CONSTRUCTION AND ITS SCHEMATIC DESIGN OF A MULTISTORED RESIDENTIAL BUILDING FOR RESISTING SEVERAL OUTWARD FORCES

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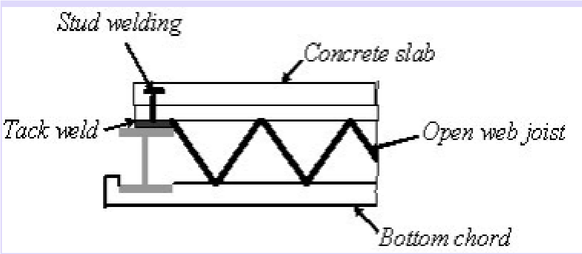
ABSTRACT

Although measured development has many points of interest, the take-up of this type of development in the private division has been moderate. This venture investigates the diverse types of MMC accessible and continues to the outline of a flexible, volumetric, private building. Transport and lifting of the completed modules were both considered. The modules were outlined with the point of institutionalization keeping in mind the end goal to encourage achieving the volumes required for volumetric development to end up financially savvy.

Hyderabad is the fifth biggest city in our nation. As it is quickly creating in the field of development in the city is exorbitant. The outline procedure of basic arranging and configuration requires creative impulses and reasonable speculation as well as a sound full information on how a basic designer would economies be able to the structure other than the learning of commonsense viewpoints, for example, late plan codes, bye laws, experience, instinct and judgment. The primary reason for the task is to guarantee and improve the wellbeing, keeping cautious harmony amongst economy and security (i.e. most temperate segment strategy).

CHAPTER 1
INTRODUCTION

This Research aims at computing the minimum seismic gap between buildings for rigid floor diaphragm idealizations by dynamic and pushover analysis using ETAB Nonlinear. The principal objectives of the study are as follows: To Analyse displacement of buildings for Eight Storey (G+8) building cases to permit movement, in order to avoid pounding due to earthquake by Linear and Non-linear Dynamic Analysis. Performing Pushover analysis for rigid floor diaphragm idealization for three lateral load patterns on the models.



1.1 Open- web joists

1.4 One-way and two-way reinforced concrete slabs.

These are much heavier than most of the newer light weight floor systems and they take more time to construct, thus negating the advantage of speed inherent in steel construction. This floor system is adopted for heavy loads. One way slabs are used when the longitudinal span is two or more times the short span. In one-way slabs, the short span direction is the direction in which loads get transferred from slab to the beams. Hence the main reinforcing bars are provided along this direction.
However, temperature, shrinkage and distribution steel is provided along the longer direction. The two-way concrete slab is used when aspect ratio of the slab i.e. longitudinal span/transverse span is less than 2 and the slab is supported along all four edges. The main reinforcement runs in both the directions. A typical cross-section of a one-way slab floor with supporting steel beams is shown in below figure. Also shown is the case when the

steel beam is encased in concrete for fire protection.

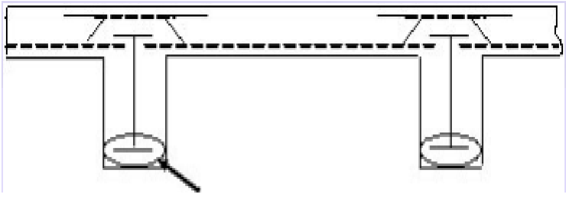


Figure 1.2 Cross section of one-way slab floor

1.5 Composite floors with a reinforced concrete slab and steel beams

Composite floors have steel beams bonded with concrete slab in such a way that both of them act as a unit in resisting the total loads. The sizes of steel beams are significantly smaller in composite floors, because the slab acts as an integral part of the beam in compression. The composite floors require less steel tonnage in the structure and also result in reduction of total floor depth. These advantages are achieved by utilising the compressive strength of concrete by keeping all or nearly all of the concrete in compression and at the same time utilises a large percentage of the steel in tension. The types of composite floor systems normally employed are shown below.

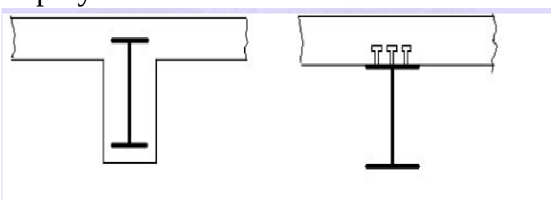


Fig 1.3 Steel beam encased in concrete b)steel beam acting composite

1.6 Precast concrete floors

Precast concrete floors offer speedy erection and require only minimal formwork. Light-weight aggregates are generally used in the concrete, making the elements light and easy to handle. Typical precast concrete floor slab sections are shown in below figure. It is necessary to use cast in place mortar topping of 25 to 50 mm before installing other floor coverings. Larger capacity cranes are required for this type of construction when compared with those required for profiled decking. Usually prestressing of the precast elements is also done.

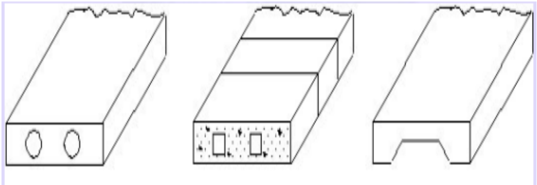


Figure 1.4 precast concrete floor slabs

CHAPTER 2
LITERATURE REVIEW

[1] M. Ashraf, Z.A. Siddiqi and M. A. Javed (2014) A study was carried out to determine optimum configuration of a multi storied building by changing the shear wall location. Two cases of shear wall location for a 20 storied building was studied. Analysis was carried out by space frame system subjected to gravity and lateral loads. Design by coinciding centroid and mass centre is ideal. However on many occasions, design has to be based on the off-centre with respect to centre of mass. These cases result in excessive stresses in most structural members, unwanted torsional moment Beam moments: At extreme grid bending moment increased with increase in eccentricity for lower levels and for higher levels, bending moment decreased with increase in eccentricity.

[2] Syed Khasim Mutwalli, Dr. Shaik Kamal Mohammed Azam(2010)

This study presents the procedure for seismic performance estimation of high-rise buildings based on a concept of the capacity spectrum method. In 3D analytical model of thirty storied buildings have been generated for symmetric buildings Models and analysed using structural analysis tool ETABS. The analytical model of the building includes all important components that influence the mass, strength, stiffness and deformability of the structure. To study the effect of concrete core wall & shear wall at different positions during earthquake, seismic analysis using both linear static, linear dynamic and non- linear static procedure has been performed.

(3} Lakshmi K.O, Prof. Jayasree Ramanujan1, Mrs. Bindu Sunil, Dr. Laju Kottallil, Prof. Mercy Joseph Power(2009)

Performance of structures under frequently occurring earth quake ground motions resulting in structural damages as well as failures have repeatedly demonstrated the seismic vulnerability of existing buildings, due to their design based on gravity loads only or inadequate levels of lateral forces. This necessitates the need for design based on seismic responses by suitable methods to ensure strength and stability of structures. Shear wall systems are one of the most commonly used lateral load resisting systems in high rise buildings..

This study aims at comparing various parameters such as storey drift, storey shear, deflection, reinforcement requirement in columns etc of a building under lateral loads based on strategic positioning of shear walls.

[4] Mahesh N. Patil, Yogesh N. Sonawane 2003.

The effective design and the construction of earthquake resistant structures have much greater importance in all over the world. In this paper, the earthquake response of symmetric multi-storeyed building is studied by manual calculation and with the help of ETABS 9.7.1 software. The method includes seismic coefficient method as recommended by IS 1893:2002. The responses obtained by manual analysis as well as by soft computing are compared. This paper provides complete guide line for manual as well s software analysis of seismic coefficient method.

[5] Sonia Longjam, S. Aravindan (2010).

The paper presents the plan, model, analyze and design of a vertical irregular shopping mall structure of G+ 10 storeys and investigate its performance under various lateral loading conditions. The main goal is to assess current Indian Standard design practice and to provide design guidelines using ETABS and to find a detailing strategy which will ensure a sufficient level of safety for various levels of loading demands.

CHAPTER 3
METHODOLY

SOFTWARES

This project is mostly based on software and it is essential to know the details about these software's.

3.1 STAAD

Staad is powerful design software licensed by Bentley .Staad stands for structural analysis and design any object which is stable under a given loading can be considered as structure. So first find the outline of the structure, whereas analysis is the estimation of what are the type of loads that acts on the beam and calculation of shear force and bending moment comes under analysis stage. Design phase is designing the type of materials and its dimensions to resist the load. This we do after the analysis.

To calculate s.f.d and b.m.d of a complex loading beam it takes about an hour. So when it comes into the building with several members it will take a week. Staad pro is a very powerful tool which does this job in just an hour's staad is a best alternative for high rise buildings. Now a days most of the high rise buildings are designed by staad which makes a compulsion for a civil engineer to know about this software. This software can be used to carry rcc, steel, bridge, truss etc. According to various country codes.

3.2 Alternatives for staad

Struts, robot, sap, adds pro which gives details very clearly regarding reinforcement and manual calculations. But these software's are restricted to some designs only where as staad can deal with several types of structure.

3.3 Staad Editor

Staad has very great advantage to other software's i.e., staad editor. staad editor is the programming For the structure we created and loads we taken all details are presented in programming format in staad editor. This program can be used to analyze another structures also by just making some modifications, but this require some programming skills. So load cases created for a structure can be used for another structure using staad editor. Limitations of Staad pro:

1. Huge output data
2. Even analysis of a small beam creates large output.
3. Unable to show plinth beams.

3.4 Staad foundation

Staad foundation is a powerful tool used to calculate different types of foundations. It is also licensed by Bentley software's. All Bentley software's cost about 10 lakhs and so all engineers can't use it due to heavy cost. Analysis and design carried in Staad and post processing in staad gives the load at various supports. These supports are to be imported into this software to calculate the footing details i.e., regarding the geometry and reinforcement details. This software can deal different types of foundations SHALLOW (DB)

1.Pile Cap
2. Driller Pier

1. Isolated footing is spread footing which is common type of footing.
2. Combined Footing or Strap footing is generally laid when two columns are very near to each other.
3. Mat foundation is generally laid at places where soil has less soil bearing capacity.
4. Pile foundation is laid at places with very loose soils and where deep excavations are required. So depending on the soil at type we have to decide the type of foundation required.

Also lot of input data is required regarding safety factors, soil, materials used should be given in respective units. After input data is give software design the details for each and every footing and gives the details regarding

1. Geometry of footing
2. Reinforcement
3. Column layout
4. Graphs
5. Manual calculations

These details will be given in detail for each and every column. Another advantage of foundations is even after the design; properties of the members can be updated if required. The following properties can be updated Column Position Column Shape Column Size Load Cases Support List It is very easy deal with this software and we don't have any best alternative to this.

3.5 AutoCAD

AutoCAD is powerful software licensed by auto desk. The word auto came from auto Desk Company and cad stands for computer aided design. AutoCAD is used for drawing different layouts, details, plans, elevations, sections and different sections can be shown in auto cad. It is very useful software for civil, mechanical and also electrical engineer. The importance of this software makes every engineer a compulsion to learn this software's. We used AutoCAD for drawing the plan, elevation of a residential building. We also used AutoCAD to show the reinforcement details and design details of a stair case. AutoCAD is a very easy software to learn and much user friendly for anyone to handle and can be learn quickly Learning of certain commands is required to draw in AutoCAD.

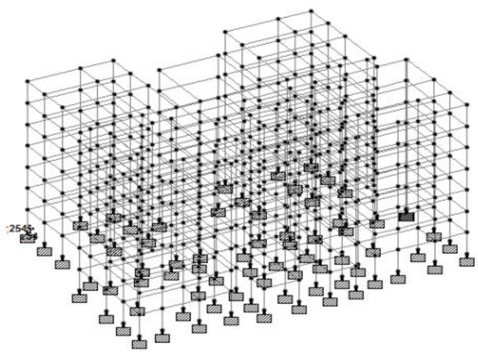


Figure 3.1 shows the design of multi-storeyed building using E-TABS

3.6.4 Load Conditions and Structural System Response:

The concepts presented in this section provide an overview of building loads and their effect on the structural response of typical wood-framed homes. As shown in Table, building loads can be divided into types based on the orientation of the structural action or forces that they induce: vertical and horizontal (i.e., lateral) loads.

3.6.5 Building Loads Categorized by Orientation:

Types of loads on a hypothetical building are as follows. ¾ Vertical Loads ¾ Dead (gravity) ¾ Live (gravity) ¾ Snow (gravity) ¾ Wind (uplift on roof) ¾ Seismic and wind (overturning) ¾ Seismic (vertical ground motion)

3.6.6 Horizontal (Lateral) Loads:

Direction of loads is horizontal w.r.t to the building. ¾ Wind ¾ Seismic(horizontal ground motion) ¾ Flood(static and dynamic hydraulic forces ¾ Soil(active lateral pressure)

3.6.7 Vertical Loads:

Gravity loads act in the same direction as gravity (i.e., downward or vertically) and include dead, live, and snow loads. They are generally static in nature and usually considered a uniformly distributed or concentrated load. Thus, determining a gravity load on a beam or column is a relatively simple exercise that uses the concept of tributary areas to assign loads to structural elements, including the dead load (i.e., weight of the construction) and any applied loads(i.e., live load).

For example, the tributary gravity load on a floor joist would include the uniform floor load(dead and live) applied to the area of floor supported by the individual joist. The structural designer then selects a standard beam or column model to analyze bearing connection forces (i.e., reactions) internal stresses (i.e., bending stresses, shear stresses, and axial stresses) and stability of the structural member or system a for beam equations.

The selection of an appropriate analytic model is, however no trivial matter, especially if the structural system departs significantly from traditional engineering assumptions are particularly relevant to the structural systems that comprise many parts of a house, but to varying degrees. Wind uplift forces are generated by negative (suction) pressures acting in an outward direction from the surface of the roof in response to the aerodynamics of wind flowing over and around the building.

As with gravity loads, the influence of wind up lift pressures on a structure or assembly(i.e., roof) are analyzed by using the concept of tributary areas and uniformly distributed loads. The major difference is that wind pressures act perpendicular to the building surface (not in the direction of gravity) and that pressures vary according to the size of the tributary area and its location on the building, particularly proximity to changes in geometry (e.g., eaves, corners, and ridges).

However, Vertical earthquake loads are usually considered to be implicitly addressed in the gravity load analysis of a light-frame building.

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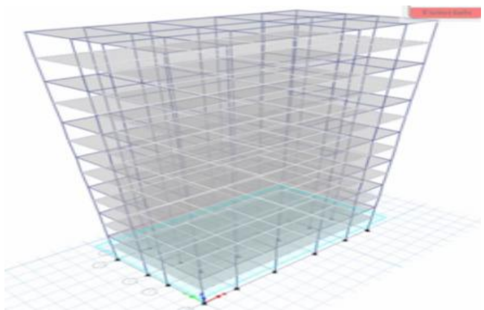


Figure 3.2 shows the 3-D design of the G+8 multistore building

Dead Loads:

Dead load is the total load of all of the components of the components of the building that generally do not change over time, such as the steel columns, concrete floors, bricks, roofing material etc. In staad pro assignment of dead load is automatically done by giving the property of the member. In load case we have option called self-weight which automatically calculates weights using the properties of material i.e., density and after assignment of dead load the skeletal structure looks red in colour as shown in the figure.

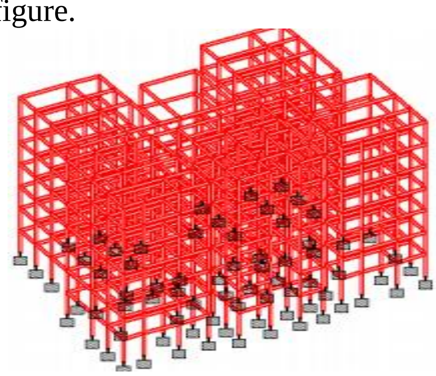


Figure 3.3 shows the dead load on G+8 building

Dead load calculation

Weight=Volume x Density Self weight floor finish

=0.12*25+1=3kn/m^2

The above example shows a sample calculation of dead load.

Dead load is calculated as per IS 875 part 1

Live Loads:

Live loads are produced by the use and occupancy of a building. Loads include those from human occupants, furnishings, no fixed equipment, storage, and construction and maintenance activities. As required to adequately define the loading condition, loads are presented in terms of uniform area loads, concentrated loads, and uniform line loads. The uniform and concentrated live loads should not be applied simultaneously n a structural evaluation.

Design wind speed:

The basic wind speed (Vb) for any site shall be obtained the following effects to get design wind velocity at any height (Vz) for the chosen structure.

a) Risk level

b) Terrain roughness, height and size of the structure and

c) Local topography

It can be mathematically expressed as follows:

Vs.=Vb* K1* K2* K3

Where Vz= design wind speed at any height Z in m/s

K1= probability factor (risk coefficient)

K2=terrain height and structure size factor and

K3=topography factor

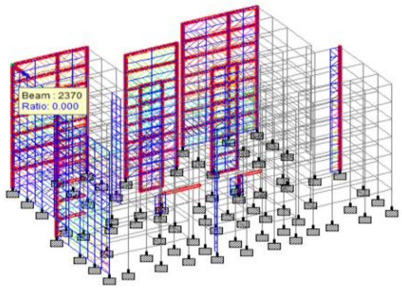


Figure 3.5 shows the Wind load is applied on G+8 multistore building

Load combinations:

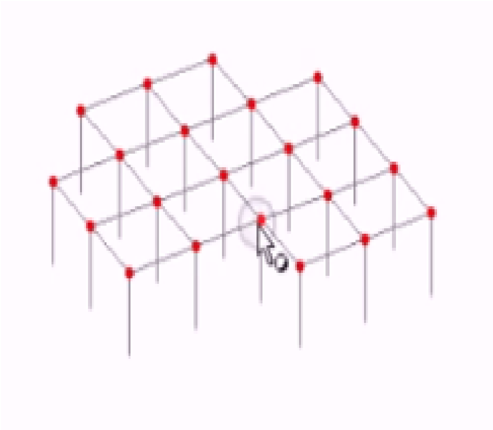
All the load cases are tested by taking load factors and analysing the building in different load combination as per IS456 and analysed the building for all the load combinations and results are taken and maximum load combination is selected for the design

Table 3.1 maximum load combination is selected for the design

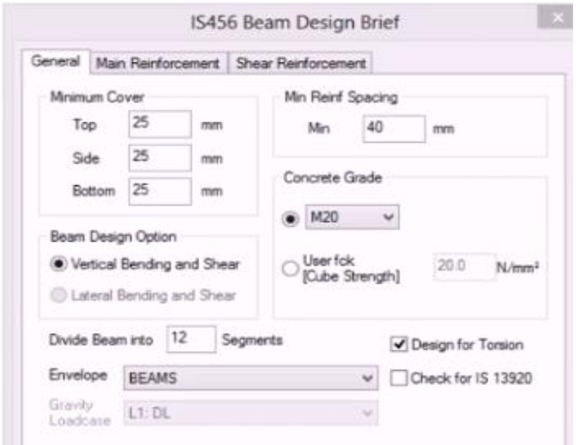
Live load	Dead load	Wind load
1.5	1.5	0
1.2	1.2	1.2
0.9	0.9	0.9

When the building is designed for both wind and seismic loads maximum of both is taken. Because wind and seismic do not come at same time as per code. Structure is analysed by taking all the above combinations.

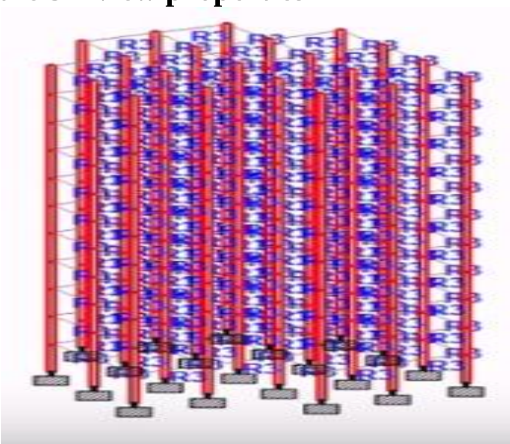
4.0 RESULTS & Discussion



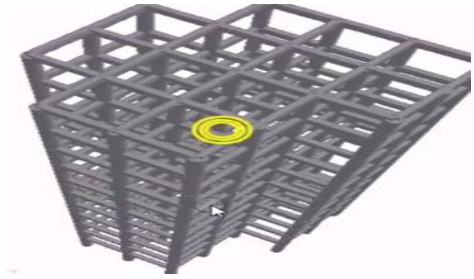
The 4.1 fig shows that basement of the view



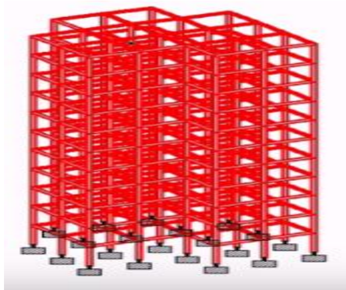
The fig 4.4 shows that beam design of the 3D view properties



4.6 shows that dead loads of the 3D view



The fig 4.8 shows that g+8 structural shape of the 3D View



The fig 4.9 shows that live loads of the 3D View

LENGTH: 5000.0 mm SIZE: 500.0 mm X 750.0 mm COVER: 25.0 mm

SUMMARY OF REINF. AREA (Sq.mm)

SECTION	0.0 mm	1250.0 mm	2500.0 mm	3750.0 mm	5000.0 mm
TOP REINF.	768.07 (Sq. mm)	0.00 (Sq. mm)	0.00 (Sq. mm)	0.00 (Sq. mm)	768.07 (Sq. mm)
BOTTOM REINF.	0.00 (Sq. mm)	737.35 (Sq. mm)	737.35 (Sq. mm)	737.35 (Sq. mm)	0.00 (Sq. mm)

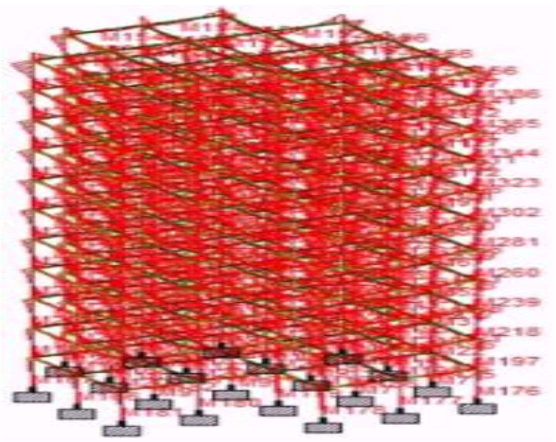
SUMMARY OF PROVIDED REINF. AREA

SECTION	0.0 mm	1250.0 mm	2500.0 mm	3750.0 mm	5000.0 mm
TOP REINF.	10-10i 1 layer(s)	10-10i 1 layer(s)	10-10i 1 layer(s)	10-10i 1 layer(s)	10-10i 1 layer(s)
BOTTOM REINF.	10-10i 1 layer(s)	10-10i 1 layer(s)	10-10i 1 layer(s)	10-10i 1 layer(s)	10-10i 1 layer(s)
SHEAR REINF.	2 legged 8i @ 180 mm c/c	2 legged 8i @ 180 mm c/c	2 legged 8i @ 180 mm c/c	2 legged 8i @ 180 mm c/c	2 legged 8i @ 180 mm c/c

The fig 4.11 shows that g+8 properties of displacement loads

The graph 4.1 shows that structural shape design of rein for cement buildings

Serial No.	Bar Dia	X Dist (cm)	Starting Distance (m)	Ending Distance (m)
1	12	5.4	0.001	9.999
2	12	11.9	0.001	9.999
3	12	18.5	0.001	9.999
4	12	25.0	0.001	9.999
5	12	31.5	0.001	9.999



The fig 4.11 shows that dead loads applied to the g+8 multi stored building

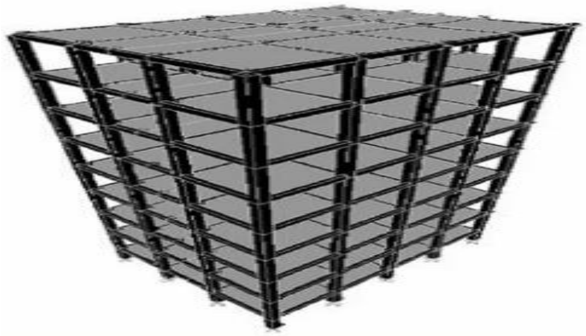


Fig 4.12 3-D view of the eight storey building (G+8) created in ETAB Gravity load

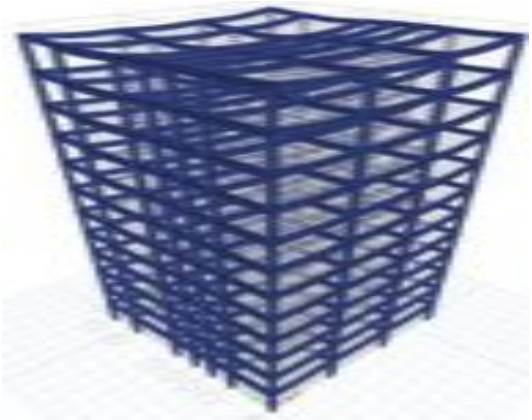


Fig 4.13 COLUMN AND BEAM REINFORCEMENT DETAILS

The table 4.3 shows that g+8 multi-stored design properties

Structure1 - Design Group 1 - Member 1 Main Reinforcement (Hogging)

Distance (m)	Span	Moment (kNm)	As Req. (mm^2)	As' Req. (mm^2)	Bottom Layers Bars	Bottom Layers Area (mm^2)	Top Layers Bars	Top Layers Area (mm^2)
0.000	1(s)	51.960	709	0	7T12	792	7T12	79
0.417	1	30.854	714	0	7T12	792	7T12	79
0.833	1	12.506	714	0	7T12	792	7T12	79
1.250	1	0.000	714	0	7T12	792	7T12	79
1.667	1	0.000	714	0	7T12	792	7T12	79
2.083	1	0.000	714	0	7T12	792	7T12	79
2.500	1	0.000	714	0	7T12	792	7T12	79
2.917	1	0.000	714	0	7T12	792	7T12	79
3.333	1	0.000	714	0	7T12	792	7T12	79

5.0 CONCLUSION

Pride seems to be the prime motivation for the construction of ancient tall structures such as the pyramids of Egypt, the Mayan temples of Mexico and the Kutub Minar of India. Industrialisation and urbanisation have led to the evolution of modern tall buildings for residential and commercial purposes. Significant advances in the design and construction of high-rise buildings have occurred in recent years. This has been possible on account of developments in the use of new materials, construction techniques or forms of service. This chapter mainly concentrated with the evolution, anatomy and different types of tall structural systems and loadings. Meeting the design challenges are described in conceptual way.

1. Designing using Software's like Staad reduces lot of time in design work.

2. Details of each and every member can be obtained using staad pro.
3. All the List of failed beams can be obtained and also Better Section is given by the software.
4. Accuracy is improved by using software.

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