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Comparative Study of G+8 Building with Conventional Slab and Waffle Slab using Etabs

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ABSTRACT: Now a days we see large construction activities happening everywhere, hence there will be a shortage of land space, so construction of tall structures have been initiated up to overcome this problem. There are numerous elements which are modified to make work faster and economical also like introducing flat slab and waffle slab construction which reduces deadload, and makes beams invisible which increases floor area. The object of the present work is to compare the behaviour of multi-storey buildings having flat slab with that of having grid slab and to study the effect of base shear, storey drift and maximum displacement on it under seismic forces. For this purpose a multi-storey building of G+8 is considered and analysed by using software ETABS.

KEYWORDS: Waffle Slab, Seismic force, Conventional slab, Storey Drift.

I. INTRODUCTION

A building is a man-made structure with a roof and walls standing more or less permanently in one place. Buildings come in a variety of shapes, sizes and functions, and have been adapted throughout history for a wide number of factors, from building materials available, to weather conditions, to land prices, ground conditions, specific uses and aesthetic reasons. To better understand the term building compares the list of nonbinding structures. Buildings serve several needs of society – primarily as shelter from weather, security, living space, privacy, to store belongings, and to comfortably live and work. Grid floor systems consisting of beams spaced at regular interval in perpendicular directions, monolithic with slab. They are generally employed for architectural reasons for large rooms such as auditoriums, theatre halls, show rooms of shop where column free spaced void formed in the ceiling is advantageously utilized for concealed architectural lighting. A waffle slab or two-way joist slab is a concrete slab made of reinforced concrete with concrete ribs running in two directions on its underside. The name waffle comes from the grid pattern created by the reinforcing ribs. Waffle slabs are preferred for spans greater than 40 feet (12 m)

- Conventional Slab

Slab which is supported with beams and columns is called conventional slab. In this kind of slab the thickness of slab is small whereas depth of beam is large and load is transferred to beam and from beams to columns. It requires more formwork when compared with the flat slab, and there is no need of providing column caps in conventional slab. The thickness of conventional slab is 4 or 10 cm. 5 to 6 inches is recommended if the concrete will receive occasional heavy loads.

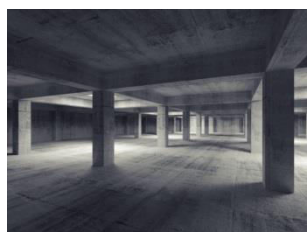


Fig. 1 Conventional Slab

- **Waffle Slab**

A waffle slab or two-way joist slab is a concrete slab made of reinforced concrete with concrete ribs running in two directions on its underside. The name waffle comes from the grid pattern created by the reinforcing ribs. Waffle slabs are preferred for spans greater than 40 feet (12 m), as they are much stronger than two-way slabs, one-way slabs.



Fig. 2 Waffle Slab

II. METHODOLOGY

Every structure has some methodology for analysis and design. Following is methodology.

1. Structural planning of building.
2. Preparation of building layout using Auto-Cad.
3. Analysis of G+8 building using conventional slab and waffle slab.
4. Analysis by assigning various load combinations.
5. Preparation of result tables and graphs for Conventional slab and waffle
6. Comparison of Results
7. Conclusion

III. OBJECTIVES

1. To examine a G+8 -storey residential building for distinctive loads combinations using ETABSSoftware.
2. Study of displacement, drift, overturning, shear forces, Reactions and bending Moments.
3. Compare the analysis different shape of model with software calculations
4. To analyse the building using IS code 1893 (part 1): 2002 for seismic analysis.
5. To verify deflection obtained by ETABS with IS code Limit.

IV. SEISMIC ANALYSIS

Seismic load or the Earthquake load/loading is the load generated when an earthquake is inaction. It is very much important for areas near volcanoes or areas with high earthquake intensity (or ZONES). These zones are more prone to high intensity earthquake than the other areas into consideration. For example, in India, Zone 5 is considered to be highly prone to major earthquakes whereas zone 1 is considered to be least prone to major seismic activities.

- **SEISMIC ZONES**

1. **Zone II:**

Low intensity zone-It covers about 40.93% area of the country. It consists of major parts of peninsular region and Karnataka Plateau.

2. **Zone III:**

Moderate intensity zone-It covers about 30.79% area of the country. It consists of Kerala, Goa, Lakshadweep islands, and remaining parts of Uttar Pradesh, Gujarat and West Bengal, Parts of Punjab, Rajasthan, Madhya Pradesh, Bihar, Jharkhand, Chhattisgarh, Maharashtra, Odisha, Andhra Pradesh, Tamil Nadu and Karnataka.

3. Zone IV:

Severe intensity zone-It covers about 17.49% area of the country. It consists of parts of Jammu and Kashmir, Himachal Pradesh, National Capital Territory (NCT) of Delhi, Sikkim, Northern Parts of Uttar Pradesh, Bihar, West Bengal, parts of Gujarat, small portions of Maharashtra near the coast and Rajasthan.

4. Zone V:

Very severe intensity zone-It covers 10.79% area of the country. It consists of the entire north-eastern India, parts of Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Rann of Kutch in Gujarat, part of North Bihar and Andaman & Nicobar Islands

V. PROBLEM STATEMENT

In this project we will study G+8 storey RCC building of 12m x 12m panel. The construction Technology is R.C moment resisting frame and Grid slabs. The modelling is done in ETABS. The structure is divided into frame and shell elements. Grid lines are made for the x, y and z coordinates and the wall is drawn from scratch. Boundary conditions are assigned to the nodes wherever it is required. Boundary conditions are assigned at the bottom of the wall i.e., at ground level where restraints should be against all movements to imitate the behaviour of structure. The material properties are defined such as mass, weight, modulus of elasticity, Poisson's ratio, strength characteristics etc.

Table 1. General Data for Design

Building Description	
Plan Dimension	12 x 12 M
Length in X-direction	12 M
Length in Y- Direction	12 M
Floor to Floor Height	3 M
No. Of stories height	G+8
Total Height of the building	27 M
Thickness of Slab	200 MM
Beam	230 × 380 MM
Size of Column	230 × 450 MM
Grade of Concrete	M-25
Grade of Steel	FE 250
Panel Dimension	4 m × 4 m

Table 2. General Data for Material Specification

MATERIAL SPECIFICATIONS	
Grade of Concrete, M40	$f_{ck} = 40 \text{ N/mm}^2$
Grade of Steel	$f_y = 415 \text{ N/mm}^2$
Density of Concrete	$\gamma_c = 25 \text{ kN/m}^3$

VI. LOAD COMBINATION

Load combination between dead load, live load, wind load and seismic load as per 875(Part 5),1987

1. $1.5(DL+LL)$
2. $1.2(DL+LL+WX)$
3. $1.2(DL+LL+WY)$
4. $1.2(DL+LL+EQX)$
5. $1.2(DL+LL+EQY)$
6. $0.9(DL+LL+WX)$
7. $0.9(DL+LL+WY)$
8. $0.9(DL+LL+EQX)$
9. $0.9(DL+LL+EQY)$

VII. LAYOUT OF PROBLEM STATEMENT

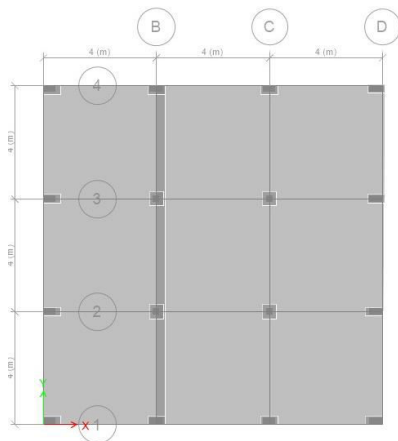


Fig.3 Plan View of Conventional Slab Building.

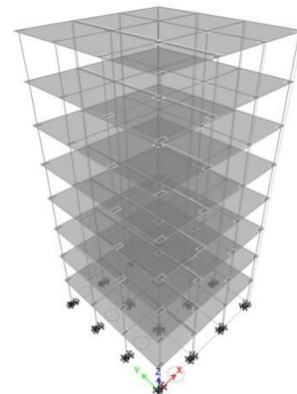


Fig.4 3D View of Conventional Slab Building

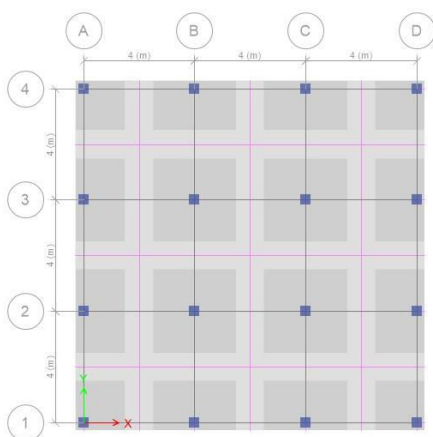


Fig.5 Plan View of Waffle Slab Building.

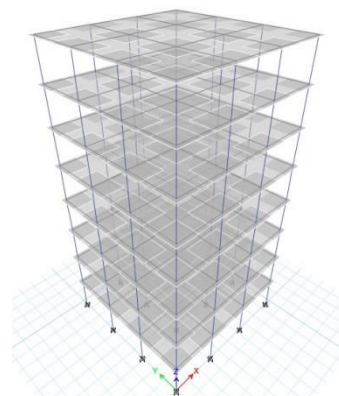


Fig.6 3D View of Waffle Slab Building

VIII. RESULT**1. MAXIMUM STOREY DRIFT**

Table 3. Maximum Storey Drift

SLAB TYPE	STORY	STORY DRIFT
Conventional	Story 08	0.00003
Waffle	Story 08	0.00002

2. MAXIMUM STOREY DISPLACEMENT

Table 4. Maximum Storey Displacement

SLAB TYPE	STORY	STORY DISPLACEMENT (MM)
Conventional	STORY 08	0.0505
Waffle	STORY 08	0.0390

3. STORY OVERTURNING MOMENT

Table 5. Overturning Moment

SLAB TYPE	STORY	MAX. OVERTURNING (KN/M)	MIN. OVERTURNING (KN/M)
Conventional	Base	4.0183	-0.028
Waffle	Base	-1.66	-5.5

IX. CONCLUSION

- The G+8 residential building of Conventional Slab and waffle slab has been analysed and designed using ETABS. Seismic forces have been considered and the structure is designed as an earthquake resistant structure.
- Conventional slab is compared with waffle slab maximum story drift is more in conventional slab as compared to waffle slab.
- Conventional slab is compared with waffle slab maximum story displacement is more in conventional slab as compared to waffle slab.
- Conventional slab is compared with waffle slab maximum over turning is more in conventional slab as compared to waffle slab

REFERENCES

1. IS: 875-1987. 'Indian Standard Code of Practice for Design Loads (other than Earthquakes) for Buildings and Structures, (2nd revision).' Bureau of Indian Standard, New Delhi
2. IS: 456-2000. 'Indian Standard Code of Practice for Design of reinforced concrete', Bureau of Indian Standard, New Delhi



3. Design of Reinforced concrete structures by S. Ramamrutham and R. Narayanan, 17th edition Dhanpat Rai Publishing Company.
4. User manual for E tabs.
5. A Sathawane R.S Deotale 'Analysis and design of flat and grid slab and their comparison, international journal of engineering Research and their applications vol 1. Issue.3.PP 837-848.
6. Baishali Das Static and dynamic analysis of grid beams, project report of Bachelor of technology, Department of civil engineering, National institute of technology Rourkila 21010.
7. Shaikh Ibrahim, Md Arifuzzaman, Jisan Ali Mondal, Md Taukir Alam, Sanuwar Biswas, Sagar Biswas, Design and Analysis of Residential Building, International Research Journal of Engineering and Technology (IRJET), Volume: 06 Issue: 04 | Apr 2019.
8. Dunnala Lakshmi Anuja, V.S.Nagasai , Planning, Analysis and Design of Residential Building(G+5) By using STAAD Pro., International Journal of Engineering Development and Research(IJEDR), Volume 7, Issue 3 | ISSN: 2321-9939.
9. 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.
10. Deevi Krishna Chaitanya, L. Santhosh Kumar, Analysis and Design of A (G + 6) Multi Storey Residential Building Using STAAD Pro., Anveshana's International Journal of Research in Engineering and Applied Sciences (AIJREAS), Volume 2, Issue 1 (2017, Jan), (Issn-2455-6300)



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