Reduce Seismic Behavior of Flat Slab Structures under Static and Seismic Analysis by the Shear Wall

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***Abstract*- For the construction of floors, roofs, bridges, etc, structural concrete slabs are provided to have flat surfaces, typically horizontal. Also this structural concrete slab might be supported by walls, by reinforced concrete beams usually constructed monolithically with the slab, by steel beams, by columns, or by the ground. RC flat slabs are one of the most popular floor systems used in residential buildings, car parks and many other structures.**

The object of the present work is to compare the behaviour of multi-storey buildings with flat slab using shear wall In structural engineering, a shear wall is a vertical element of a seismic force resisting system that is designed to resist in-plane lateral forces, typically wind and seismic loads. In many jurisdictions, the International Building Code and International Residential Code govern the design of shear walls.

Details of the building structure for analysis are given below:

Number of storeys: G+4.Height of each storey: 3.7m.Total height of building: 14.8m.Number of bays along X: 7.Number of bays along Y: 3.Sizes of columns: 600 x 600mm.Thickness of flat slab: 230 mm. Thickness of flat drop: 330 mm.

1. **To study the performance of multi-storey buildings of rectangular shape having flat slab under seismic loading considering static analysis.**
2. **To study the manually design of flat slabs according to IS codes 456-2000 for the practice of the concrete structures using software analysis of flat slab.**
3. **To study some parameters taken in Staad Pro software with providing two sides of building using shear wall.**
4. **To compare the manual design and software design of multi-storey buildings.**
5. **To analyse both methodologies and compare between then for the static load and seismic load considerations taken into account.**

Present work provides good information on the result parameters displacement

***Index Terms*- Manually design Flat Slab, Static Analysis, seismic load, Base Shear**

I.INTRODUCTION

Flat slab called beamless slab is a slab supported directly by columns without beams. A part of slab bounded on each of the four sides by centre line of column is called a panel. The flat slab is often thickened closed to supporting columns to provide adequate strength in shear and to reduce the amount of negative reinforcement in the support regions.

The thickened portion is the projection below the slab is called drop or drop panel. In some cases, the section of column at top as it meets the floor slab or drop panel, is enlarge so as to increase primarily the parameter of the critical section, for shear and increasing the capacity of slab for resisting two-way shear and to reduce negative.

1.1 TYPES OF SLAB

For the construction of floors, roofs, bridges, etc, structural concrete slabs are provided to have flat surfaces typically horizontal. Also this structural concrete slab might be supported by walls, by reinforced concrete beams usually constructed monolithically with the slab, by steel beams, by columns, or by the ground. The depth of a slab is usually very small compared to its span. The various types of slab are:

1. One Way Slab
2. Two Way Slab
3. Flat Slab
4. Grid Slab

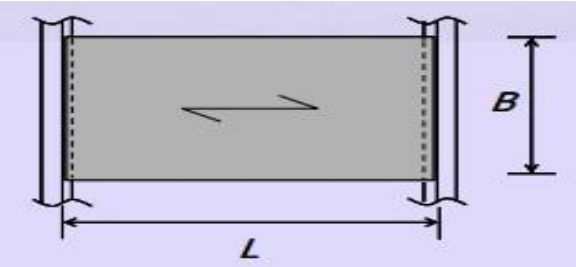


Fig 1.1 Plan of One Way Slab

1.2 FLAT SLAB: DEFINITION

A flat slab is a two-way reinforced concrete slab that usually does not have beams and girders, and the loads are transferred directly to the supporting concrete columns. In general normal frame construction utilizes columns, slabs & Beams. However it may be possible to undertake construction without providing beams, in such a case the frame system would consist of slab and column without beams. These types of Slabs are called flat slab, since their behaviour resembles the bending of flat plates.

Classification of flat slabs:-

- Flat slab or flat plate.
- Flat slab with drop panels.
- Flat slab with column head.
- Flat slab with drop panel and column head.

2. SEISMIC BEHAVIOUR OF FLAT SLAB

The construction of RC buildings with flat slab systems are widely used in some high seismicity European countries. This type of structures is predominantly familiar in South European countries, such as Italy, Spain and Portugal, both for office and residential buildings. Even while national codes may consist of rules for the design of these structures; this issue is not covered by the latest draft of Euro code.

3. OBJECTIVES OF PRESENT WORK

In this paper we study different cases of multi-storey buildings having various types of plan shapes have been taken to study the behaviour of flat slab under seismic loading for static analysis. The objectives of the present work are her under:-

- To study the performance of multi-storey buildings of rectangular shape having flat slab under seismic loading considering static analysis.
- To study the manually design of flat slabs according to IS codes 456-2000 for the practice of the concrete structures using software analysis of flat slab.
- To study some parameters taken in Staad Pro software with providing two sides of building using shear wall.
- To compare the manual design and software design of multi-storey buildings.

4.0 MODEL DESCRIPTION

Details of the building structure for analysis are given below:

Number of storeys: G+4.
Height of each storey: 3.7m.
Total height of building: 14.8m.
Number of bays along X: 7.
Number of bays along Y: 3.
Sizes of columns: 600 x 600 mm.
Thickness of flat slab: 230 mm.
Thickness of flat drop: 330 mm.

4. LOADING CONSIDERED

1. Dead Load- 8 Kn/m2 (from as manually design adopted)
2. Live Load- 5 KN/m2 on all the floors.
3. Earthquake Load- As per IS 1893 (part-I):2002.

4.11.4 LOAD COMBINATIONS

Load combinations considered are as follows

1. 1.5(DL + LL)
2. 1.5(DL ± EQL)
3. 1.2(DL + LL ± EQL)
4. 0.9DL ±1.5EQL

Step-1 size of column
Internal column= L/16 or H/8
8/16=0.5 or 3.7/8=0.46
so adopt 500mm X 500mm Square column
Step-2 the length of drop 1/3 long span =8000/3=2.66
1/3 short span 6000/3=2.00
Adopt 2.8m X 2.10m
Step -3 the minimum slab thickness= h= L/36
=8000/36=222.22
So adopt thickness =230mm
Step -4 Estimates the thickness of drop H1.25 to 1.5 h
= 1.25X230 To 1.5X230
=287.5 To 345
So adopt thickness 330.
IS code 1893 and Also use ACI-318 Zone:- for city Indore and Bhopal.
Response redactor Factor table No.7 is 1893 special =5 clause no. 6.4.2
Importance Factor table 5 clauses no. 6.4.2 = 1.5 for commercial Building
Period in X direction and period in Y direction (clause no. 7.6)

For X RC frame building =0.0075h (0.75)
For Y RC frame =0.09h/root d

X=0.55 Y =0.17 # Foundation depth =3m Plinth =1m

4.11.4Different Plan of Commercial building for Flat Slab

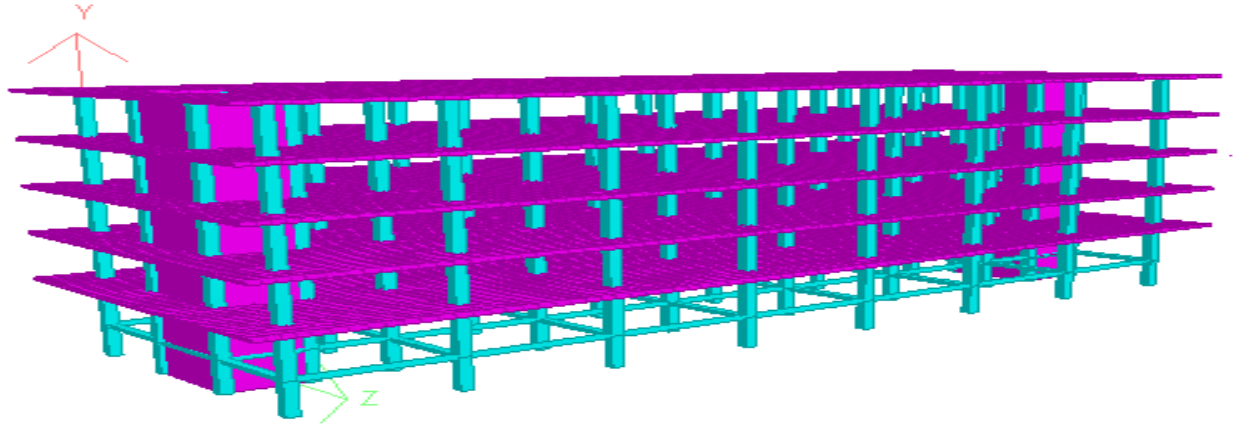


Fig 4.3

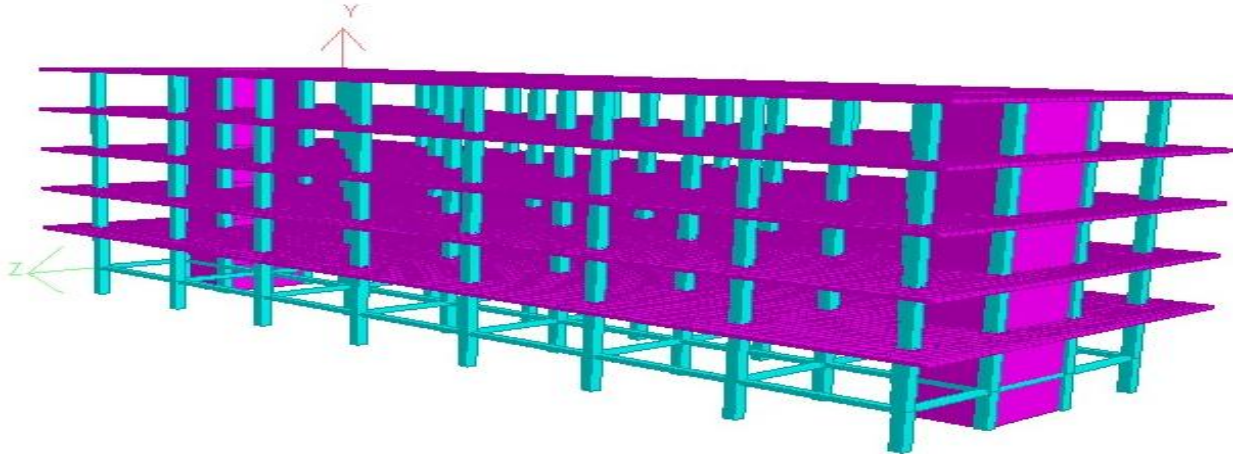
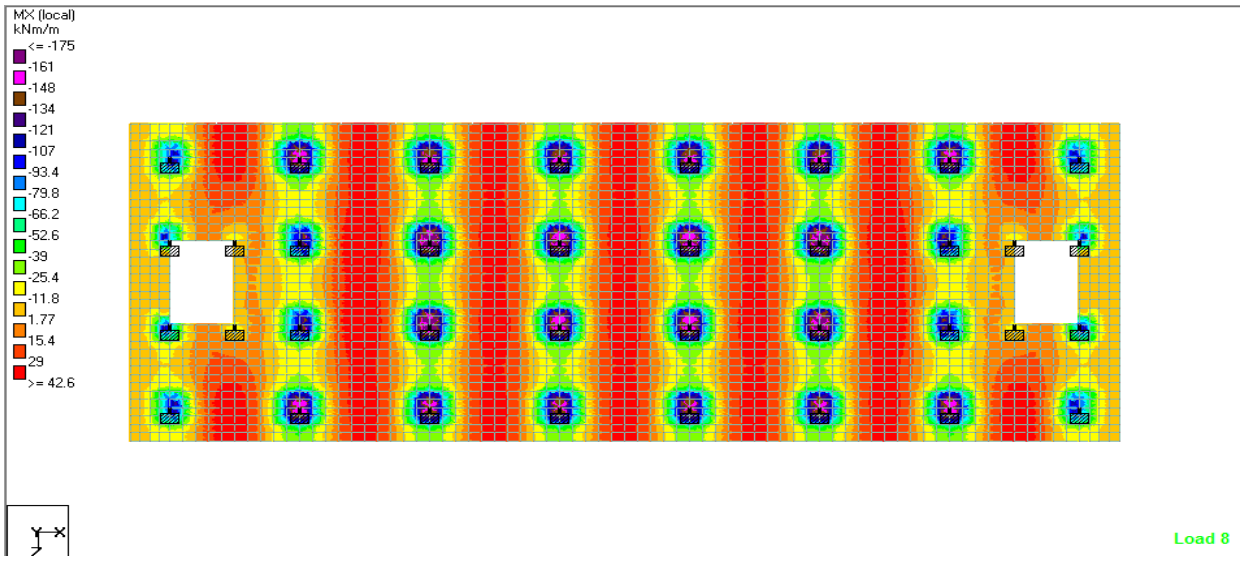


Fig 4.4

4.11.5 Load Combination for static and Dynamic loads

1. 1.5(DL + LL)- Dead Load, and Live Load.



4.6- MBX- Maximum banding moment in X direction

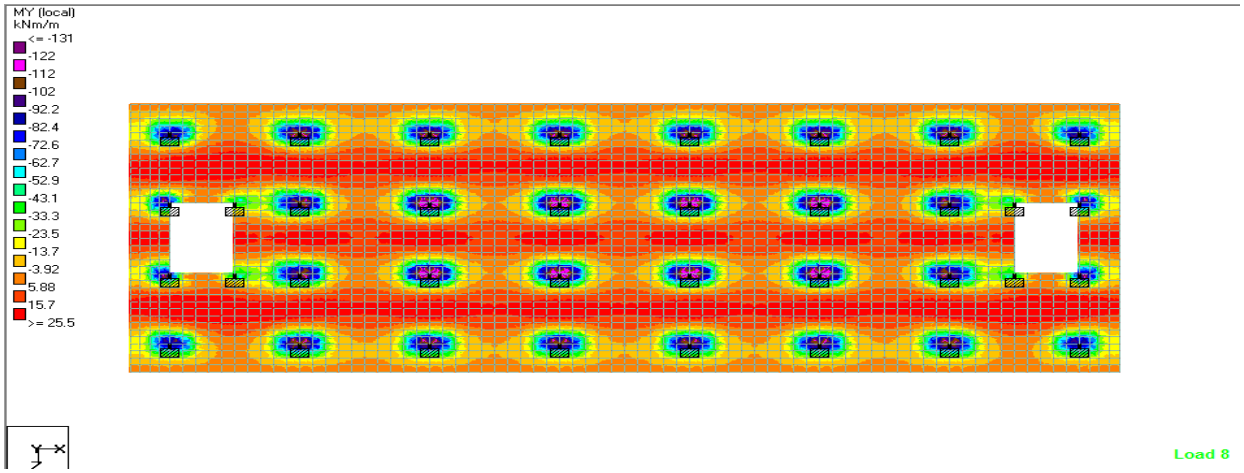


Fig 4.7– MBY Maximum banding moment in Y direction

5. CONCLUSION & FUTURE SCOPES

By comparing with different codes we concluded that IS code 456 2000, ACI 318,from the soft ware most effectively as compared to Indian code is 456- 2000 all condition is well and provide appropriate reinforcement are most effective in designing of flat slabs.

- As per Indian code we are using cube strength but in international standards cylindered are used which gives higher strength than cube.
- Drops are important criteria in increasing the shear strength of the slab.
- Enhance resistance to punching failure at the junction of concrete slab & column.
- By incorporating heads in slab, we are increasing rigidity of slab.
- The negative moment's section shall be designed to resist the larger of the two interior negative design moments for the span framing into common supports.

REFERENCES

[1] Indian Standards, New Delhi, "IS 456:2000, Plain and Reinforced Concrete - Code of Practice", Fourth Revision, July (2000).

[2] American Concrete Institute, "ACI 318-08, Building Code Requirements for Structural Concrete and Commentary", January (2008).

[3] European Standard, "Euro code 2:Part1-2004, Design of concrete structures - Part 1-1: General 2rules and rules for buildings", December (2004).

[4] British Standard, "BS 8110-1:1997, Code of practice for design and construction", March (1997).

[5] M.Anitha, B.Q.Rahman and JJ.Vijay, "Analysis and Design of Flat Slabs Using Various Codes", International Institute of Information Technology, Hyderabad, April (2007).

[6] P.C. Varghese "Advanced Reinforced Concrete Design", prentice hall of India limited, New Delhi, EEE (2002).

[7] I.C.Syal&A.K.Goel "Reinforced Concrete Structures, S.Chand& Company of India limited, New Delhi.

[8] S.Ramamrutham"Design of Reinforced Concrete Structures, DhanpatRai Publishing Company (P) limited, New Delhi.

[9] Dr. B.C. Punmia "Design of Reinforced Concrete Structures, Laxmi Publications (P) limited, Jodhpur. 2015, Salman I Khan and Ashok R Mundhada, "Comparative Study of Seismic

[10] Performance of Multistoried RCC Buildings with Flat Slab and Grid Slab: A Review". 2014, SumitPahwa, VivekTiwari, MadhaviPrajapati, "Comparative Study of Flat Slabwith Old Traditional Two Way Slab".