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Analysis and Design of G+9 Educational Building Using Etabs

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Abstract- In this project work, an attempt has been made to plan and design a G+9 storied educational building. This project work involves planning, analysis, designs, and drawings of a typical multistoried building. The salient features of the G+9 storied building are as given below the basement floor is 1.20m above the existing ground level. The shopping complex consists of G+9 floors with 4.00m ceiling height. The carpet area available in each floor is 3000sq.m. This educational building having all facilities under one roof, designed with workstations, conference hall, individual cabins for higher officials, Discussion rooms with all other amenities and very good water supply and sanitary arrangements. Structural analysis is a branch which involves determination of behavior of structures in order to predict the responses of real structures such as buildings, bridges, trusses etc, with economy, elegance, serviceability and durability of structure. Structural engineers are facing the challenge of striving for the most efficient and economical design with accuracy in solution, while ensuring that the final design of a building must be serviceable for its intended function over its design lifetime. This project attempts to understand the structural behavior of various components in the multi-storied building. Analysis, designing and estimation of multi-storied building has been taken up for Basement+G+2 Building, thereby depending on the suitability of plan, layout of beams and positions of columns are fixed. Dead loads are calculated based on material properties and live loads are considered according to the code IS875-part 2, footings are designed based on safe bearing capacity of soil. For the design of columns and beams frame analysis is done by limit state method to know the moments they are acted upon. The structural design has been manually done. The estimate of the building is prepared on the basis of plinth area rate. Necessary structural drawings are enclosed at appropriate places.

Index Terms- Modelling, R.C.C Design, Beaam, Slab

I. INTRODUCTION

1. General

Structural design is the methodical investigation of the stability, strength and rigidity of structures. The basic objective in structural analysis and design is to produce a structure capable of resisting all applied loads without failure during its intended life. There are three fundamental components to the analysis and design of structures. These are, geometry, loading and ground conditions. For a structure to be accurately modelled, these three components must be defined correctly. Geometry and loading have very little margin of error. Structural Design. Structural Engineering is the branch which involves analysis and design of mainly steel, concrete, or timber framed structures such as Tall Buildings, Bridges, Dams, Towers, Offshore Platforms, Stadiums, Retaining Walls and Foundation.

- Step 1: Project Planning.
- Step 2: Site Preparation.
- Step 3: Foundation Construction.
- Step 4: Framing and Structural Work.
- Step 5: Electrical and Plumbing Installation.
- Step 6: Interior Finishes.
- Step 7: Exterior Finishes.

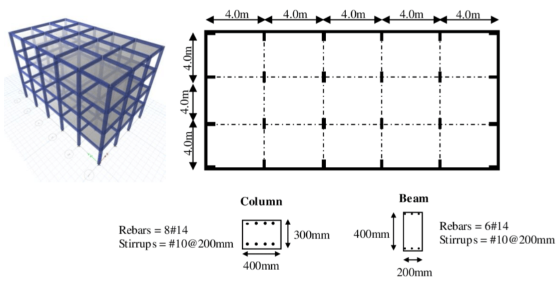

Fig 1 Structural Design

The 5 phases of a design project are Schematic Design, Design Development, Construction Documents, Bidding, and

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Construction Administration, according to the American Institute of Architects (AIA). Structural design is the process of creating a safe and functional structure under any load that it may experience. During this process, the structural engineer will determine the structure's stability, strength, and stiffness (rigidity). The basic objective in structural design and analysis is to produce a structure capable of resisting all applied loads without failure during its intended life.There are mainly 5 essential steps to be followed for the design of any structure. (1) modelling, (2) load analysis, (3) structural analysis, (4) structural design and (5) detailing.

2. Site Selection

I have decided to choose the site for the construction of Educational building at Dr.M.G.R Educational and Research Institute , Maduravoyal. The site accommodates the following special feature. Land is available in Chennai city. The site is located nearby commercial place.

24-hour transportation facilities available, Proposed site creates a pleasant environment.

Level at the site

The level at the site must be higher than that of its surrounding so as to provide good drainage.

Climate Condition

The intensity of the rainfall and sub soil water level should be low as to avoid dampness in the building.

Sub-Soil Condition

A hard stratum should be available at a reasonable depth so as to construct the foundation of the building safely and economically.

Availabilities of Modern Amenities

The site must be within municipal limits so that modern amenities like water supply, electricity, drainage, road etc. can be made available inner future if there is no provision at present.

3. Building

Any structure constructed of what so ever material and used for residential, business education or other purposes is called building. Types of the Building: Based on occupancy, Based on type of construction

Residential Buildings

The building in which sleeping accommodation is provided for normal residential purposes are called residential buildings.

Educational / Institutional Buildings

The building used for school, college or day care purposes are called education / institutional building.

Assembly Buildings

The buildings which are constructed for the purposes to gathering of the people for their respective purposes i.e. social, religious, civil, political is called assembly buildings.

Business Buildings

The buildings used for transaction of business, for the keeping of accounts and records and other similar purposes called business buildings.

Mercantile Buildings

The buildings used for display of merchandise, either wholesale or retail are called Mercantile Buildings.

Industrial Buildings

The buildings in which products or materials of all kinds and properties are fabricated, assembled or processed are called industrial buildings.

Storage Buildings

The buildings used primary for the storage, handling or shattering of goods and wares or merchandise, vehicles and animals are called storage buildings.

Fig 2. Building Structures

4. Loads on Structures

A structural load or structural action is a force, deformation, or acceleration applied to structural elements. A load causes stress, deformation, and displacement in a structure. Structural analysis, a discipline in engineering, analyzes the effects of loads on structures and structural elements. Excess load may cause structural failure, so this should be considered and controlled during the design of a structure. Particular mechanical structures—such as aircraft, satellites, rockets, space stations, ships, and submarines—are subject to their own particular structural loads and actions. Engineers often evaluate structural loads based upon published regulations, contracts, or specifications. Accepted technical standards are used for acceptance testing and inspection.

Dead loads are static forces that are relatively constant for an extended time. They can be in tension or compression. The term can refer to a laboratory test method or to the normal usage of a material or structure. Live loads are usually variable or moving loads. These can have a significant dynamic element and may involve considerations such as impact, momentum, vibration, slosh dynamics of fluids, etc.

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An impact load is one whose time of application on a material is less than one-third of the natural period of vibration of that material. Cyclic loads on a structure can lead to fatigue damage, cumulative damage, or failure. These loads can be repeated loadings on a structure or can be due to vibration.

Structural loads are an important consideration in the design of buildings. Building codes require that structures be designed and built to safely resist all actions that they are likely to face during their service life, while remaining fit for use.[4] Minimum loads or actions are specified in these building codes for types of structures, geographic locations, usage and building materials.[5] Structural loads are split into categories by their originating cause. In terms of the actual load on a structure, there is no difference between dead or live loading, but the split occurs for use in safety calculations or ease of analysis on complex models.

To meet the requirement that design strength be higher than maximum loads, building codes prescribe that, for structural design, loads are increased by load factors. These load factors are, roughly, a ratio of the theoretical design strength to the maximum load expected in service. They are developed to help achieve the desired level of reliability of a structure[6] based on probabilistic studies that take into account the load's originating cause, recurrence, distribution, and static or dynamic nature.

Dead load

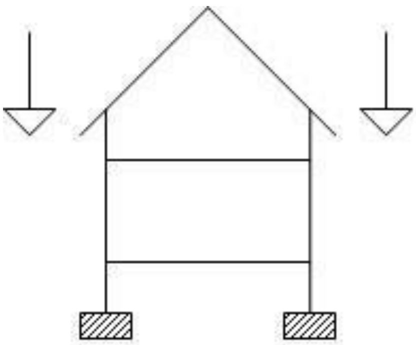

Fig 3. Dead load

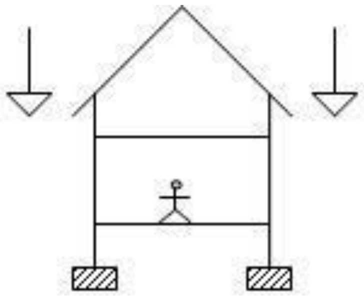

Fig 4. Imposed load (live load)

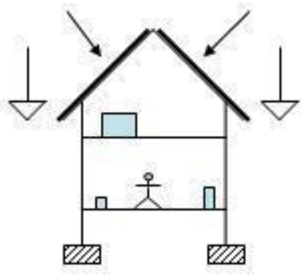

Fig 5. Live snow load

The dead load includes loads that are relatively constant over time, including the weight of the structure itself, and immovable fixtures such as walls, plasterboard or carpet. The roof is also a dead load. Dead loads are also known as permanent or static loads. Building materials are not dead loads until constructed in permanent position.[8][9][10] IS875(part 1)-1987 give unit weight of building materials, parts, components.

Live load

Live loads, or imposed lds, are temporary, of short duration, or a moving load. These dynamic loads may involve considerations such as impact, momentum, vibration, slosh dynamics of fluids and material fatigue. Live loads, sometimes also referred to as probabilistic loads, include all the forces that are variable within the object's normal operation cycle not including construction or environmental loads.

Roof and floor live loads are produced during maintenance by workers, equipment and materials, and during the life of the structure by movable objects, such as planters and people. Bridge live loads are produced by vehicles traveling over the deck of the bridge.

Environmental loads

Environmental loads are structural loads caused by natural forces such as wind, rain, snow, earthquake or extreme temperatures.

- Wind loads
- Snow, rain and ice loads
- Seismic loads
- Hydrostatic loads
- Temperature changes leading to thermal expansion cause thermal loads
- Ponding loads
- Frost heaving
- Lateral pressure of soil, groundwater or bulk materials
- Loads from fluids or floods
- Permafrost melting
- Dust loads

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Other Loads
Engineers must also be aware of other actions that may affect a structure, such as:

- Foundation settlement or displacement
- Fire
- Corrosion
- Explosion
- Creep or shrinkage
- Impact from vehicles or machinery vibration
- Construction loads

Load combinations
A load combination results when more than one load type acts on the structure. Building codes usually specify a variety of load combinations together with load factors (weightings) for each load type in order to ensure the safety of the structure under different maximum expected loading scenarios. For example, in designing a staircase, a dead load factor may be 1.2 times the weight of the structure, and a live load factor may be 1.6 times the maximum expected live load. These two "factored loads" are combined (added) to determine the "required strength" of the staircase.

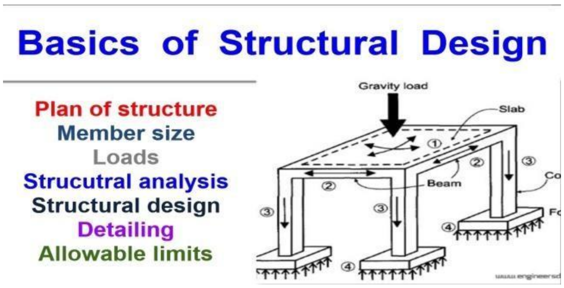

Fig 6 Load path of Structural Design

5. Structural Design
The G+9 storied commercial building is proposed to be constructed at as site heart of the town. The soil at the site is hard soil having a safe bearing of 200KN/m2. The size of the plot is 2000m2.The entire process of structural planning and design requires not only imagination and conceptual thinking but also sound knowledge of practical aspects, such as recent design codes and bye-laws, backed up by ample experience, institution and judgment. It is emphasized that any structure to be constructed must satisfy the need efficiency for which it is intended and shall be durable for its desired life span. Thus, the design of any structure is categorizes into following two main types:-

- Functional design
- Structural design

Functional Design of Structures
The structure to be constructed should primarily serve the basic purpose for which it is to be used and must have a pleasing look. The building should provide happy environment inside as well as outside. Therefore, the functional planning of a building must take into account the proper arrangements of room/halls to satisfy the need of the client, good ventilation, lighting, acoustics, unobstructed view in the case of community halls, cinema theatres, etc.

Structural Design
Once the form of the structure is selected, the structural design process starts. Structural design is an art and science of understanding the behavior of structural members subjected to loads and designing them with economy and elegance to give a safe, serviceable and durable structure.

Fig 7 Structural building

6. Stages in Structural Design
The process of structural design involves the following stages. Structural planning, Action of forces and computation of loads, Methods of analysis, Member design, Detailing, Drawing and Preparation of schedules

Structural Planning
After getting an architectural plan of the buildings, the structural planning of the building frame is done. This involves determination of the following.

- Position and orientation of columns
- Positioning of beams
- Spanning of slabs
- Layouts of stairs
- Selecting proper type of footing.

Positioning and orientation of columns Following are some of the building principles, which help in deciding the columns positions.

- Columns should preferably be located at (or) near the corners of a building, and at the intersection of beams/walls.
- Select the position of columns so as to reduce bending moments in beams.
- Avoid larger spans of beams.
- Avoid larger centre-to-centre distance between columns.
- Columns on property line.

Orientation of Columns
Avoid projection of columns: The projection of columns outside the wall in the room should be avoided as they not

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only give bad appearance but also obstruct the use of floor space, creating problems in placing furniture flush with the wall. The width of the column is required to be kept not less than 200mm to prevent the column from being slender. The spacing of the column should be considerably reduced so that the load on column on each floor is less and the necessity of large sections for columns does not arise. 2. Orient the column so that the depth of the column is contained in the major plane of bending or is perpendicular to the major axis of bending. This is provided to increase moment of inertia and hence greater moment resisting capacity. It will also reduce Leff/d ratio resulting in increase in the load carrying capacity of the column.

Positioning of Beams

1. Beams shall normally be provided under the walls or below a heavy concentrated load to avoid these loads directly coming on slabs. 2. Avoid larger spacing of beams from deflection and cracking criteria. (The deflection varies directly with the cube of the span and inversely with the cube of the depth i.e. L3/D3. Consequently, increase in span L which results in greater deflection for larger span).

Spanning of Slabs

This is decided by supporting arrangements. When the supports are only on opposite edges or only in one direction, then the slab acts as a one way supported slab. When the rectangular slab is supported along its four edges it acts as a one way slab when $Ly/Lx < 2$. The two way action of slab not only depends on the aspect ratio but also on the ratio of reinforcement on the directions. In one way slab, main steel is provided along with short span only and the load is transferred to two opposite supports. The steel along the long span just acts as the distribution steel and is not designed for transferring the load but to distribute the load and to resist shrinkage and temperature stresses. A slab is made to act as a one way slab spanning across the short span by providing main steel along the short span and only distribution steel along the long span. The provision of more steel in one direction increases the stiffness of the slab in that direction. According to elastic theory, the distribution of load being proportional to stiffness in two orthogonal directions, major load is transferred along the stiffer short span and the slab behaves as one way. Since, the slab is also supported over the short edge there is a tendency of the load on the slab by the side of support to get transferred to the nearer support causing tension at top across this short supporting edge. Since, there does not exist any steel at top across this short edge in a one way slab interconnecting the slab and the side beam, cracks develop at the top along that edge. The cracks may run through the depth of the slab due to differential deflection between the slab and the supporting short edge beam/wall. Therefore, care should be taken to provide minimum steel at top across the short edge support to avoid this cracking. A two way slab is generally economical compare to one way slab because steel along both the spans acts as main steel and transfers the load to all its four supports. The two way action is advantageous essentially for large spans (>3m) and for live loads (>3kN/m2). For short spans and light loads, steel required for two way slabs does not differ appreciably as compared to steel for two way slab because of the requirements of minimum steel.

Structural Design of Foundations

The type of footing depends upon the load carried by the column and the bearing capacity of the supporting soil. The soil under the foundation is more susceptible to large variations. Even under one small building the soil may vary from soft clay to a hard murum. The nature and properties of soil may change with season and weather, like swelling in wet weather. Increase in moisture content results in substantial loss of bearing capacity in case of certain soils which may lead to differential settlements. It is necessary to conduct the survey in the areas for soil properties. For framed structure, isolated column footings are normally preferred except in case of exists for great depths, pile foundations can be an appropriate choice. If columns are very closely spaced and bearing capacity of the soil is low, raft foundation can be an alternative solution. For a column on the boundary line, a combined footing or a raft footing may be provided.

II. LITERATURE REVIEW

Tridibesh Indu (2012) had carried out the analysis work for different types of pile caps having different number of piles under it. Principles for the analysis were suggested and an illustration for a 4-pile rectangular cap under biaxially eccentric column load had been done, this principle was utilized for a few types of caps in respect of the application and scope of truss method. The paper includes the method to analysis for three pile group, hexagonal pile group and rectangular pile group. This paper was prepared and presented as the information on the application of the truss method for the design of the pile caps is scarce. The paper concludes that the approach provides conceptually elegant solutions for triangle, hexagonal and rectangular pile group, but then beam method should continue to be used as a safe general procedure.

P.C. Varghese (2011) carried out the design of pile cap considering the case study of raja garden flyover which is situated in Delhi. The designing of the pile cap was done using the bending theory and truss analogy method. Various load combinations including seismic, longitudinal and transverse loads were considered. Reinforcement details for each method were included. The load combinations considered for design of pile cap were the total vertical load, total longitudinal moment and total transverse moment. Load on pile cap had been calculated considering the maximum effects from normal case, seismic longitudinal case and

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seismic transverse case. In this paper the analysis was done by the bending theory and truss analogy method for the different pile caps under the flyover and maximum area of steel calculated by either of the method was provided

S. C. Gupta (2010) In this study, work carried out by S. C. Gupta was on the analysis method for calculating the bending moment of piles and results of it were supported by finite element analysis on computers. Most of the methods available for analysis of piles are given in standard books and Indian codes, are for single pile. The behavior of pile under combined axial and lateral loads is not defined in codes and in general literature. Most of the design engineers are designing piles based on length of fixity charts as given in IS 2911 Part 1. Further the work also includes the drawbacks for the moment calculation on the pile as per I.S. code and other formulas from which the code has suggested the method. To prove this drawback true, a pile group model was prepared with the help of finite element and STAAD Pro software. The general theory for the calculating the length of fixity suggested by code was the main concern for this study. The method for moment calculation on the single pile was suggested by the author and possible checks for the analysis were also included. The piles designed by the suggested method were not only economical but also safer. To prove this statement a case study on a real bridge design was considered, which were earlier designed based on the length of fixity calculation as per IS: 2911 and were crossed checked by the recommended method. This study concludes that the recommended method by not only economies the design by more than 30 percent in terms of flexural reinforcement but also reduces the overall length of the pile.

K. S. Sivakumaran and T. Balendra (1994) studies about Seismic analysis of asymmetric multistorey buildings including foundation interaction and P-A effects on three-dimensional asymmetric multistorey buildings founded on flexible foundations. The calculation method also includes the P ~ effect, where the additional tilt and torsion moments on each floor due to the pA effect are replaced by fictitious lateral forces and moments. The entire system has 3N + 5 degrees of freedom displacement. The required basic equations were created taking into account the three movements of each floor and the five movements of the entire building. Given the fact that only the superstructure allows classical normal mode, the floor's definitive equations for foundation displacement are first separated by the mode superposition method. Substitution of structural deformation combined with the dynamic soil structure-interaction-forced displacement relationship in the system-wide deterministic equations leads to five integro-differential equations of basal displacement by numerical stepwise time history analysis.

Juan C. De La Llera and Anil K. Chopra (1995) develops a simplified model for the analysis and design of unsymmetrically planned building. This model is based on one super element per floor of the building and can represent the elastic and inelastic properties of the floor. This is done by adapting the projectile's stiffness matrix and load-bearing area to that of the element; this area refers to the thrust and moment of the projectile. Several numerical studies have shown that the accuracy of the super element model is sufficient for most design purposes. The peak response error is expected to be less than 20% for most practical structures.

A structure can be defined as a body which can resist the applied loads appreciable deformations. Structure analysis involves the determination of the forces and displacement of the structure or components of a structure. Design process involves the selection and detailing of the component that make up the structure system. The main object of reinforced concrete design is to achieve a structure that will result in a safe economical solution. The design of each part may be designed separately as follows: 1. Beam design 2. Column design 3. Slab design 4. Foundation design These all are designed under limit state method.

Rashmi Agashe April2020 Comparison between manual calculation and STADD Pro. Software analysis and design, conclude that the analysis is same but design is some different. Using STADD Pro., analysis and design of multistorey building has completed much quickly and easier than the manual calculation. Building plan was developing and draft in AutoCAD with required dimension. During designing G+4 storey residential building structure is capable to sustain all loads acting on building. The design of slab, beam, column, rectangular footing and staircase is done with IS 456-2000 as limit state method.

Arjun Sahu (2010) - Design & Analysis of Multistorey (G+3) Residential Building Planning, analysis and design of G+3 multi-storey residential building was done. It's a G+3 storied building with parking in the basement and the rest of the floors are occupied with apartments. All the structural components were designed manually and detailed using AutoCAD. The analysis and design were done according to standard 8 specifications using STAAD.Pro for static and dynamic loads. The dimensions of structural members are specified and the loads such as dead load, live load, floor load and earthquake load are applied. Deflection and shear tests are checked for beams, columns and slabs. The tests proved to be safe. Theoretical work has been done. Hence, I conclude that we can gain more knowledge in practical work when compared to theoretical work.

Sreeshna K.S (2016) this paper deals with structural analysis and design of B+G+4 storied apartment building. The work was completed in three stages. The first stage was modelling and analysis of building and the second stage was to design the structural elements and the final was to detail

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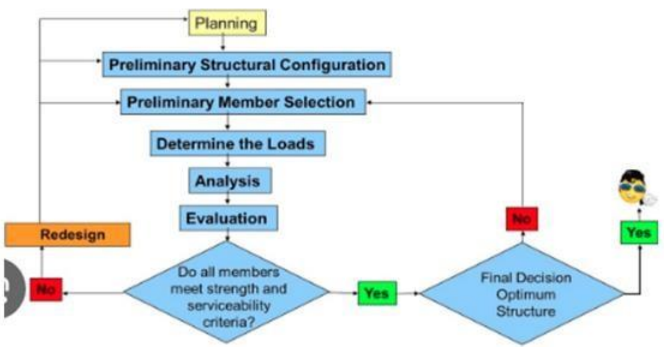
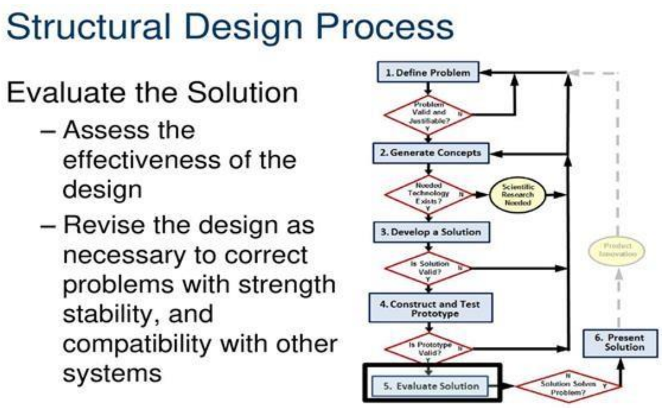
III. METHODOLOGY





IV. STRUTURAL CALCULATION

1. Desing of R.C.C Grid Floor Slab (IS456-2000)

Data

Floor slab area =12m x 15m

Spacing of ribs in mutually perpendicular direction =1.5m c/c

Live load on floor =4kN/m2 M20 & Fe415

Design Floor Slab IS456

Solution

Let size of grid =1.5m x 1.5m

Effective span of slab =1.5m(Lx) & Ly =1.5m

span ratio =Ly/Lx =1.5/1.5 =1

Load on slab per square m

Assume Thickness of slab =100mm & Effective cover 20mm

Load

Self Wt (0.10*25kN/m3) =2.5kN/m^2

Live load =4kN/m^2

Floor finish load =1.5kN/m^2

Total load =8kN/m2

Factored load(1.5x8kN/m2) =12kN/m2

Refer Page 91, Table 26 (IS456), for interior panel

Bending Moment

Ly/Lx =1.5/1.5 =1 Moment = coeff *w *lx^2

Negative moment =0.032x12x103x1.52=0.864 kN.m

Positive moment =0.024x12x103x1.52 = 0.648 kN.m

Check the Depth of Slab

$0.864*10^6$ =0.138*fck*b*d^2

=0.138*20 *1000*d^2 (say d=18mm)

Provide effective depth d =80mm

Total depth D =80+20 =100mm

Area of Tensile Reinforcement

M =0.87*fy*Ast*0.8d

$0.648*10^6$ =0.87*415*Ast*0.8*80

Ast =28.04mm^2

Use 10mm @150mm c/c on both Direction as in the Bottom Tensile Reinforcement

Deign for the negative moment to the slab at the support

Area of tensile reinforcement M =0.87*fy*Ast*0.8d

$0.864*10^6$ =0.87*415*Ast*0.8*80

=37.34mm^2

Use 8mm @150mm c/c on both Direction as in the 8 mm Top Negative Reinforcement

4.2 Desing of R.C.C Grid Beam (IS456-2000)

Data

Lx =12m & Ly =15m: k=Ly/Lx =1.25

Size of hall =12m x 15m

Spacing of grid =1.5m x 1.5m

Concrete =M20Grade

Steel =Fe415

Depth of Grid Beam

Depth of grid beam: D =Lx/25 to Ly/20

=12000/25 =480mm to 12000/20 =600mm

Provide depth grid D=600mm:effective depth of grid beam d =600-40 =560mm

Width of rib ≤≠ 0.25x560 =140mm : provide 200mm

Load Acting on the Grid Beam

[Weight of ribbs = (0.2x0.50x25) =2.5kN/m]

Beams in X-direction = (9x12) x 2.5) =270kN

Beams in Y-direction = (7x15) x 2.5) =262kN

Total live load = (12x15x3) =540kN

Floor finish load = (12x15x1.5) =270kN

Slab load on grid beam = (12*15) *slab load (8) =1440kN

load acting on the total grid beam =2782kN

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Load acting per m2 (w) =Tt load/Tt area
=15.45kN/m2

Load Acting on Edge of Grid Beam
Size of the hall is =Lx=12m, Ly=15m span ratio =Ly/Lx =1.25
Factored load on beam&slab =1.5*15.45
=23.17kN/m2
Load on Lx direction per m length =w*Lx/3
=92.68kN/m
Load on y direction
Span ratio =r =Ly/Lx =1.25
Load on Ly direction per m length =w*Lx[r/(2+r)]

=23.17*12[1.25/(2+1.25)] =107kN/m

Design of Edge Beam on Lx Direction
max bending moment on x-direction = +-wl2/12 = +-[(92.68*106*42)/12]
= +-128kN-m
max bending moment on y-direction = +-wl2/12 = +-[(92.68*106*52)/12]
= +-193kN-m
Design Beam on Lx Direction
Assume depth of beam on Lx direction 4000/13=307 say provide 450mm
Max shear on x-direction =w*spacing/2 =92.68*103*4/2 =185kN

Area of Reinforcement on X-Direction
Ast = m/[0.87*fy*0.8*d] = $(193*10_6)$/ [0.87*415*0.8*410]
Ast =1080mm2
Provide reinforcement 1% B.D = 1*300*450/100 =1350mm

Say #25-3nos Top & Bottom
Design of Shear Reinforcement on x-Direction(185kN)
Nominal shear stress =ultimate shear force/c/s area
= $[185*10^3/(300*410)]$ =1.50
Percentage of steel = [Ast/b*d]*100 =[3*490/(300*410)]*100
=1.195
Permissible Shear Stress is 0.40N/mm^2. Hence Shear Reinforcement is to be Provided.
Design of Vertical Stirrups
Vs =185*103-0.4*300*410 =135kN
use 12mm 2legged stirrups
$sv=2*113*230*410/135*10^3$ =150mm c/c

Provide #12 2 Legged Stirrups 150mm c/c for the Distance of L/3 and Provide #12mm 2-Leggeed Stirrups 200mmc/c L/3.
Accordance to the primary objectives of this study, which is to evaluate and design a commercial building while also adopting a manual procedure to satisfy criteria like economy, endurance, safeness, and aesthetic qualities, it is essential to compose the structure using this finite element software in the approach that is outlined here below in chronological.

- Modelling of Plan
- Defining and Assigning Members
- Assigning Loads and Combinations
- Checking Model for Errors
- Analysis and design of structure

As once plan has been developed, the columns and beams should be positioned in conformance with the centre line diagram. All members should then be defined and assigned in full compliance with the geometrical details as specified. The next step is to apply the loads and combinations to the structure. This one will show the loads very clearly in a 3-Dimensional Display, which is easy to comprehend. Individuals can see live loads and floor loads, after, performing everything by clicking on the details causes the structure to be detailed, and the values of every component in the structure are displayed.

V. CONCLUSION

In conclusion, the design and analysis of a G+9 residential building involves various aspects such as site selection, structural analysis, architectural design, building materials selection. A thorough analysis of the project is necessary to ensure the building's safety, stability, and durability. The selection of appropriate building materials, such as reinforced concrete and steel, is crucial to ensure the building's structural integrity. The design and construction of a G+5 building requires compliance with local building codes and regulations to ensure the safety of the occupants. Moreover, the architectural design of the building should prioritize functionality and aesthetics while providing comfortable living spaces. Proper ventilation, lighting, and thermal insulation are essential factors that need to be considered.

REFERENCES

1. Design and analysis of multi-storeyed building under static and dynamic loading conditions by using E-TABS by Balaji and Selvarasan in International Journal of Technical Research and Applications, Volume 4 , Issue 4(July-Aug, 2016), PP.1-5
2. Effect of base isolation in multistoried reinforced concrete building by M. Rajesh Reddy, Dr.N. Srujana, N.Lingeshwaran, IJCIET International Journal of civil engineering & technology, Volume 8, Issue 3, March 2017, PP. 878-887
3. Mahesh N. Patil, Yogesh N. Sonawane, –Seismic Analysis of Multi-storied Building‖, International Journal of

Engineering and Innovative Technology, ISSN: 2277-3754, Volume 4, Issue 9, March 2015.
4. Piyush Tiwari, P.J.Salunke, ―Earthquake Resistant Design of Open Ground Storey Building‖, International Research Journal of Engineering and Technology, ISSN: 2395 - 0056, Volume: 02 Issue: 07-Oct-2015.
5. ode Book-
6. IS 456-2000, Indian standard code of practice for plain and reinforced concrete standards.
7. IS: 1893 (Part 1)-2002, Indian Standard Criteria for Earthquake Resistant Design of Structures, (Part 1- General Provisions and Buildings.
8. IS: 875 (Part 1) – 1987, for Dead Loads, Indian Standard Code of Practice for Design Loads (Other than Earthquake) For Buildings and Structures.
9. IS: 875 (Part 2) – 1987, for Imposed Loads, Indian Standard Code of Practice for Design Loads (Other than Earthquake) For Buildings and Structures.
10. IS: 875 (Part 3) – 1987, for Wind Loads, Indian Standard Code of Practice for Design Loads (Other than Earthquake) For Buildings and Structures.
11. IS: 875 (Part 5) – 1987, for Special Loads and Combinations, Indian Standard Code of Practice for Design Loads (Other than Earthquake) For Buildings and Structures.