, Issue 02, February 2024

b) Parapet Load

Unit Weight of Brick Masonry = $2x_{10}$-^{5} kN/cm^{3}
Width of the wall = 23cm
Height of Parapet = 60cm
Parapet Load = $2x_{10}$-^{5}x23x60 = 0.024 kN/cm

B . Live Load

Imposed loads are the loads assumed to be produced by the intended use or occupancy of a building, including the weight of movable partitions, distributed concentrated loads, loads due to impact and vibration, and dust load but excluding wind, seismic, snow and other loads due to temperature changes, creep, differential settlement etc. Live load for this project is taken by IS 875 codes.

a) Floor Load

Floor load = Thickness of slab x Density of concrete
= 12.5x25
= 312.5 kN/cm^{2}

b) Seismic Load

In Seismic load calculations Zone is given. We have Chose Zone 3 as it is Kerala. Kerala has Laterite Soil. Also, the Damping Ration is 5%. So, by giving the IS code ie, IS 1893-2002 / 2005 the values will be generated , In Fig 8 Shown below

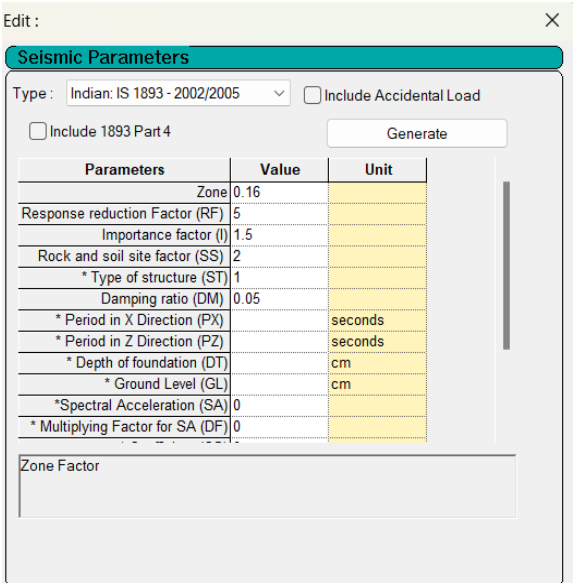


Figure 8.Seismic Loads

XIII ANALYSIS USING STAAD PRO

A.Introduction

STAAD.Pro is a structural analysis design program software. The building plan designed with the help of AUTOCAD, is analyzed for its structural stability towards considered forces using STAAD.Pro analysis software. The plan is developed into an entire 3-D structure and the basic details such as shear and displacement are studied. The commercial version of STAAD.Pro supports several steel, concrete and timber codes. It is one of the software applications created to help structural engineers to automate their tasks and to remove the tedious and long procedures of the manual methods.
Using Centre Line Method, Plan of the structure is drawn and converted to DXF file. Then it is imported to STAAD.Pro [Fig.9]. Then Duplicate and Orphan nodes are checked. Intermediate Beams are provided. Then using Interceptional Repeat it is brought to a Three-storey structure. Then 58 plates are created and moving to properties thickness is provided as 15cm. The Column Size and Beam size is applied to the structure. Column size is 40x40 cm and Beam size is provided as two. That is for Ground and First floor as 65x40cm and for Second floor it is 45x40cm. Then it is assigned. Supports and Materials are assigned to the structure and we will get 3D view of the structure [Fig.10].

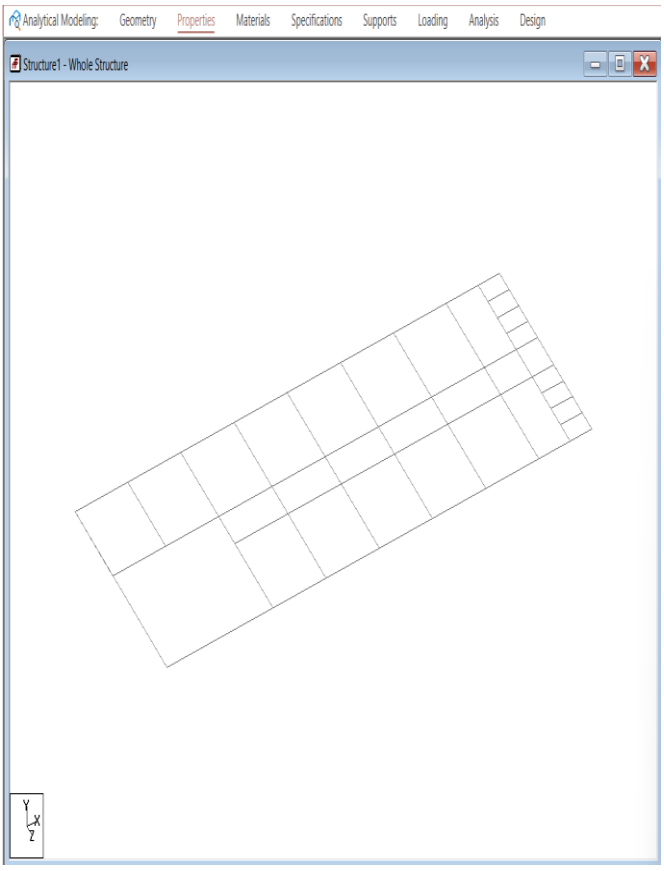


Figure 9. Imported Structure

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Volume 13, Issue 02, February 2024

The loads are applied to the structures. Dead loads (Wall Load and Parapet Load) are assigned to it. Live Load (Floor Load) is assigned to it. Then the Seismic load is also assigned to it. Then Load Combination is Auto Generated. Analysis is done and Zero error Occurred. Then Design is given with Material as Concrete and IS 475 codes. The Design parameters given are Clear cover 3cm, Fc as 2.5 kN/cm², Fymain as 41.5kN/cm², Fysec as 41.5kN/cm², Maxmain as 20mm, Maxsec as 16mm, Minmain as 16mm, Minsec as 10mm. Then Commands need to be provided like takeoff, design of column beam and slab. Then again go for analysis and zero error occurred. Then Post Processing and get the results of Job Info, Loading Diagram, Deflection, Displacement, Axial Force, Shear Y and Shear Z, Bending Y and Bending Z diagrams.

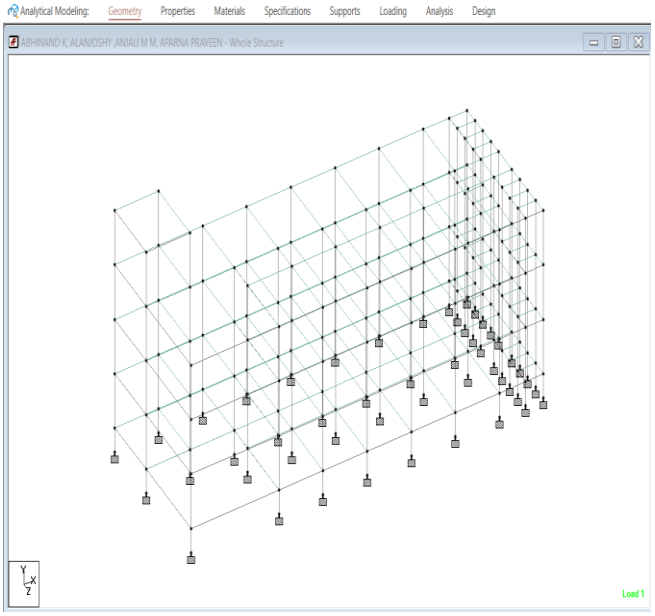


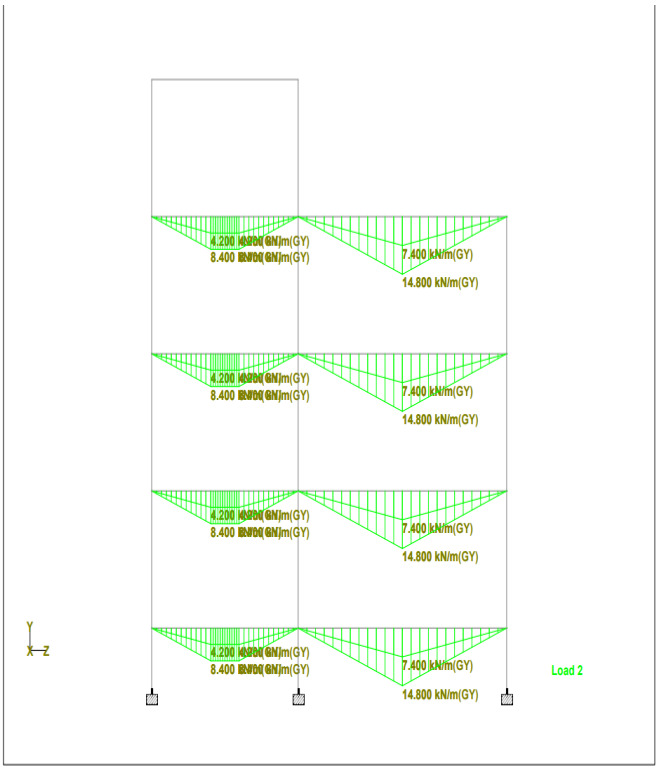
Figure 10. 3D Veiw of the Structure

XIV RESULTS AND DISCUSSIONS

By Analysing the structure , after the run analysis and concrete design , we can obtain the results of our structures . Here we can obtain the maximum and minimum values of Loading diagram, Shear Force diagram , Bending moment diagram, Axial force diagram etc.. By using these diagram post processing can be completed .It is all about analysing the structure to check whether the completed building structure is safe or not and getting various reactions .

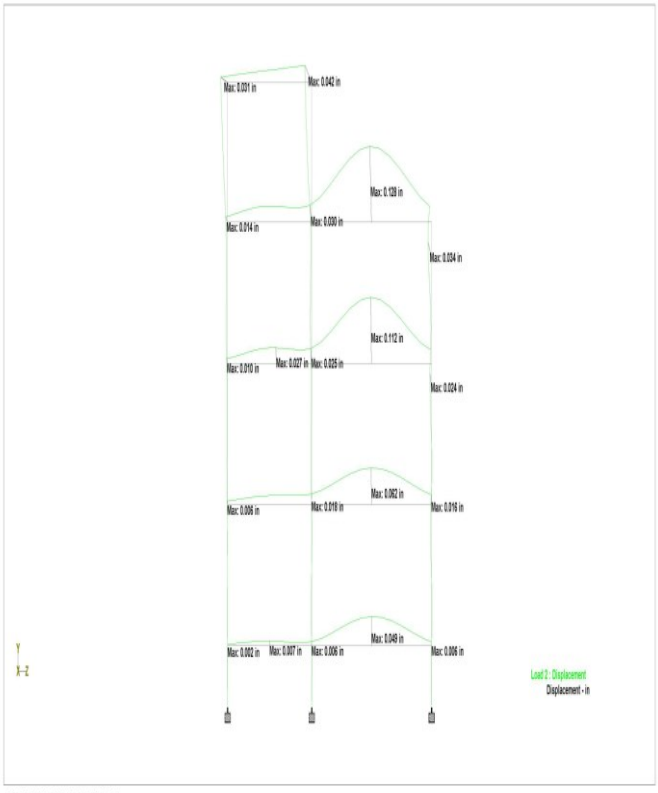
The results that we collected in this project are

1) Loading diagram (Fig 11)
2) Displacement force diagram (Fig 12)
3) Shear y diagram (Fig13)
4) Shear z diagram(Fig 14)
5) Bending y diagram (Fig 15)
6) Bending z diagram (Fig 16)
7) Axial force diagram (Fig 17)



LOADING DIAGRAM FINAL

Figure 11. Loading diagram



DISPLACEMENT FINAL

Figure 12 Displacement diagram

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Volume 13, Issue 02, February 2024

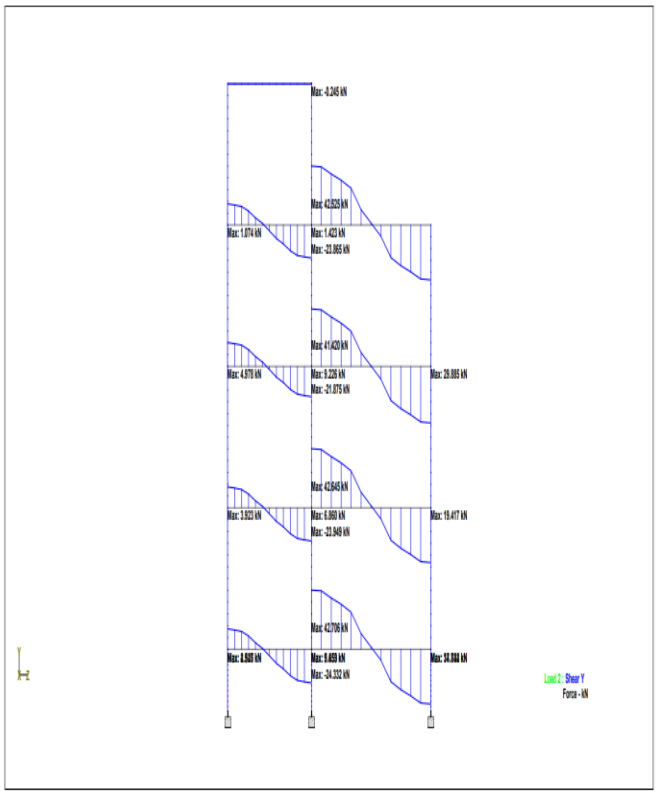


Figure 13 Shear Y diagram

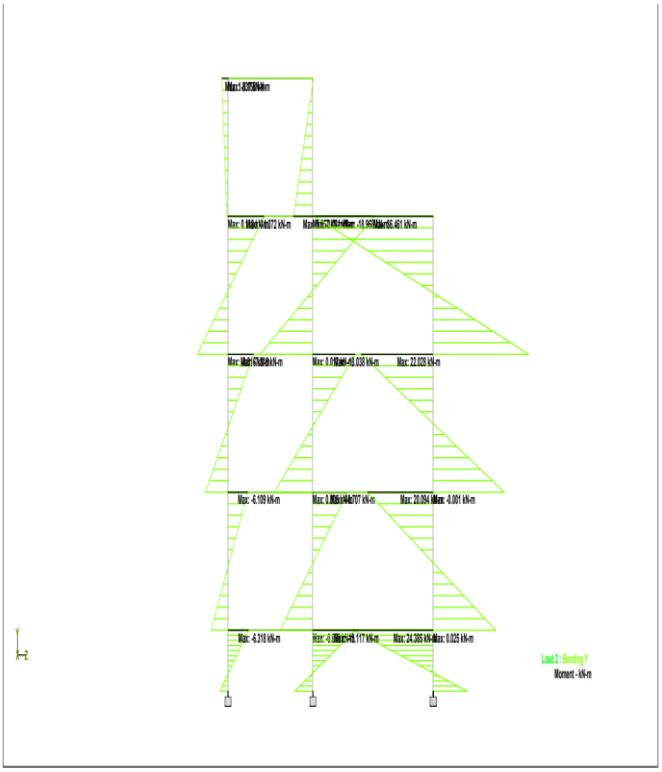


Figure 15 Bending Y diagram

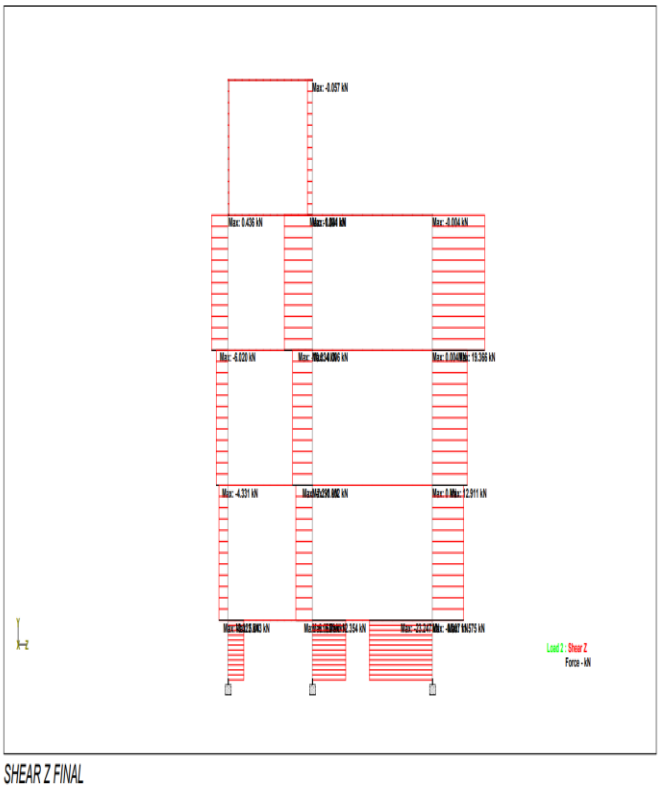


Figure 14 Shear Z diagram

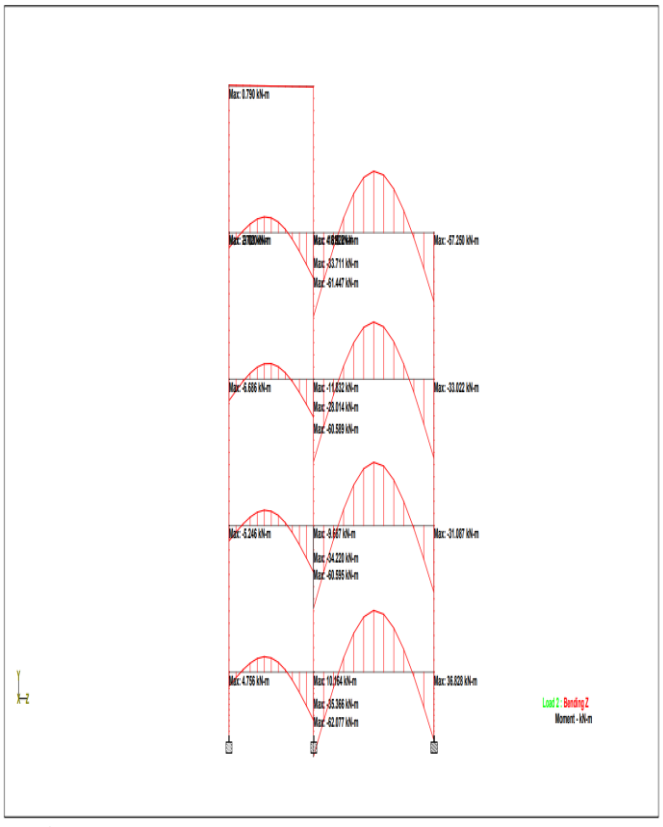


Figure 16 Bending Z diagram

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Volume 13, Issue 02, February 2024

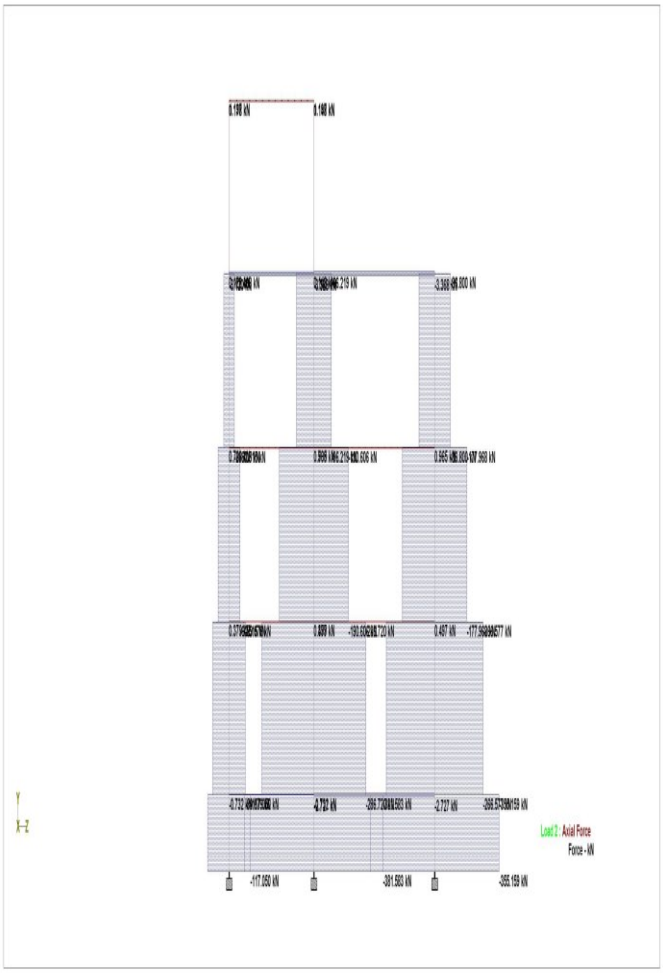
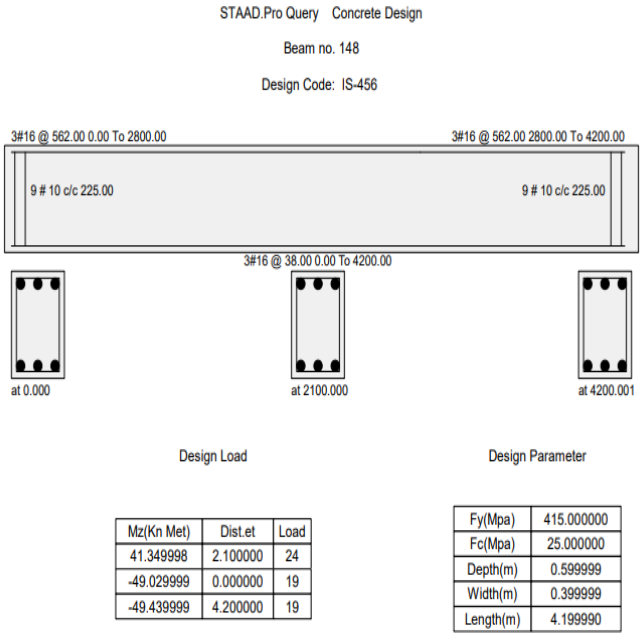


Figure 17 Axial Force diagram

XV DETAILING

A. Beam

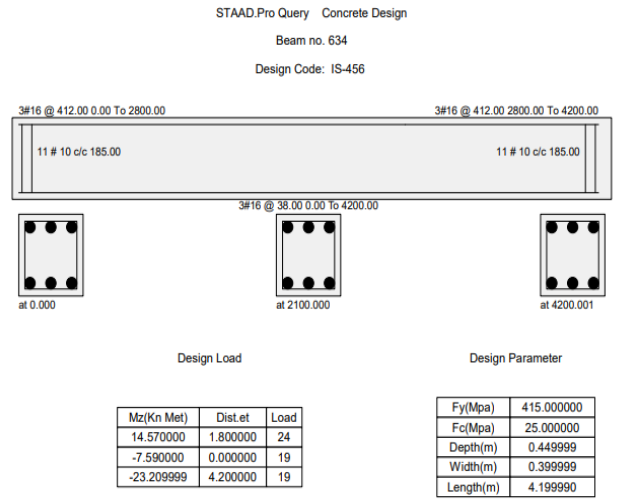
Here size of beam is 65x40cm. It Is the Beam of Ground and First Floor. Here 9 nos of 10mm diameter stirrups with 225mm spacing. Tension and Compression bars here provided is of 3 nos with 16mm diameter is provided [Fig 18)]. In Second Floor, size of beam is 45x40cm. Here 11 nos of 10mm diameter stirrups with 185mm spacing is provided. Tension and Compression bars of 3 nos with 16mm diameter is provided [Fig 19].



Mz(Kn Met)	Dist.et	Load
41.349998	2.100000	24
-49.029999	0.000000	19
-49.439999	4.200000	19

Fy(Mpa)	415.000000
Fc(Mpa)	25.000000
Depth(m)	0.599999
Width(m)	0.399999
Length(m)	4.199990

Fig 18 Beam detialing of Ground and first floor



Mz(Kn Met)	Dist.et	Load
14.570000	1.800000	24
-7.590000	0.000000	19
-23.209999	4.200000	19

Fy(Mpa)	415.000000
Fc(Mpa)	25.000000
Depth(m)	0.449999
Width(m)	0.399999
Length(m)	4.199990

figure 19 Beam detailing od second floor

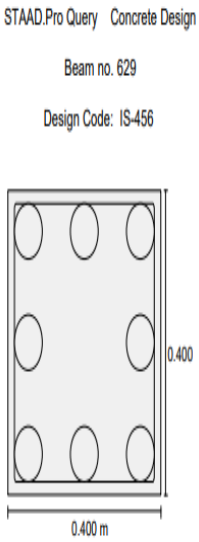
(This work is licensed under a Creative Commons Attribution 4.0 International License.)

Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Volume 13, Issue 02, February 2024

B . Column

Column Size provided is 40 x 40cm. The Bar Size of the column is 16mm and No of Bars is 8 (Fig 20).



Design Load

Load	3
Location	End 1
Pu(Kns)	-53.820000
Mz(Kns-Mt)	3.760000
My(Kns-Mt)	4.360000

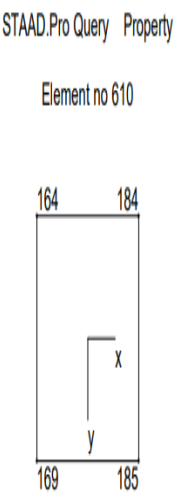
Design Results

Fy(Mpa)	415
Fc(Mpa)	25
As Reqd(mm²)	1280.000000
As (%)	1.005000
Bar Size	16
Bar No	8

Figure 20 Column detialing

C .Slab

The Slab Thickness provided is 15cm (Fig 21).



Physical Properties

Node	Thickness (m)
164	0.150000
184	0.150000
185	0.150000
169	0.150000

Material Properties

Elasticity(kip/in2)	Density(kip/in3)	Poisson	Alpha
3150.001	0.000	0.170	5.5 E-6

Figure 22 Slab Detailing

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Volume 13, Issue 02, February 2024

XIIV REFERENCES

[1] K Prabin Kumar, Gopi Bala Vinay (2018), "Design and Analysis Of G+8 Commercial Building Using STAAD Pro", International Journal of Pure and Applied Mathematics, Volume 119, Page no. 2981-2987.

[2] Lamuo Francis Suglo, Jai Prakash Nayak (2018), "Structural Design; Technology and Computerization Not the Problem", Impact: International Journal of Research in Engineering & Technology, Volume 6, Issue 7, Page no. 13-20.

[3] A D Bhosale, Archit Pradip Hatkhambkar, Rupesh Vinayak Kattkar (2018), "Analysis and Design of Multi-storey Building by using STAAD-Pro V8i", International Journal of Research in Engineering & Technology, volume 3, Issue 4, Page no. 148-150.

[4] C. Roopasri1, R. Raj Kumar2, S. Rathna SwamyDesign and Analysis of Residential Building Using AUTOCAD and STAAD Pro International Journal of Research Publication and Reviews, Vol 4, no 7, pp 2041-2049 July 2023

[5] Anurag Verma, Arjun Sahu, Ankit Singh,Aryan Pal,Mohd. Shariq Design & Analysis of Multistorey (G+3) Residential Building Using STAAD.Pro & AutoCAD 2020 IJCRT | Volume 8, Issue 7 July 2020 | ISSN: 2320-2882

[6] S.Brahma Naidu , P.Anil ,V,Venkatesh ,Y.Vinod Kumar ,A.Srikanth Planning, Designing And Analysis Of Hostel Building International Journal of Engineering Trends and Applications (IJETA) – Volume 5 Issue 2, Mar-Apr 2018

[7] IS456:2000 - Code of practice for general structural use of plain and reinforced concrete.

[8] IS 875 (part 1) - 2015 Provides design dead loads for buildings and structures.

[9] IS 875 (part 2) - 2015 Provides design imposed or live loads for buildings and structures..

[10] IS 1893 - 2002/2005 Code used for earthquake resistant / seismic load design of normal structures.

(This work is licensed under a Creative Commons Attribution 4.0 International License.)