iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** VII **Month of publication:** July 2022

DOI: https://doi.org/10.22214/ijraset.2022.45993

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue VII July 2022- Available at www.ijraset.com

Review on Multistoried Building with Flat and Grid Slab

Y. K. Nikam[1], Dr. H. S. Jadhav[2]
[1]*Student M. Tech Structure, Rajarambapu Institute of Technology, Rajaramnagar*
[2]*Professor, Department of Civil Engineering, Rajarambapu Institute of Technology, Rajaramnagar*

***Abstract:** An increase the use of tall structures is caused by a constant rise in population. An earthquake is called on by seismic waves that reach the surface of the earth. Different locations experience different shaking intensity during earthquakes, and these locations also experience various degrees of construction damage. In order to build the structure to withstand an earthquake, these lateral forces on the structure must be estimated and specified. Structures should be stiff and strong enough to control displacement at supports and be designed to resist these rapid forces. Even a building's floor design can vary depending on how the structure responds to load. For long span projects, a conventional slab types are not typically used, but grid slab and flat slab are the most appropriate and cost-effective options. However, these two slabs have recently seen significant growth in India; they are often both flat slabs and grid slabs, which makes them comparable. The usage of flat slab buildings for construction is widespread in the modern day because they have several advantages over conventional RC frame structures in terms of architectural freedom, space use, ease of formwork, and speed of construction. For analysis and design IS 1893:2016, IS 456:2000 are used.*

***Keywords:** Flat Slab, Grid slab, Conventional slab, Lateral loads, Seismic parameters*

I. INTRODUCTION

The population's flexibility and ongoing development have increased the demand for the development of tall buildings. Such tall constructions are prone to earthquakes.

Because earthquake forces are unpredictable and random in nature, we should develop engineering tools for assessing structures when they are subjected to their effects. In order to analyse the behavior of the structure with a clear perspective of the potential damage, detailed modelling of such earthquake loads is therefore required. Over the past few decades, it has become critical activity to analyse the structure for various earthquake intensity and then carry out checks for various criteria at each level. The slab rests directly on the column in a flat slab building method. The load is transferred from the slab to the columns and then to the foundation as the slab rests directly on the column.

The thickness of the slab near to the support is increased to withstand heavy loads, causing drops, and columns are typically fitted with enlarged heads known as capitals or column heads. This type of structure reaches a flat ceiling, giving it an attractive architectural appearance. The construction known as a Grid Floor slab is constructed vertically to support both all its load and loads of a similar form.

With an increase in demand for space, the multi - story building is developing into a necessary element of our sophisticated and aesthetic way of life. The limited quantity of room forces us to raise the high level of the structure as high as we can in order to accommodate the biggest number of people possible while also keeping in mind the requirements of building design. The experience of design and construction is to hold the rays with columns and support the bits of material with lengthy supports. Beam slab buildings are the name given to these kinds of constructions. Framed buildings and flat slab buildings are the two primary categories based on how the slab, beams and girders, and columns are arranged.

II. LITERATURE REVIEW

1) *C H. Lokesh Nishanth, Y. Sai Swaroop, Durga Chaitanya Kumar Jagarapu, Pavan Kumar Jogi. "ANALYSIS AND DESIGN OF COMMERCIAL BUILDING WITH DIFFERENT SLAB ARRANGEMENTS USING ETABS" Elsevier (2020)*

This study aims to analyze and design a commercial structure with various slab configurations, including grid/waffle slabs, flat slabs with drop panels, and structures, conventional slabs and structure with load-bearing walls. The impact of seismic and wind loads on structures with various slab layouts has been examined by using ETABS software.

2) *K.Vivek, Prof G.V.Rama Rao "SEISMIC ANALYSIS AND COMPARISON BETWEEN FLAT SLAB AND GRID SLAB WITH DIFFERENT MASONRY IN FILLS" International Journal of Advanced Science and Technology Vol. 29, No. 4, (2020), pp. 11278 – 11289 (2020).*

In this study, one significant technology that is successful in transferring gravity and lateral stresses to vertical supports is the structural reinforced concrete floor system. Out of various types of floor systems this study offers frame modelling using flat slab and grid slab.

The majority of architects and clients prefer flat slabs because to their aesthetic and other benefits, which decrease design and delivery times, building costs, and increase building quality. Therefore, due to significant deflections and punching shear, when additional slab thickness is required, it may not be appropriate for short spans. When longer spans and greater weights are required, which calls for a thicker slab to provide a deflection limit. In this case, a grid slab is a great solution since it has a greater span in a structure with fewer columns and higher stiffness and less deflection. Where there is a need for less number of columns over a wide length, these slabs are frequently preferred. The current work uses ETABS to compare seismic factors such as story drift, story shear, and story displacement.

3) *Atif Zakaria, M. Shiva Rama Krishna, S.V.Surendhar "COMPARATIVE STUDY OF THE SEISMIC PERFORMANCE OF RCC BUILDING WITH RIBBED SLAB AND GRID SLAB" International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-8, Issue-6S3 (2019)*

This work contained a study of flat slab and grid slab to determine the seismic response of each of the two slab systems, a thorough study of each system was performed. The OMRF frame with shear walls and 4, 6, and 8 floors were adopted for study. ETABS software was used for analysis and design, after this the following methodology were used: 1. Response spectrum, 2. Time history, 3. Equivalent static method. After that following parameters were examined like Story drift, time period, story shear, base shear, and axial force in columns. Typical slab varieties are usually not adopted for long span projects, but grid slab and ribbed slab are the most appropriate and cost-effective options.

4) *Latha M.S., Pratibha K. "ANALYSIS AND COMPARISON OF CONVENTIONAL SLAB AND GRID SLAB FOR SYMMETRIC AND ASYMMETRIC STRUCTURES" Elsevier (2021).*

For this investigation, the square voided design is chosen. The study takes into account, analyses, and compares 12 storeys of symmetrical and asymmetrical buildings for vertical irregular, regular and plan irregular structures for both regular slab and grid slab under gravity load and lateral stress situations in accordance with IS standards. ETABS software is used to examine the structures.

Static analysis is performed in accordance with IS code 1893:2002 (Part 1) for regular and plan irregular structures, and dynamic analysis is performed by taking reference of with IS code 1893:2002 for both regular and grid slab structures for vertical irregular structures (Part 1). And compared the outcomes for the criteria of deflection, displacement, storey stiffness and storey shear between the regular slab and grid slab.

5) *Saksheshwari, Guruprasad T N, Raghu K S "COMPARATIVE STUDY ON CONVENTIONAL BEAM SLAB AND FLAT SLAB UNDER VARIOUS SEISMIC ZONES AND SOIL CONDITIONS" International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056 (2016).*

The goal of the effort is to comparing the behaviour of multi-story commercial structures like a flat slab with peripheral beams, flat slabs with drop and beam slab. Base shear, lateral displacement, and storey drift characteristics are well-covered in the current work by using ETABS.

6) *Hemalatha K.R, Ashwini B.T, Chethan V.R "FINITE ELEMENT ANALYSIS OF FLAT SLAB WITH DROP PANEL FOR APARTMENT BUILDING USING ETABS" International Research Journal of Engineering and Technology (IRJET) (2021).*

The primary objective of this research is to use etabs to analyze a flat slab with a drop panel. IS 456:2000 used to design the flat slab. According to IS 456:2000, the comparable frame technique with or without staggered columns is used for analysis and design. The flat slab has a high initial cost, and as per IS code study indicated that the structure's ductility and stiffness are limited.

7) *Abhijit K Sawwalakhe, Prabodh D Pachpor "COMPARATIVE STUDY OF CONVENTIONAL SLAB, FLAT SLAB AND GRID SLAB USING ETABS" IOP Conference Series: Materials Science and Engineering (2021).*

The project's goal is to identify which slab is the most affordable: out of grid slab, flat slab with drop, or standard slab. Parameters such as story displacement, shear force, bending moment, and story drift were investigated in this study for a G+5 commercial multi-story structure with flat slab, normal slab, and gird slab.

There are a total of 18 buildings that are being evaluated. The performance and behavior of all structures in India's seismic zone III have been examined using dead load, live load, and seismic load. Because of the overall obtained results, the shear force, bending moment, story shear, displacement, drift, and quantity of concrete and steel suggest that the flat slab is a more suitable structure than the standard and grid floor.

8) *S.Lakshmi Kiran1, Sri Raghu M.E. "COMPARATIVE ANALYSIS OF CONVENTIONAL SLAB AND FLAT SLAB SYSTEM OF COMMERCIAL BUILDING ON DIFFERENT ZONES AND HEIGHTS BY USING ETABS" International Research Journal of Engineering and Technology (IRJET) (2020)*

The primary purpose of this study is to analyze and compare the seismic performance of normal and flat floor systems of commercial buildings in all zones and at all heights using Etabs. In this concept, which also comprises a double basement, G+5, and G+10 story with terraces, a comparison was done between grid floor and flat floor slab with drop panels. Each structure was subjected to various loads, such as dead load, live load, seismic load, and wind load, either individually or collectively. The principal tool utilized in this study to measure how well the structures perform during earthquakes is the response spectrum technique.

9) *Niranjan Chaudhary, Krishna Prasad Bhatta, Nitin Verma "REVIEW PAPER ON SEISMIC BEHAVIOR OF FLAT SLABS OVER CONVENTIONAL RC SLABS IN MULTISTORIED BUILDING" International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 (2019)*

This study examine how flat slabs behave during earthquakes under various height variations, ground conditions, seismic zones, and other circumstances is the main objective of this work. Various evaluations have been carried out in diverse literatures utilizing various methodologies. In general, many software programs including STADD PRO, ETABS, and SAFE were employed, along with comparable static research methodologies, response spectrum methodologies, and time history techniques. Different criteria, including tale shear, story drift, story displacement, natural time period, and others, have been used to evaluate the authors.

10) *S Abhishek, Manoj S K, Roopa B D, Bhagyashree M S, Guruprasad "C H MDESIGN AND ANALYSIS OF RESIDENTIAL BUILDING USING E-TABS". International Research Journal of Engineering and Technology (IRJET) 5(2018)*

This project shows a multi-story residential building that was ETABS- analyzed and designed to account for lateral earthquake loading. The IS 1893-part2:2002 and IS 456:2000 Indian Standards followed in the design of this project. In this paper, the analysis of a commercial building (G+1) in Hyderabad as a result of seismic forces is examined. Shear forces and bending moments of columns and beams are measured and concluded that larger span experiences more shear force and bending moment.

11) *Lalit Balhar1, Dr. J.N. Vyas "REVIEW PAPER ON COMPARATIVE ANALYSIS OF FLAT SLABS & CONVENTIONAL RC SLABS WITH AND WITHOUT SHEAR WALL" International Research Journal of Engineering and Technology (IRJET) 2(2019)*

The goal of the current study is to examine the behaviour of multi-story structures with flat slabs and conventional RC slab construction and to study the performance of these kinds of buildings under seismic loading. Respective study covers information on the parameters like a seismic base shear, story drift, story shear and lateral displacement.

12) *Khwaja Moinuddin Khan, M. Jeelani "ANALYSIS AND DESIGN OF FLAT SLABS IN COMMERCIAL BUILDING BY USING ETABS SOFTWARE" International Research Journal of Engineering and Technology (IRJET) 6(2018)*

This study uses seismic analysis to determine whether flat-slab commercial buildings may be used in a variety of zones without having any problems. ETABS software is used for the analysis and design of G-2, G+7 commercial buildings with flat slabs. The final outcome is that flat slabs have a position in offering features like greater stiffness, greater capacity, safety, and economy.

13) *Sudhir Singh Bhaduria, Nitin Chhugani "COMPARATIVE ANALYSIS AND DESIGN OF FLAT AND GRID SLAB SYSTEM WITH CONVENTIONAL SLAB SYSTEM" International Research Journal of Engineering and Technology (IRJET) 8(2017)*

In the current study, comparisons of various parameters, including the amount of concrete and steel used, the cost of the building, the shear force, bending moment, and displacement of the flat slab system and the grid slab system, are made. This study utilizes STAAD Pro V8i to design and analyze the slab system for a G+10 building in seismic zone III with medium soil conditions. The slab system was analyzed for various plan areas or grid sizes and column spacing. The IS 456-2000 and IS 1983-2002 standards are used for the analysis and design of the slab system.

14) *Ragy Jose, Restina Mathew, Sandra Devan, Sankeerthana Venu, Mohith Y S "ANALYSIS AND DESIGN OF COMMERCIAL BUILDING USING ETABS" International Research Journal of Engineering and Technology (IRJET) 6(2017)*

In this paper, an attempt is made to analyze and design a commercial building using ETABS in this project, A G+3-story structure is considered, analysis is done by using static analysis method and design is carried in accordance with IS 456:2000 standards. Additionally, an effort has been made to manually design the structural components. Auto CAD is used for drawing and detailing in accordance with SP 34.

15) *Amrut Manvi, Sandeep Gouripur, Pooja Sambrekar, Ramanjeetkaur, Dr. Kishor S. Kulkurni "COST COMPARISON BETWEEN CONVENTIONAL AND FLAT SLAB STRUCTURES" International Research Journal of Engineering and Technology (IRJET) 6(2015)*

For the purposes of cost comparison, the current work compares flat slab and conventional B+G+3 storied structures. The structure is assumed to be located in earthquake zone 2. For earthquake forces, the codal provisions of IS: 1893 (Part- 1)-2002 are considered. For Model and analysis of flat flab and conventional structures, ETABS software is used. According to IS 875-1987, the live load, dead load, and wind load are taken into account. The design is carried out in accordance with IS 456-2000, and SP 34 is used for the reinforcing detailing. The study show that flat slab buildings are lighter than conventional slab buildings. Comparing flat slab building to conventional slab building, the cost is reduced by 15.8%. According to the study's findings, flat slab buildings are more cost-effective than conventional slab buildings for high rise buildings.

16) *Mrs. Sarita R. Khot, Mr. Kumar T. Bharekar, Mr. Vishwajit V. Jadhav, Mr. Himanshu V. Mahajan, Mr. Purval D. Shiram, Mr. Siddharth V. Tupe "COMPARATIVE STUDY OF WAFFLE SLABS WITH FLAT SLABS AND CONVENTIONAL RCC SLABS" International Journal of Engineering Research & Technology (IJERT) 4(2016)*

This study analyzes the advantages that waffle slabs have over flat slabs and traditional RCC slabs while comparing them to flat slabs and RCC slabs. This comparison is shown using a case study in which waffle slabs, flat slabs, and RCC slabs were all designed in accordance with IS: 456-2000, and various points were compared.

17) *Sudhan N, B S Sureshchandra "DESIGN OF GRID SLAB/FLOOR" (IJTSRD) Volume 4 Issue 6 e-ISSN: 2456 – 6470 9-10(2020)*

For long span structures without intermediate columns, grid slabs or floors are constructed in order to allow huge public gatherings, meeting assembly, etc. the creation of a solid, balanced structure for long serviceability. The stiffness and deformation of the entire structure are greatly influenced by the spacing of the ribs, hence why three possible grids with varying spacing—750, 1000, and 1250 mm—are modelled using the etabs software. The results are computed and checked against IS codal requirements.

18) *M.G. Sahaba, A.F. Ashourb, V.V. Toropov "COST OPTIMISATION OF REINFORCED CONCRETE FLAT SLAB BUILDINGS" Elsevier (2005)*

In this study, the British Code of Practice (BS 8110)'s recommendations for cost optimization of reinforced concrete flat slab buildings are provided. The building's overall cost, including the cost of the slabs, columns, and foundations, serves as the objective function. Each structural component's cost includes the cost of the reinforcing, concrete, and formwork materials and labor. The equivalent frame approach is utilized to model and analyze the structure. Three separate layers are used to manage the optimizing process. In the first level, a thorough analysis offers the optimum column layout. In the second stage, the ideal slab thickness and column dimensions for each column layout are obtained using a hybrid optimization technique. In this hybrid approach, a global search is conducted using a genetic algorithm, and then a discretized version of the Hook and Jeeves method is applied. A thorough search is used at the third level to identify the ideal quantity and size of reinforcing bars for reinforced concrete members.

The results of the optimum and standard design processes are contrasted, and cost optimization for three reinforced concrete flat slab buildings is shown.

19) *Vishesh P. Thakkar, Anuj K. Chandiwala, Unnati D. Bhagat "COMPARATIVE STUDY OF SEISMIC BEHAVIOR OF FLAT SLAB AND CONVENTIONAL RC FRAMED STRUCTURE" International Journal of Engineering Research & Technology (IJERT) ISSN: 2278-0181*

In this study, the utilization of flat slab buildings for construction is popular in the modern day because they have several advantages over traditional RC frame structures in terms of architectural freedom, space use, ease of formwork, and speed of construction. In the current work, ETABS software has been used to analyze a G+5, G+8 and G+11 multi-storied structure for the parameters of story displacement, story drift, story shear, base shear, and time period. The building included flat slabs with drop, flat slabs without drop, and conventional slabs. The main goal of the current research is to compare the seismic behavior of multi-story buildings with conventional RC frames, flat slabs with drops and flat slabs without drops in seismic zone III with type II medium soil and to analyze the effects of building height on where these types of structures respond to seismic forces. To determine the seismic behavior, a linear dynamic response spectrum analysis was done on the structure.

20) *Uttam V Chothani, Jashmin Gadhiya, Hitesh K Dhameliya "Comparative Study of Seismic Behaviour and Cost Comparison of Multi-Storey Flat Slab and Conventional Reinforced Concrete Framed Structure" IJSRSET (6/2016)*

In this study, for a flat slab construction system, the beams used in more conventional construction methods are avoided. The slab rests directly on the column, and the load from the slab is transmitted directly to the columns before being transmitted to the foundation. To help determine the best slab for a long span or long panel of slab, comparisons of flat slabs with drops, flat slabs without drops, and grid slabs for their behavior during and after earthquakes should be made. This comparison can also be used to get a slab for a long panel or span that is more economical. The main goal or objective of this study is to use the conclusions to produce safer and more economical slabs for large panels or spans in the future. A moderate effort is made in this project to compare flat slabs with drops, flat slabs without drops, and grid slabs with the same span and panel size. These slab types have been examined and designed using ETABS.

21) *E. Yadunandan Yadav, P.N, Pradeep.T.R, Vijayalakshmi Akella "PARAMETRIC ANALYSIS, DESIGN, EVALUATION AND OPTIMIZATION OF FLAT SLABS AND CONVENTIONAL STRUCTURE" IJRET Volume: 06 Special Issue: 05 (2017)*

In this study, due to large budgetary limits, many construction projects around the world are presently undergoing financial challenges. Methods for structural optimization should be utilized to minimize the structure's cost. Because it directly affects building costs, structural optimization is a must for major projects. In the current study, G+15 structures are taken into consideration and have been analyzed using ETABS while taking into account a number of different parameters, including the grade of concrete (M25, M30, M35, M40), the depth of beams (300x400mm, 300x450mm, 300x500mm), the depth of slabs (150mm, 175mm, 200mm, 225mm), the column size (600x700mm, 600x800mm, 600x900mm, 600x (150mm, 175mm, 200mm, 225mm).For each model, the cost of the structure is estimated. Following that, it is evaluated against other models. The cost of the construction is then optimized after selecting the best structure components. Based on the investigation, the grade of concrete used for the 600x700 mm column, the 300x550 mm beam, and the 150 mm conventional slab is M25. The structure costs less than all other combinations at Rs.32, 22,707. Based on research of flat slab optimization, the M35 concrete grade, 600 x 700 mm columns, 300 x 550 mm beams, and 150 mm slabs were used. The structure is an optimal structure combination and costs Rs40, 97,551

22) *Sayli D. Madavi, Prof. Sushant M. Gajbhiye "COMPARATIVE ANALYSIS OF FLAT SLAB AND GRID SLAB" International Journal of Creative Research Thoughts (IJCRT) Volume 8, Issue 7 (2020)*

The only solution in the current global industrial development era and rapidly expanding population is the construction of tall structures. Each structural element plays a crucial role in the construction of tall buildings. Like the slab systems, columns, beams, and primarily. Different slab designs are used to build buildings today to achieve good view characteristics depending on circumstances. As the most important part of a building, the slab is examined in this study for two similar building models, using the software Etabs to compare flat and grid slab systems. For parameters like as shear force, bending moment, and deflection. Graphs were made to show the results.

23) Anitha. K. 2R.J, Rinu Isah "DESIGN AND ANALYSIS OF GRID FLOOR SLAB" International Journal of Pure and Applied Mathematics ISSN: 1311-8080 (2017)

This study examines how different characteristics affect the grid floor's economical transverse beam spacing. The parameters taken into account in this study include span to depth ratio, transverse beam spacing, web thickness, and flange thickness. The range of the span-to-depth ratio taken into consideration is 16 to 60.

Transverse beam spacing can range from 0.5 m to 2.0 m. The thickness of the slab and the rib are kept constant and are, respectively, 0.1 and 0.15 meters thick.

The results of conventional and numerical approaches used to predict the bending moment, shear force, and mid-span deflection developed in grid floor beams are compared. The model proposed by the ANSYS 12.0 software is used to conduct the parametric analysis. The study's researchers concentrated on the magnitude range for the different parameters that should be taken into account for grid floors to work at their best.

24) Sourabh Ram Ingole, Ansari Fatima Uz Zehra "COMPARATIVE ANALYSIS AND DESIGN OF FLAT AND GRID SLAB SYSTEM WITH CONVENTIONAL SLAB SYSTEM BY ETABS" International Research Journal of Modernization in Engineering Technology and Science Volume: 04/Issue: 06/June-2022

In the proposed investigation, the story drift, quantity of concrete and steel, and story displacement of a G+5 residential multi-story building with a flat slab, grid slab, and conventional slab have been examined. According to IS 456-2000, the analysis and design of the slab system are completed. To determine which grid size of the column or plan area is the most cost-effective, the slab system is designed for a variety of spacing and grid sizes of columns. Models measuring 20.5 x 26 meters have been made for these case studies.

25) B. Anjaneyulu, K Jaya Prakash "ANALYSIS AND DESIGN OF FLAT SLAB BY USING ETABS SOFTWARE" International Journal of Science Engineering and Advance Technology (2016)

In this paper, the Equivalent Frame Method without staggered column and with staggered column as given in the various standards like IS 456-2000, ACI 318-08 are compared. The Finite Element Analysis and Equivalent Frame Analysis are carried out using software ETABS. Moments are distributed in this method as middle strip moments and column strip moments. Utilizing the stated rules, an interior panel of a flat slab with dimensions of 6.6 x 5.6 m and a superimposed load of 7.75 KN/m2 was designed for this project.

26) Mayuri H. Kanekar, Mahendra Umare, and Aditya Deshmukh "ANALYSIS AND DESIGN OF BUILDING AND COST OPTIMIZATION WITH DIFFERENT FLOOR SYSTEM" VOLUME 51 ISSN: 0031-4773 (2021)

The objective of this project is to analyze, design, and compare the costs of several floor systems for a building. In the following order: flat slab, flat slab with drop panels, conventional slab, grid slab, and ribbed slab. Using ETABS software, the impacts of seismic loads on buildings with different slab structures were analyzed. Structural analysis and design software is referred to as ETABS.

Design and analysis are performed using IS 456-2000. Fe-500 steel and concrete of the M40 grade were both used. According to IS 1893-part 1, load combinations are used (2016). According to IS 875, live loads are taken (part 1) Analysis is adopted for earthquake zone 2. When it comes to seismic loads, story drift, base shear, story shear, and story displacement all have an impact on the structure's output. Following the design of these five cases, an economical comparative analysis is performed. Tables and bar charts are used to represent the results.

27) Shital Borkar, Kuldeep Dabhekar, Isha Khedikar, Santosh Jaju "ANALYSIS OF FLAT SLAB STRUCTURES IN COMPARISON WITH CONVENTIONAL SLAB STRUCTURES" IOP Conference Series: Earth and Environmental Science (2021)

The major purpose of this analysis is to analyze the seismic behavior of various slab structure types, including flat slab structures, conventional slab structures, and flat slab structures with drops, in various seismic regions. These structures have multiple stories. We use a G+5-story building for our analysis. ETAB analysis software was used. For different bands, parts like zone, zone-II, zone-III, zone-IV, and zone-V, we also analyzed the behavior of flat parts of material construction to compare it to the old common 2 way parts of material system in terms of the maximum point making bent moment.

28) Amit A. Sathawane & R.S. Deotale "ANALYSIS AND DESIGN OF FLAT SLAB AND GRID SLAB AND THEIR COST COMPARISON" International Journal of Advanced Technology in Civil Engineering: Vol. 1: Iss.3 (2012)

The study objective is to choose the flat slab with drop, flat slab without drop, or grid slab that is the most cost-effective. The proposed project location is located in Nagpur at Nexus Point, close to Vidhan Bhavan and the NMC office. The slab is 27.22 m in width and 31.38 m in total length. The slab has a total area of 854.16 sqm. Fe415 steel and M35 grade concrete were used in its design. IS 456-2000 has done a manual analysis of the flat slab and grid slab as well as employing software. STAAD PRO has examined Flat slab and Grid slab. Rates have been determined based on N.M.C. C.S.R.

29) Avinash Patela and Seema Padamwar "STUDYING THE RESPONSE OF FLAT SLABS & GRID SLABS SYSTEMS IN CONVENTIONAL RCC BUILDINGS" Indian J.Sci.Res. 14 (2): 516-521 ISSN: 2250-0138 (2017)

This paper focuses on analyzing the different behaviours of conventional slabs, flat slabs, and grid slabs. To determine which slab system was optimum, a comparison analysis was conducted. In conformity with Indian Standard Code of Practice IS 1893-2002 part-I: Criteria for Earthquake Resistant Structure, it is necessary to perform dynamic analysis of multi-story RCC buildings with Flat slab and Grid slab (10 Story) having Square geometry using Response Spectrum Analysis while obtaining earthquake Zone II into consideration.

III. CONCLUSION

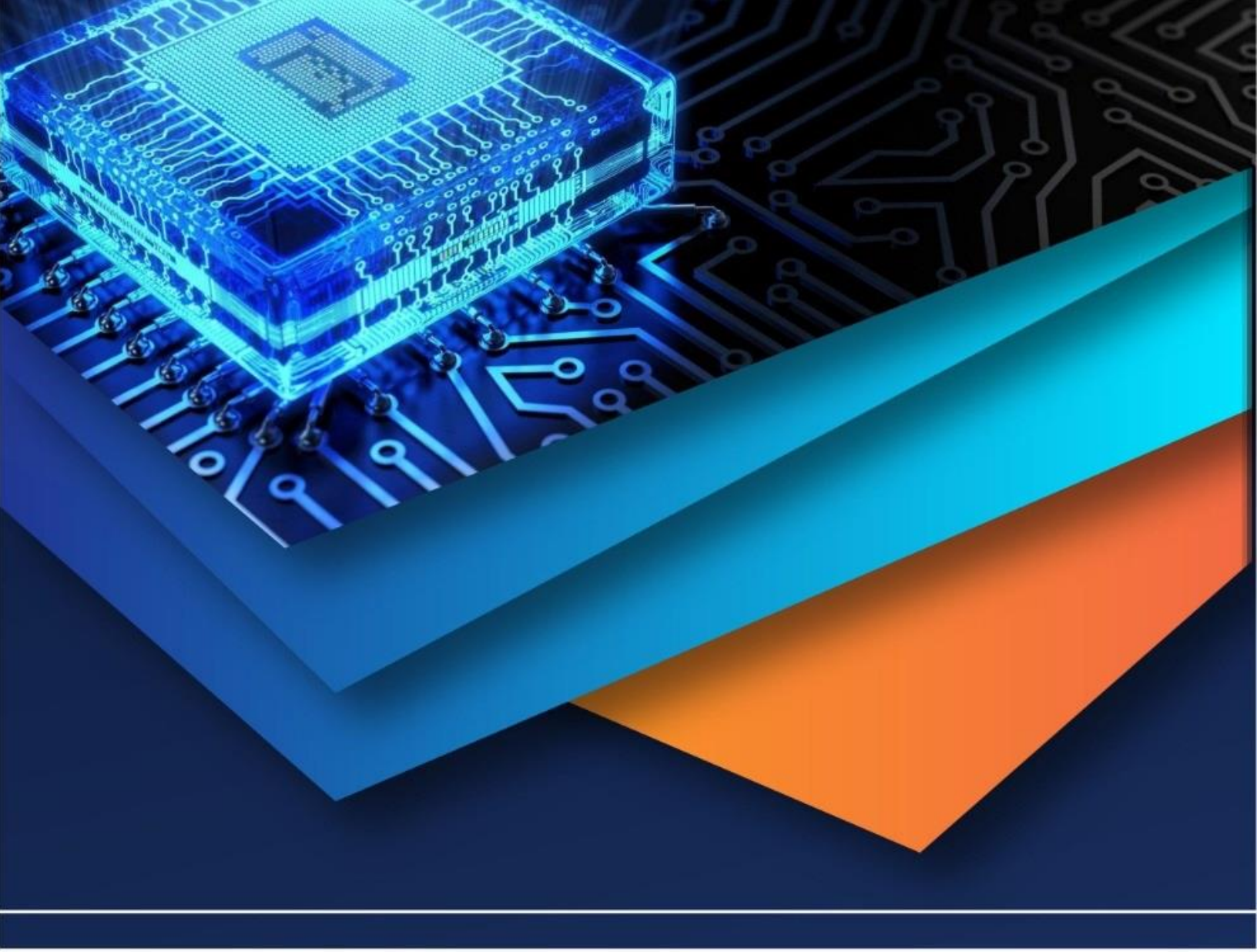
After reading the above-mentioned literature, it is clear that various researchers used the ETABS software to analyse and design different multi-story RCC structures, alike residential and commercial, with flat slab and grid slab for gravitational and lateral loading for different zones and different geometry. Additionally, several researchers had performed cost analyses by manually. Buildings are constructed using the flat slab system are lighter than those constructed using the conventional slab system. The weight of the building has an impact on its seismic base shear value. The seismic base shear value of a building increases with a building's weight(R A. Pradhana, et al. 2019). In the apartment building system, it is determined that the greatest displacement is observed at higher levels. To enhance the strength and stability of the building, we can increase the thickness of the supporting drop panels or the overall slab thickness (Hemalatha K.R, et al. 2021). The conventional slab's maximum Storey Displacement value of G+5 is less than that of the flat slab, and it also shows lesser values when compared to higher heights, such as G+10. It means that in the X-direction, flat slab has more values than conventional slab in both directions, while in the Y-direction, displacement values are the reverse (S. Lakshmi Kiran, et al. 2020). The values of the lateral forces gradually increase from the bottom floor to the top floor. As the seismic zone moves from level II to level IV, the maximum story displacement goes up. As the seismic zone increases from II to IV, the storey shear increases. The flat slab in commercial buildings is therefore built to withstand earthquakes in the II to IV zones that are examined in this study (Khwaja Moinuddin Khan, et al. 2018). When compared to flat slabs, the cost of conventional slabs has increased by 45.97 %, while the cost of grid slabs has increased by 163.57 %. This also results in a reduction of 66.12 % in the amount of storey drift in Flat Slabs. In comparison to Flat Slabs or Conventional Slabs, Grid Slabs require significantly more concrete and steel. This is as a result of the model's increased number of beams (Avinash Patel, et al. 2017). All cases taken into consideration for drift values follow a parabolic curve along storey height, with the fourth storey having the highest value. In flat slab with drop buildings as compared to flat slab without drop buildings, the fundamental natural period value is significantly larger (Sanjay P N, et al. 2014).

The future focus of the research will be the structural optimization algorithms should be utilized to save cost on the structure. The study mentioned above is not sufficient to complete any project because along with analysis and design, schedule and detailing of structural components needed to give to execution on site within a short period of time.

REFERENCES

[1] S. Ramamrutham and R. Narayanan, (1 January 2016) "Design of Reinforced concrete structures", Dhanpat Rai Publishing Company (P) Ltd-New Delhi. ISBN10:9352161327, ISBN-13: 978-9352161324.
[2] P.C Varghese (2010), "Advanced Reinforced Concrete Design." By PHI Learning ISBN: 9788120327870, 9788120327870.
[3] C.S. Krishnamoorthy, (1 July 2017), A Text book on "Finite Element Analysis" Second Edition, MC Graw Hill Education.
[4] B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, (2007), A Text book on "Limit State Design of Reinforced Concrete" (As per IS 456:2000) First Edition. Laxmi Publications (P) Ltd.
[5] Bureau of Indian standard, New Delhi, (1987), "SP 34: Handbook on concrete reinforcement and detailing."
[6] Amit A. Sathwane, Prof. R.S. Deotale (2020) "Analysis and Design of Flat Slab and Grid Slab and Their Cost Comparison" International Journal of Engineering Research and Applications. Vol. 1, Issue 3, pp.837-848.

[7] Sayli D. Madavi, Prof. Sushant M. Gajbhiye (2020) "Comparative Analysis of Flat Slab and Grid Slab" International Journal of Creative Research Thoughts (IJCRT) Volume 8, Issue 7 July 2020
[8] Girum Mindaye, Dr. Shaik Yajdani, (September 2016) "Seismic Analysis of a Multistorey RC Frame Building in Different Seismic Zones" IJIRSET (An ISO 3297: 2007 Certified Organization) Vol. 5, Issue 9, pp. 17209–17221. ISSN(Online): 2319- 8753 ISSN (Print): 2347-6710
[9] S. S. Patil and Rupali Sigi, "Analysis and design of flat slabs using various codes," IJRET: International Journal of Research in Engineering and Technology,ISSN: 2319-1163, ISSN: 2321- 7308,Volume: 03 Issue: 04 Apr-2014
[10] Mohana H.S, Volume 02 Issue 03, June-2015 Comparative Study of Flat Slab and Conventional Slab Structure Using ETABS for Different Earthquake Zones of India, International Research Journal Of Engineering and Technology (IRJET).pp.1931 – 1936.
[11] Chandrashekarand and Rajashekar (2015), "Analysis and Design of Multi Storied Building by Using ETABS Software", International journals of scientific and research vol.4: issue.7: ISSN no. 2277-8179.
[12] Y. K. Jain, V. N. S. Nikhil, and P. P. Raju, (2017) "Analysis of a commercial building using ETABS," Int. J. Civil. Engg. Technol., vol. 8, no. 4, pp. 1438–1444.
[13] R. R. Bhandarkar, U. M. Ratanpara, and M. Qureshi, 2017 "Seismic Analysis & Design of Multistory Building Using Etabs," vol. 5, no. 2, pp. 78–90.
[14] Sudhir Singh Bhaduria, Nitin Chhugani, (2017) "Comparative Analysis and Design of Flat and Grid Slab System with Conventional Slab System." Volume: 04, Issue: 08, IRJET-2017, pages 2314-2329.
[15] Mr. K. Prabin Kumar, R. Sanjaynath, A Study on Design of Multi Storey Residential Building -A Review, International Journal of Pure and Applied Mathematics (IJPAM), Volume 119 No. 17 2018, 2797-2802 ISSN: 1314-3395.
[16] Rashmi Agashe, Marshal Baghele, Vaishanvi Deshmukh, Sharad Khomane, Gaurav Patle, Kushal Yadav, "To Study Analysis and Design of Multi-Storey building using STAAD-pro. and Comparing with Manual Calculations" *International Research Journal of Engineering and Technology (IRJET)* Volume: 07 Issue: 04 e-ISSN: 2395-0056 p-ISSN: 2395-0072
[17] Uttam V Chothani, Jashmin Gadhiya, Hitesh K Dhameliya "Comparative Study of Seismic Behaviour and Cost Comparison of Multi-Storey Flat Slab and Conventional Reinforced Concrete Framed Structure" *IJSRSET* Volume 2 ISSN : 2394-4099



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY