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OPTIMUM EARTHQUAKE RESPONSE OF DIFFERENT TYPES OF SLAB SYSTEM OVER THE HEIGHT

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Abstract

India Earthquakes can create serious damage to structures. The damage to structures causes deaths, injuries, economic loss, and loss of functions. Earthquake risk is associated with seismic hazard, vulnerability of buildings, exposure. Seismic hazard quantifies the probable ground motion that can occur at site. The speed growth of population in urban areas and the consequent pressure on limited space considerably influenced tall building constructions in developing countries like India. These tall buildings can be constructed using various structural systems. At present, normally conventional RC Frame buildings with conventional RCC slab are adopted for the construction which has shown the risk of damages due to earthquake. So it has become necessary to analyse seismic behaviour of buildings for various slab systems to find the system which is less vulnerable to seismic and have more advantages compared to conventional RC frame building.

In this paper, an attempt has been made to investigate the seismic effect on multi storey building of G+15storey with waffle slab, flat slab, conventional RCC slab and combined system using the software ETABS 2015. The seismic evolution is performed by response spectrum, analysis as per IS 1893 (2002). Parameters like lateral displacement, time period, storey drift and base shear are computed using analytical software and comparison is made between different slab systems are considered.

Keywords—Framed structure, Seismic analysis, time history analysis, Shear wall, multi storey.

I. INTRODUCTION

Earthquakes can create serious damage to structures. The structures already built are vulnerable to future earthquakes. The harm to structures causes deaths, injuries, economic loss, and functional loss. Earthquake risk is related with seismic hazard, vulnerability of buildings, exposure. Earthquake risk quantify the most likely ground motion that can occur at site. Vulnerability of building is important in causing risk to life. Increasing in urban population caused development of tall building structures.

The express growth of urban city populations and force on inadequate space noticeably influenced the low rise, medium rise and tall structures. Usually beam and slab consisting structures are provided for such type buildings. Such high rise building subjected to lateral forces and vertical forces. In tall structures, lateral force caused by wind and seismic will have good control the design more than the vertical loads. The structure which is being designed for vertical load cannot avoid these lateral loads. Lateral forces are somewhat variable and increases with structural height. The lateral forces are more in the top storey compared to bottom storey because of which building behaves as cantilever. These lateral forces bring about sway in the frame. Among many of the earthquake vulnerable places there are many examples of structural failure because of poor design for earthquake loads or other way earthquake loads may not be considered for the design. And all these behaviour of the structure to earthquake has shown the need of seismic resistant design.

II. ANALYSIS METHODS

A. Equivalent Static evaluation

Earthquake analysis of many structures continues to be done on the best guess that the lateral force is equal to the real loading. This system of discovering designed lateral forces is sometimes called the static process or equivalent lateral force method or the seismic coefficient method.

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B. Response Spectrum Analysis

This analysis is even referred as modal method or mode superposition method. The analysis is valid to those structures where modes except the fundamental one significantly affect the response of the structure. Generally, the analysis is valid to analysis of the dynamic behaviour of structures, that are unbalanced or have places of irregularity, in their linear range of behaviour. [2] proposed a principle in which another NN yield input control law was created for an under incited quad rotor UAV which uses the regular limitations of the under incited framework to create virtual control contributions to ensure the UAV tracks a craved direction. Utilizing the versatile back venturing method, every one of the six DOF are effectively followed utilizing just four control inputs while within the sight of un demonstrated flow and limited unsettling influences. Elements and speed vectors were thought to be inaccessible, along these lines a NN eyewitness was intended to recoup the limitless states. At that point, a novel NN virtual control structure which permitted the craved translational speeds to be controlled utilizing the pitch and the move of the UAV. At long last, a NN was used in the figuring of the real control inputs for the UAV dynamic framework. Utilizing Lyapunov systems, it was demonstrated that the estimation blunders of each NN, the spectator, Virtual controller, and the position, introduction, and speed following mistakes were all SGUUB while unwinding the partition Principle.

III. OBJECTIVE OF THE STUDY

The objective of this current study shall be listed as follows

1. To gain knowledge of the earthquake response of tall building with waffle slab, flat slab, and conventional slab system by response spectrum evaluation.
2. To study the most effective earthquake response of tall building by utilising distinct slab process over the height by response spectrum evaluation.
3. To search out the storey drift, storey shear and highest displacement of multi storey constructing having subjected to seismic loads with the aid of utilizing response spectrum analysis for G+15 storey buildings with waffle slab, flat slab, conventional RCC slab and combined slab process using the application ETABS 2015.
4. To evaluate the above said points.

IV. METHODOLOGY

A. Structural Model

In this project work, structure with 15 storeys is considered. 50mx50m dimension plan is considerd for the present work. The structural models have the identical storey peak of 3.5m and have a uniform mass distribution over their top.

B. Types of models

The following four types of models is considerd for the present work

1) Waffle slab model (Type1)
2) Flat slab mode (Type2)
3) Conventional slab model (Type3)
4) Combined model (Type4)

C. Structural Properties

Density of concrete: 25 KN/m3
Density of brick masonry: 20 KN/m3
Wall thickness: 200 mm

D. Static Load Assignment

1) Waffle slab model (Type 1)
2) Flat slab mode (Type 2)
3) Conventional slab model (Type 3)
4) Combined model (Type 4)

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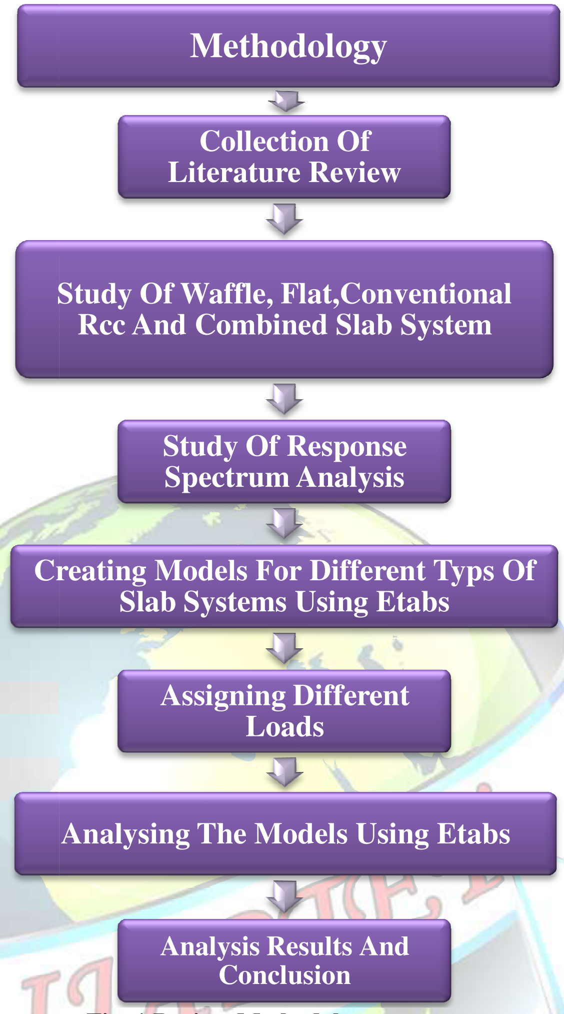

Fig. 1 Project Methodology

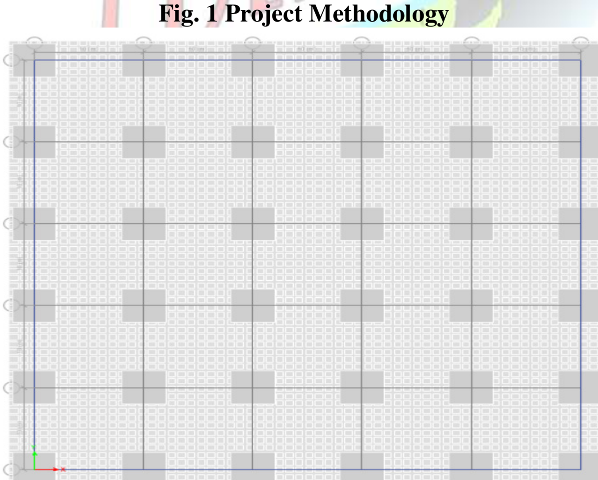

Fig.2 Plan of Type 1- structure

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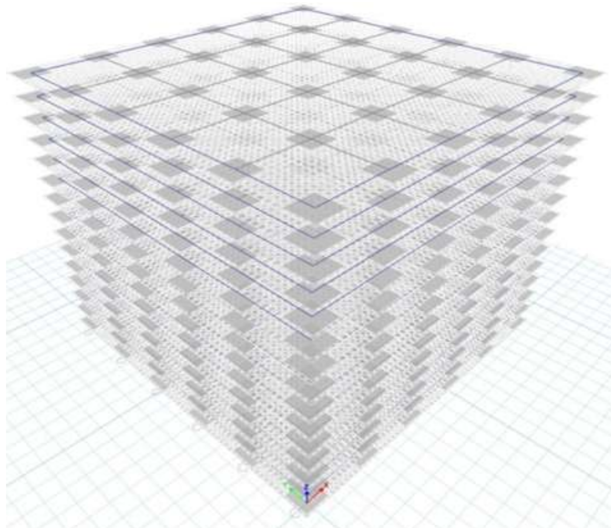

Fig. 3 Model of Type 1- structure

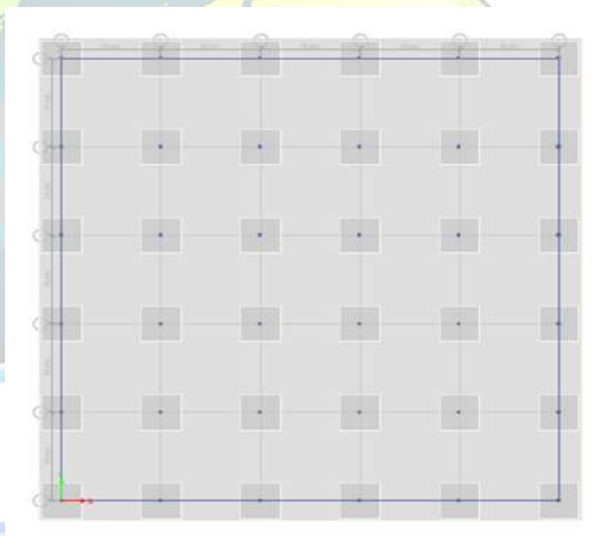

Fig. 4 Plan of Type 2- structure

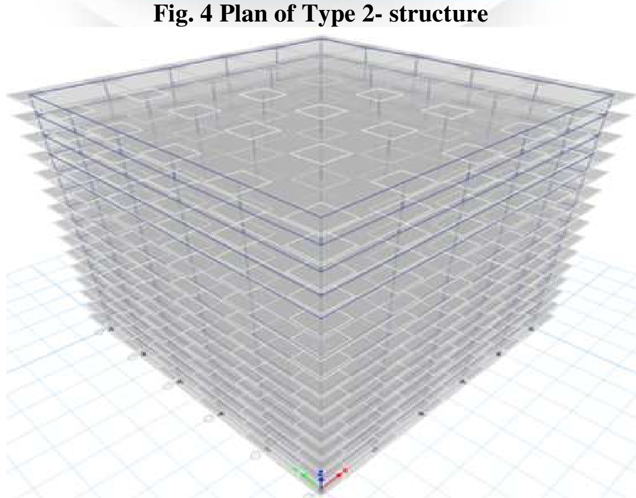

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Fig. 5 Model of Type 2- structure

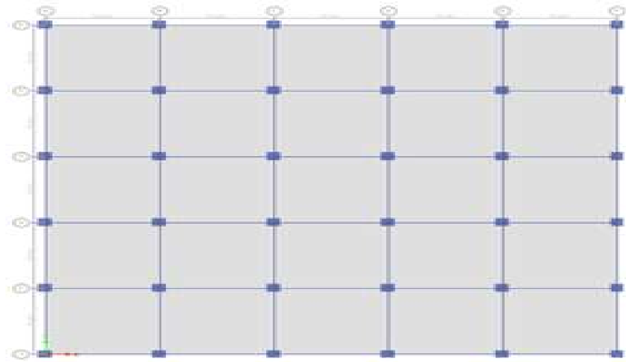

Fig. 6 Plan of Types 3- structure

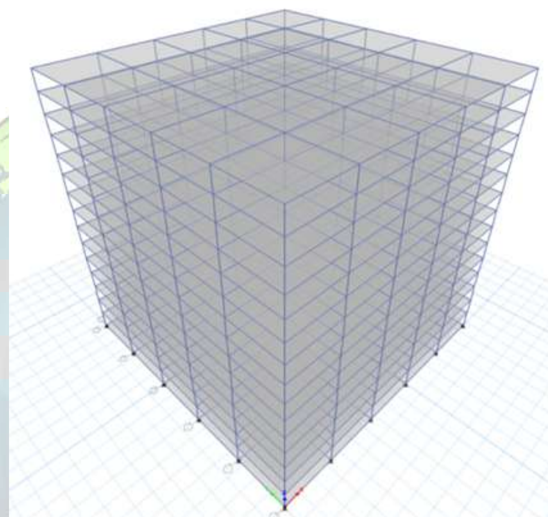

Fig.7 Model of Type 3- structure

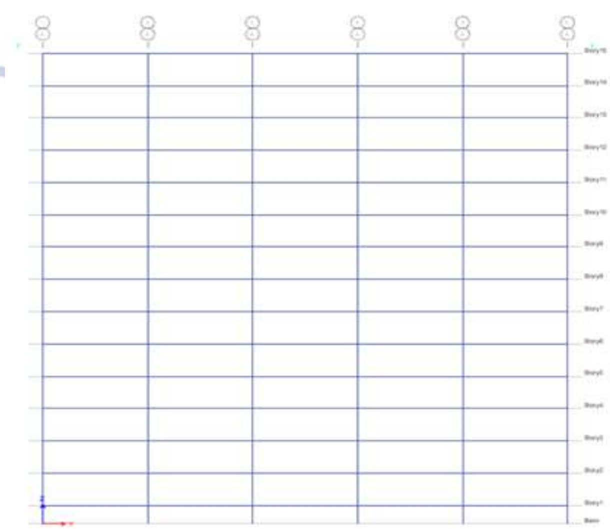

Fig. 8 Elevation of Type 4- structure

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Table 1Seismic Loading Zone As Per IS: 1893

DETAIL	VALUE
R	5
I	1
Z	0.24
Sa/g	Type2

Table 2 Structural Properties

MODELS	COLUMN	BEAM	SLAB
TYPE1	C-1000X1000	B-200X750	100
TYPE2	C-1000X1000	B-200X750	350
TYPE3	C-1000X1000	B-200X750	150
TYPE 4	C-1000X1000	B-200X750	350,150

V. RESULTS&DISCUSSION

A. *Time Period*

By viewing the graph it is found that the time period is maximum at plinth level and decrease's with the increase in storey height for all types of slab systems.

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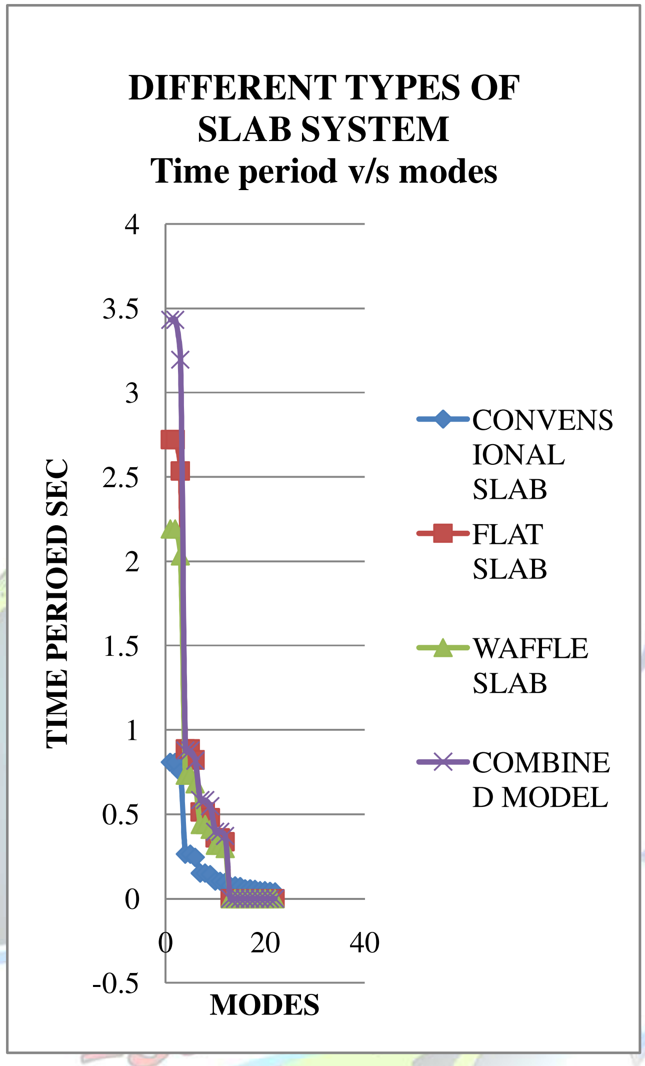

Graph 1. Different types of slab systems - Time Period v/s modes

*B. **Frequency***

The outcomes and shown in graph. By viewing the graph it is found that the frequency of conventional slab at terrace level is highest compared to different type of slab process.

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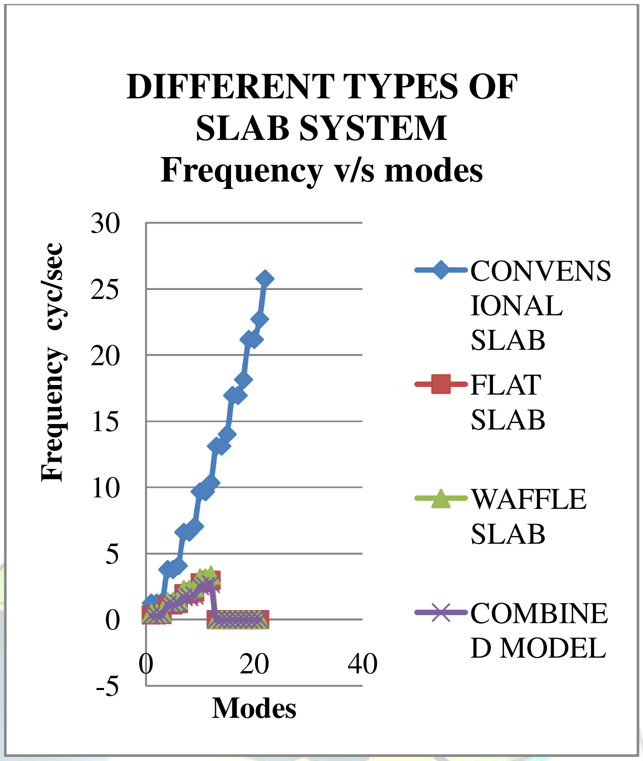
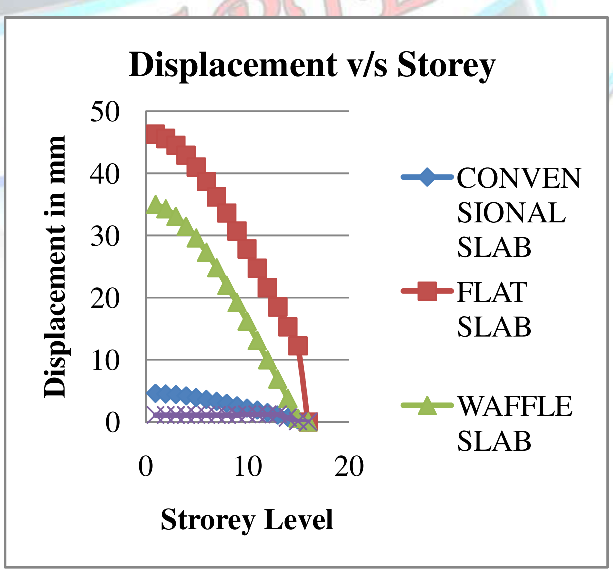


Graph 2. Different Types of Slab System – Frequency v/s modes

*C. **Displacement (mm)***

By viewing the graph it is found that the lateral displacement is minimum at terrace level and highestat plinth degree for all varieties of slab approach. Flat slab approach indicates bigger lateral displacement at plinth degree evaluate to different slab systems considered.



Graph 3. Displacement v/s Storey for Earthquake in X-Direction

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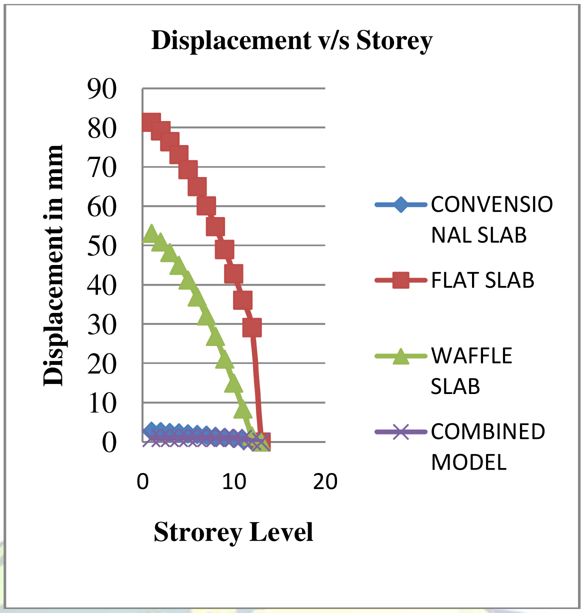
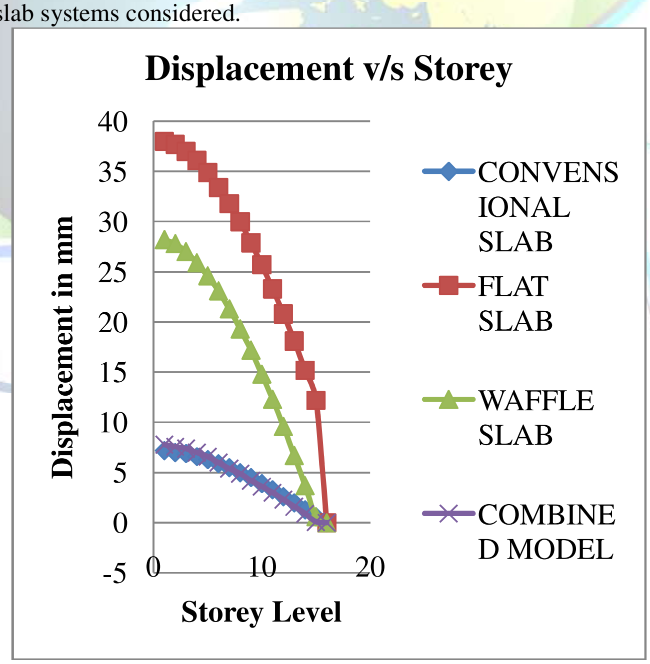


Graph 4. Displacement v/s Storey for Wind in X-Direction

By viewing the graph it is found that the lateral displacement is minimum at terrace level and maximum at plinth level for all types of slab system. Flat slab system shows higher lateral displacement at plinth level compare to other slab systems considered.



Graph 5. Displacement v/s Storey for Response Spectrum in X-Direction

By viewing the graph it is found that the lateral displacement is minimum at terrace level and maximum at plinth level for all types of slab system. Flat slab system shows higher lateral displacement at plinth level compare to other slab systems considered.

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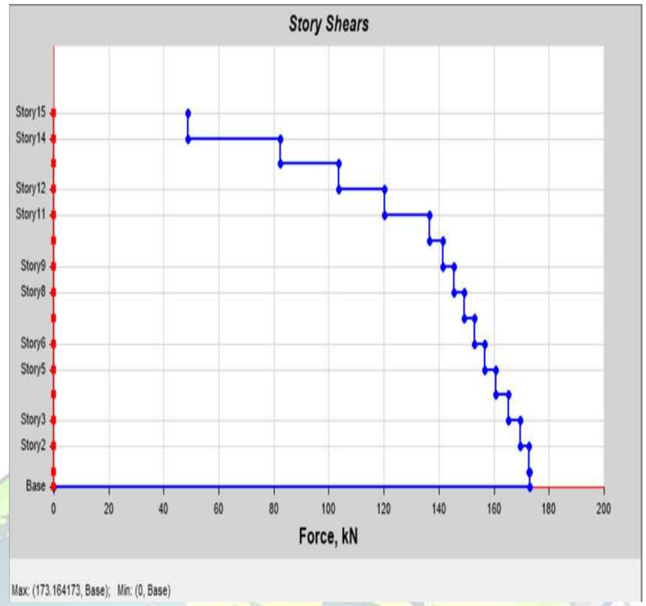
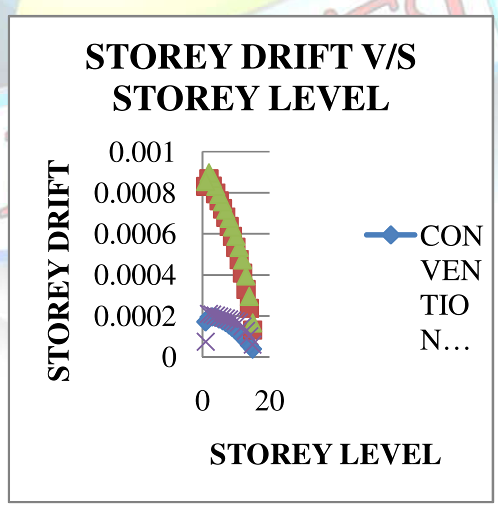
D. Storey Shear



Graph 6.Storey Shear for Response Spectrum in X-Direction of Combined slab

By viewing the graph it is found that the storey shear is minimum at base level and maximum at 1st storey for Response Spectrum in X-Direction of Combined slab.

E. Storey Drift



Graph 7.Storey Drift v/s Storey Level for Response Spectrum in X Direction of Different Types of Slab System

By viewing the graph it is found that the storey drift is maximum for Flat slab and Waffle slab at base level when compared with other types of slab system for Response Spectrum in X Direction. Storey drift value decreases with the increase in the storey height from 2nd storey for all different types of slab system considered.

VI. CONCLUSION

With the present study the following conclusions are drawn:

1) Waffle slab building permits enormous reduction within the dead load of the overall constitution as in comparison with flat slabs and traditional RCC slabs
2) The thickness of waffle slabs can be minimized to pleasant extent as compared to flat slabs and RCC slabs.
3) The highest displacement is observed to be a lot bigger in combined slab process however less in conventional slab in comparison with others varieties of slabs viewed.

REFERENCES

[1] Pradip S. Lande, Aniket B. Raut, " Seismic Behaviour of Flat Slab Systems", vol 2, Issue 10, 2015, Journal of Civil Engineering and Environmental Technology.

[2] Christo Ananth,"A Novel NN Output Feedback Control Law For Quad Rotor UAV",International Journal of Advanced Research in Innovative Discoveries in Engineering and Applications[IJARIDEA],Volume 2,Issue 1,February 2017,pp:18-26.

[3] Dhananjay D. Joshi1, Dr. Pranesh B. Murnal, " Performance of Flat Slab Structure Using Pushover Analysis" vol. 8, Issue 3, 2013, Journal of Mechanical and Civil Engineering.

[4] Anurag Sharma1 Claudia JeyaPushpa.D, "Analysis of Flat Slab and Waffle Slab in Multistorey Buildings using ETABS", vol. 3, Issue 2, 2015, International Journal of Scientific Research & development.

[5] Sanjay P N, Mahesh Prabhu K, Umesh S, "Behaviour of Flat Slab Rcc Structure Under Earthquake Loading", vol 3, Issue 5, 2014, International Journal of Engineering Research & Technology.

[6] Mrs. Sarita R. Khot, Mr. Kumar T. Bharekar, "Comparative Study of Waffle Slabs with Flat Slabs and Conventional RCC Slabs", vol. 5, Issue 4, 2016, International Journal of Engineering Research & Technology.