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Parametric Studies of Conventional RCC Slab Structures in Different Seismic Zone in India Considering 8M Height Using Staad Pro Software

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A B S T R A C T

Nowadays, traditional Reinforced Concrete (RC) frame buildings are frequently constructed. Conventional RC frame construction offers quicker construction times, easier form work, flexible architectural design, and effective space utilisation. The primary goal of this analysis is to investigate the seismic behavior of conventional slab structures, in various seismic regions i.e zone II, zone III, zone IV and zone V. The prototype structure is a multi-storey building containing a G+5 storey building used for the present analysis. The software used is Staad pro.V8i select series 5 and Etabs (2016). By using STAAD Pro. and Etabs Software various parameters have been obtained i.e Base shear, Axial, Bending moment, reinforcement and concrete in various zones of India. In the present work conventional slab G+5 story building is considered for model analysis. In this research normal symmetric RC frame buildings of different spans have been studied. The model analysis for this building has also been compared to various seismic zones. For modeling and analysis of conventional slab structures, Staad pro software is used. As a result, this study uses Staad Pro and Etabs to individually show the relative plans for buildings in seismic zones II, III, IV, and V for G+5 (as per IS code 1893 and 456-2000). The dead loads, live loads and Seismic pressure are considered as per Indian Standard 456-2000 and 1893 2016.This analysis satisfies the Indian code 456 (2000) requirement of conventional.

Keywords: Axial Force, Bending moment, Shear Force, Concrete, seismic zones.

1. Introduction

In this modern industrial era, we can see huge construction activities taking place everywhere; hence there will be a shortage of land space. So construction of tall structures has been triggered up to overcome this problem. High rise construction is a very good solution for need of housing and offices due to population increase. In Sri Lanka, high rise structures of 20–40 stories are currently popular in order to reduce the amount of money invested in urban development. High rise buildings are largely made to meet the requirements of the planned occupancy, which may be residential, commercial, or even a combination of the two. The choice of type of slab for a particular floor depends on many factors. Economy of construction is obviously an important consideration, but this is a qualitative argument until specific cases are discussed, and is a geographical variable. It is crucial to consider the design loads, necessary spans, serviceability requirements, and strength requirements. The decision between a flat slab and a flat plate for beamless slabs typically comes down to loading and span. For service live loads larger than possibly (4.8 kn/m2) and spans longer than approximately (7 to 8 m), the flat slab is frequently a superior option since flat plate strength is frequently determined by shear strength at the columns. The shear strength can be strengthened by utilising metal shear heads or another type of shear reinforcement if architectural or other considerations prevent the use of capitals or drop panels, although the prices may be significant

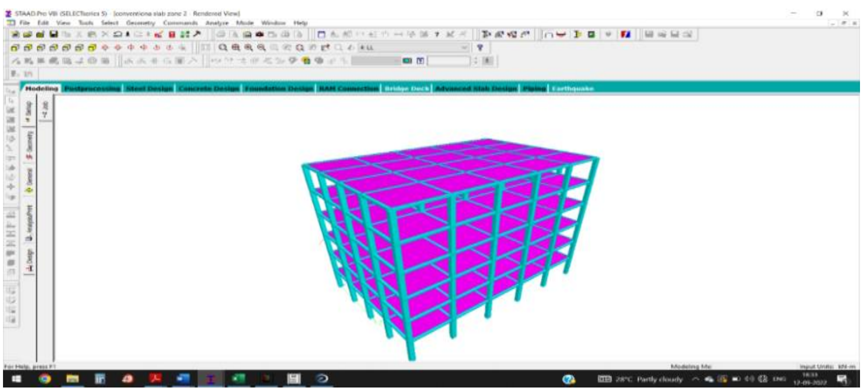

Figure 1.1 -conventional beam slab 3-d model for present study by staad pro

1.1 Objective of Present Research

1.To analyze the bending moment in the region of conventional slab by staad pro

2.To find maximum deflection in conventional slab by Staad pro.

3.To find overturning moment s maximum at base and at top staad pro .

4.To find Reinforcement provided for conventional beam slab Staad pro software.

5.Comparison of results obtained in terms of Story.

1.2 Literature Review

Agarwal and Tiwari (2017) The most essential design software for structural designers nowadays, staad pro, is used to create multi-story buildings. Today, government development projects are also created in staadpro, and commercial design firms use both staad pro for structure analysis. Therefore, utilising staad pro independently, this study shows a relative plan for a building in seismic zones II, III, IV, and V (as per IS codes 1893 and 456-2000) with five, ten, and fifteen stories, respectively.

Balhar and Vyas (2019) In recent times, Flat slab buildings are generally used for the construction because use of flat slab building provides many advantages above conventional RC Frame building in terms of economy, make use of space, easier formwork, architectural flexibility and mostly shorter construction time. The structural effectiveness of the Flat slab construction is mainly difficult by its meager performance under earthquake loading. It is essential to analyze seismic behavior of buildings to observe what are the changes are going to arise for the conventional RC frame building, flat slab building with and without shear wall respectively. The analysis is done with Staad .Pro V8i software. The characteristics seismic behavior of conventional RC frame building, flat slab buildings imply that supplementary measures for guiding the formation and design of these structures in seismic regions are desirable and to increase the performance of building having conventional RC building, flat slabs under seismic loading. The object of the present study covers the behavior of multi-storey buildings having conventional RC slab building, flat slabs and to study the performance of these types of buildings under seismic forces. Current study covers information on the parameters storey drift, lateral displacement, seismic base shear, storey shear.

Kumar et al. (2020) A building having multiple stories is referred to as multi-story. The multi-story buildings are designed to have a larger floor area without consuming more land, which also reduces costs. In order to better serve us and meet our demands, modern structures are built. Buildings may be constructed with relative ease, but it's important to create ones that are reliable and durable enough to stand the test of time. This research seeks to improve analysis for a variety of tasks, including creating load cases, applying load combinations, analysing support reactions, and reinforcing columns and beams. Review the results to see whether the beam or column withstood the loads. The building analysis, which is a case study of an ongoing building project in Hyderabad, was carried out utilising standard code manuals (IS 456: 2000, SP 16).

Choubi et al. (2021) It's difficult to build a top-notch infrastructure that is both aesthetically pleasing and structurally sound. Engineers are required to consider the structural requirements and applications of a building. When it comes to building constructions, RCC structures are relatively widespread, although steel structures offer good weight per unit length. Steel structures are very simple to build, which speeds up projects. In this essay, we have talked about the structural behaviour of a model in comparison to two computer simulation programmes, etabs and staad pro. Etabs is simple to use and has an engaging design thanks to Staad Pro's lengthy history in the simulation industry. Here, we primarily evaluate three different forms of steel-only constructions. a transmission tower, a Howe bridge truss, and a Howe roof truss. Both etabs and staad pro were used to simulate each one, and the outcomes were compared. Both pieces of software displayed the identical shear pressures, bending moments, and base reactions. But as compared to StaadPro, Etabs exhibits slightly less bending moment, shear pressures, and base reaction in the corresponding members. Etabs, on the other hand, also reveals which members are stressed or completely employed up to their strength, allowing for the most efficient construction of structures.

Patil et al. (2022) There are many intricate and irregular structures that are studied and created today'resist the force of the wind and earthquake. This buildings may studied and created using a variety of software programmes like ETABS and STAAD ,TEKLA, Pro, etc. The field of structural analysis includes indetermination of structural behaviour to forecast the responses of different structural components to load. Each The loads that are applied to the structure can be singular or many. such as wind, earthquake, and gravity loads. ETABS stands for Extended 3 Dimensional Building Analysis. System. Software called ETABS can be used to analyse static,structures' dynamic, linear, nonlinear, etc. responses building structure design. In this study, the impact of the height of extending from the base shear, the lateral force produced by ETABS software is used to assess earthquake and wind stress.The research comprises building. modelling and analysis using ETABS programme, comparing earthquake and wind loads load on various floors. The minimum conclusion from the analysis height of the building at which the wind load is predominant seismic load can be identified.

1.3 Layout Of Structure

For selecting the building layout for the case study, following factors were taken into account.

Four structures were modeled for conventional beam slab buildings

Floor to floor height was in the range of 4 m

Then, layout of the building was prepared based on the following.

Initial member sizing

The building layout Plan 6m x 5m is shown below. In this study a symmetric building model was taken.

Beam slab building

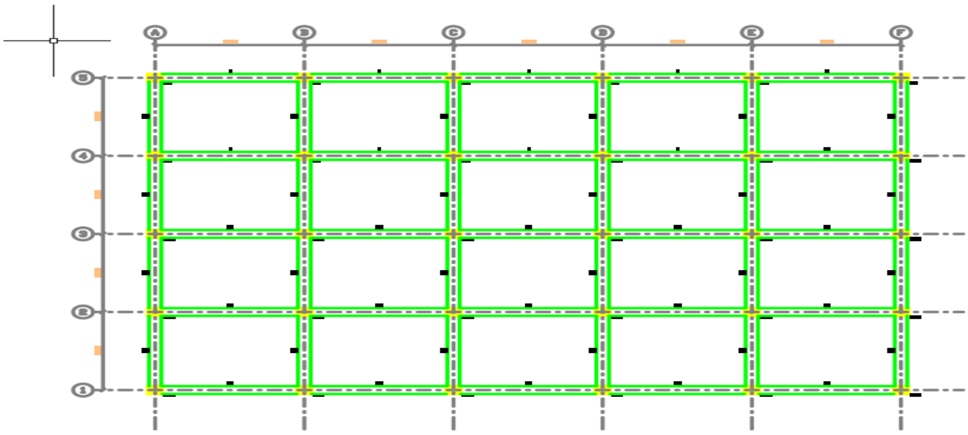

Figure 1.2 - Layout plan for 6m x 5m spa

Span[m]	3	4	5	5.5	6	6.5	7	7.5
Column size [mm x mm]	300x300	300x300	300x300	350x350	350x350	350x350	450x450	450x450
Beam width [mm]	300	300	300	300	300	300	300	300
Beam height[mm]	600	600	600	600	600	600	750	750
Slab thickness[mm]	150	150	175	175	175	200	225	250

Table 1.1 Initial member sizing of flat slabs and conventional slab

S No.	Type of Member	Dimension or No.
1	COLUMN	0.600MX0.500M
2	COLUMN	0.550MX0.500M
3	BEAM	0.300MX0.500M
4	PLATE THICKNESS	0.250M
5	ADDITIONAL BOTTOM COLUMN	150MMX100MM

Table:1.2-Dimensions of structure

Result

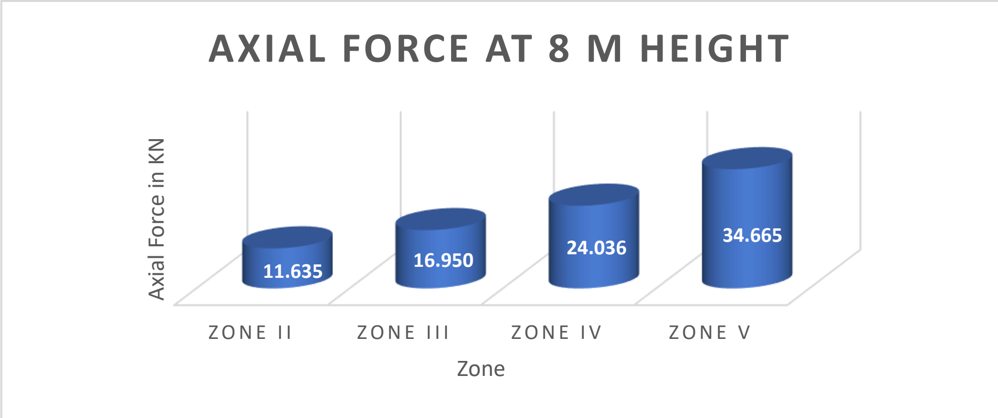

Figure 1.3 Zone v/s Maximum Axial Force

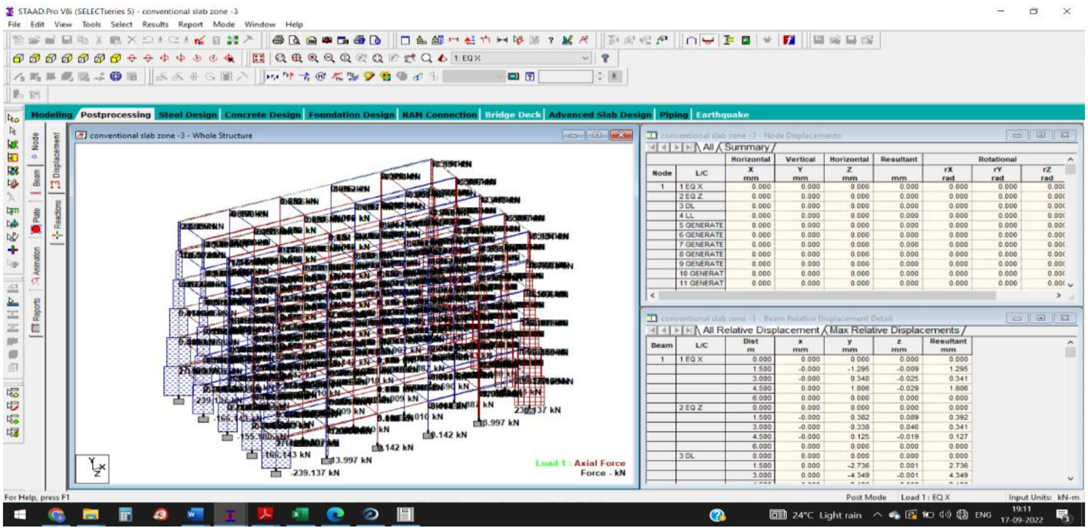

Figure 1.4 Earth quake Zone 3 Maximum Axial Force in various heights

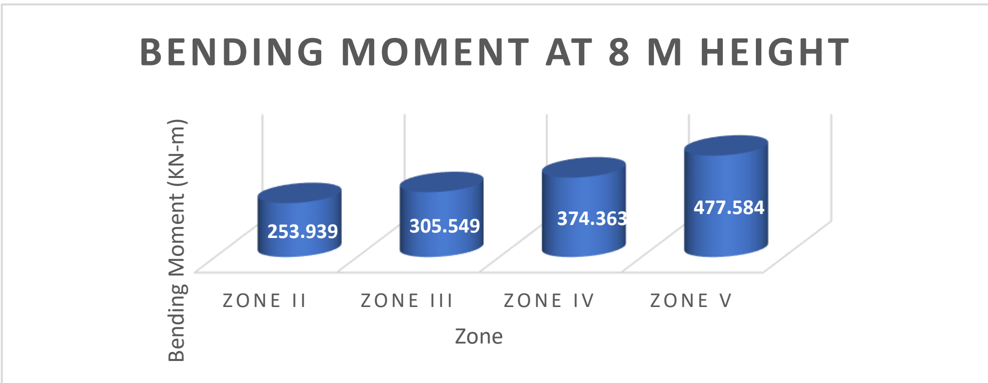

Figure 1.5 Zone v/s maximum bending moment

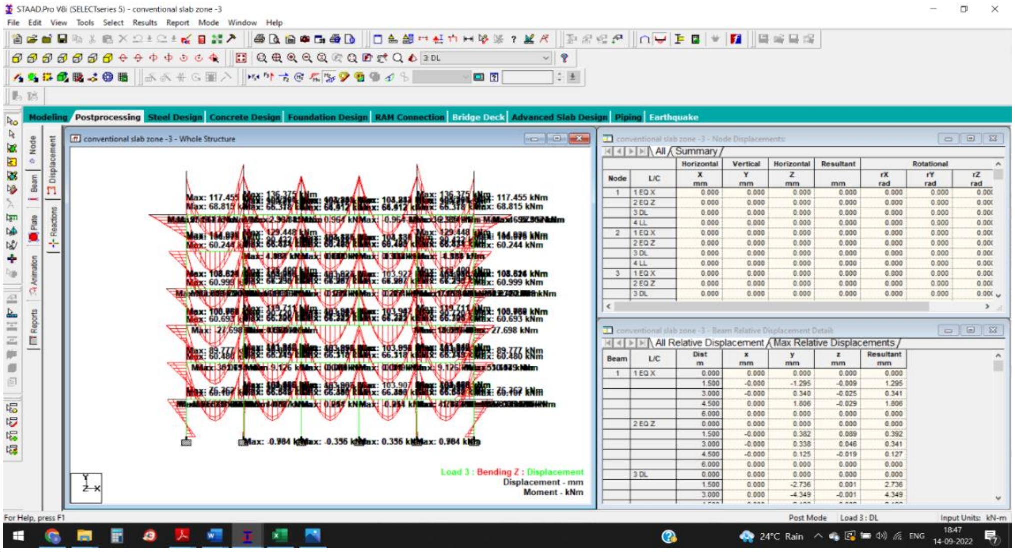

Figure 1.6 Earth quake Zone 3 maximum bending moment in various heights

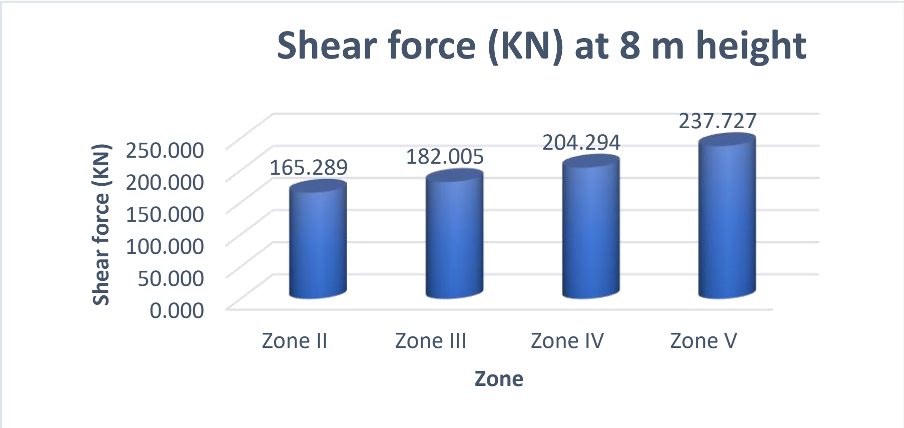

Figure 1.7 Graph 6.3 Zone v/s maximum shear force

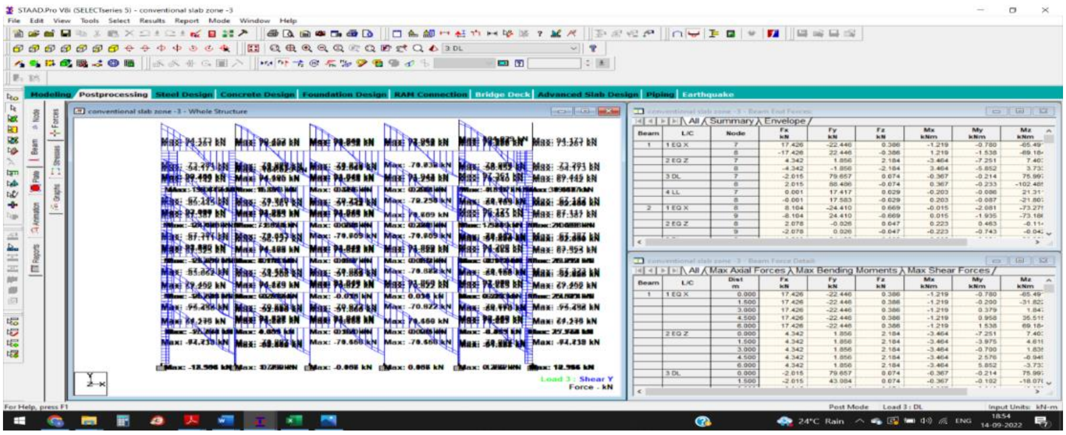

Figure 1.8 Earth quake Zone 2 Maximum shear force in various heights

	II	III	IV	V
Quantity of Concrete (m^3)	439.2	439.2	439.2	426

Table 1.4 - Steel requirement for Conventional slab

	II	III	IV	V
Quantity of Steel	340578	378116	455589	624436

Table 1.5 Various diameters of bar in various zone

		Bar Dia.					
	steel	8	10	12	16	20	25
zone	II	74303	67813	122152	34804	22154	19352
	III	74461	70438	139615	56561	15950	21091
	IV	72568	59116	165487	69694	88724	0
	V	69278	19888	141039	100201	161046	127944

Table 1.9 Concrete requirement for conventional

Seismic Zone	**Axial Force (KN)**
Zone II	11.635
Zone III	16.95
Zone IV	24.036
Zone V	34.665

Zone	**Bending Moment (KN-m)**
Zone II	11.635
Zone III	16.95
Zone IV	24.036
Zone V	34.665

Zone	**Shear Force (KN)**
Zone II	11.635
Zone III	16.95
Zone IV	24.036
Zone V	34.665

Discussion

1.Maximum Axial Force:

By staad pro. Maximum axial force in building varies from 28.230, 35.549, 48.771 & 65.605 KN from zone II to zone V.

2.Maximum Bending Moment:

Maximum bending moment in beam varies from 324.616, 316.716, 391.459 & 490.251 KN-m from zone II to zone V by Stadd Pro**.**

3. **Maximum Shear Force:**

Maximum shear force in building varies from 172.099, 185.775, 208.006 and 241.359 KN from zone II to zone V by Staad Pro.

Conclusion

Axial force for zone v

The value of axial force at 8 m height for zone V by Staad Pro is 34.665 kN .

Bending Moment for zone v

The value of bending moment at 8 m height for zone V by Staad Pro is 477.584 Kn-m .

Shear Force for zone v

The value of Shear force at 8 m height for zone V by Staad Pro is 237.727 kN .

From the above results it can be concluded from the present study staad pro software has which is based on a limit state of methodology and offers sufficient strength, serviceability, and durability in addition to economy. The beam's displacement, shear force, and bending moment Using staad pro and design a G+5 residential building.

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