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COMPARATIVE STUDY OF SEISMIC BEHAVIOUR OF FLAT SLAB WITH DROP AND CONVENTIONAL SLAB STRUCTURE

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Abstract - Flat slab structure represents easy construction and elegant representation of floored building. As this structure means flat slab and having their types are compared more flexible than conventional concrete frame structure, therefore more vulnerable to earthquake loading. Modern slab systems have showed potentials for improvement in the conventional technique of slab casting. Recent advancement in the field of RCC Design are linked to the use of Flat Slabs. Flat Slabs are highly versatile elements widely used in construction, providing minimum depth, fast construction and allowing flexible columns. In flat slabs, the beam used in conventional slabs are done away and the slab is made to rest directly over the columns. In case of higher loads, a drop panel or a column head is provide to reduce the intensity of loads. Flat Slabs are particularly appropriate for areas where tops of partitions need to be sealed to the slab soffit for acoustic or five reasons. In this project study of G+4 story building in zone II is presented. This analysis is done by using software STAAD.pro. This building is modelled with floor area 480 m^2 (20m×24m) with four bays along 20m and four bays along 24m each were considered and loads were applied as per IS specifications. The main aim of the present work is to make a comparative study of seismic behavior of conventional slab and flat slab structure.

Key Words: *Flat Slab structure, Conventional Slab structure, Response spectrum analysis, STAAD.pro*

1.INTRODUCTION

Now-a-days flat slab structures are replacing conventional slab structures as they are more feasible to construct, take less time and shows good aesthetic appearance. But the major disadvantage of flat slab is its high flexibility due to which many problems like motion sickness, high story displacement etc. occurs so to overcome this the concept of Perimeter beams is adopted which reduces the flexibility of the flat slab structure to a much greater extend. Due to the flexibility of Flat slab structures, they must be made stiffer or their rigidity must be increased by any mean

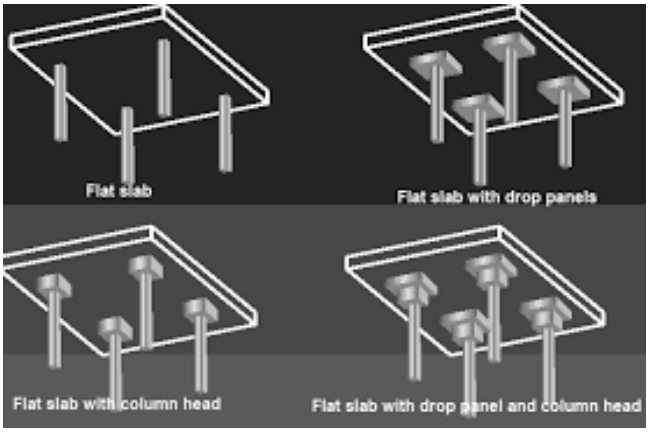
Generally, to reduce the amount of negative moment reinforcement over a column or to reduce shear stresses near column a drop panel of rectangular cross-section should be provided in flat slab structure.

1.1 Flat Slab

In general practice of design and construction, the slabs are supported by beams and beams are supported by columns. This type of construction may be called as beam-slab construction. The available net ceiling height is reduced because of the beams. Therefore offices, warehouses, public halls and tall buildings are sometimes designed without beams and slabs are directly rest on columns. This type of beamless-slab construction called as flat slab, in which slab supported directly by columns without beams. For engineers, flat slabs construction gives reduced floor height and for architectures, it gives aesthetically and beautiful appearance.

1.2 Types of flat slab Flat slabs have the following types:

1. Flat slab without drop panel and column without column head.
2. Flat slab with drop panel and column without column head.
3. Flat slab without drop panel and column with column head.
4. Flat slab with drop panel and column with column head.



1.2 Advantages of Flat Slab

Flat slabs ae used by engineers in many buildings due to its advantages over other reinforced concrete floor system in different cases. The most important advantages of flat slabs are given below:

1. Flexibility in room layout
- Partition walls can be placed anywhere.
- Offers a variety of room layout to the owner.
- False ceilings can be omitted.

2. Reinforcement placement is easier
As reinforcement detailing of flat slab is simple, it is easier to place.

3. Ease of framework installation
Big table framework can be used in flat slab.

4. Building height can be reduced
- As no beam is used, floor height can be reduced and consequently the building height will be reduced.
- Approximately 10% of the vertical member could be saved.
- Foundation load will also reduce.

5. Less construction time.

Use of big table framework helps to reduce construction time.

6. Prefabricated welded mesh

- Standard sizes
- Less installation times
- Better quality control

2. METHODOLOGY

The structure selected for the project is a residential structure with the following descriptions.

Conventional Slab Structure	
1. Building Type	G+4Residential Building
2. Plan area	480m^2
3. Beam Size	230mm × 300mm
4. Slab Thickness	120 mm
5. Flat Slab Thickness	150 mm
6. Storey Height	12 m
7. Earthquake Directions	X and Z
8. Earthquake Zone	II
9. Soil Type	Medium
10. Damping ration	0.5
11. Importance Factor	1.5

Table 2.1 Design Criteria for Structure

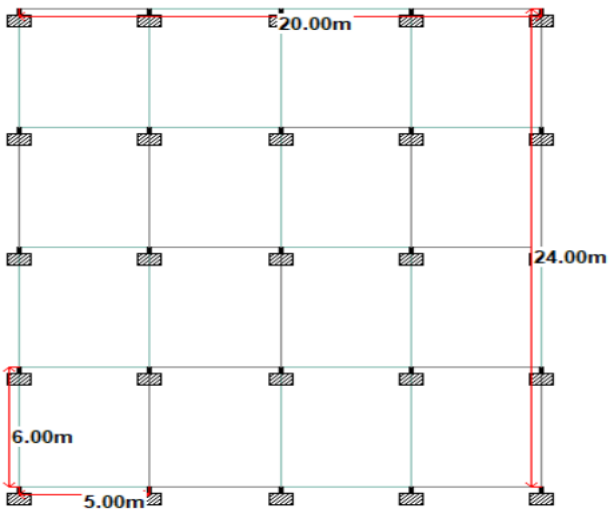


Fig. 2.1 Plan of Structures

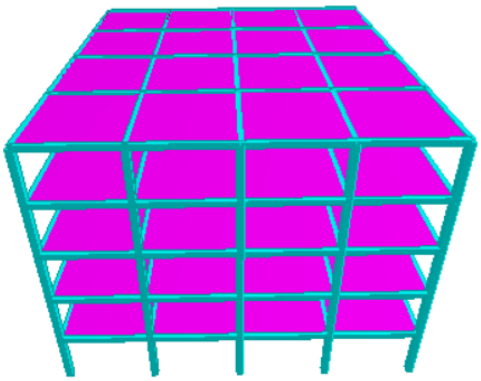


Fig. 2.2 3D View of Conventional Slab Structure

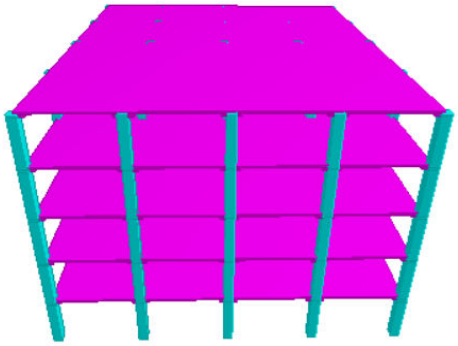


Fig. 2.3 3D View of Flat Slab Structure

2.1 Loads: - Loads in structure can be specified as live load, dead load, seismic load, floor load. STAAD.pro can also generate the self-weight of the structure and used it as uniformly distributed member loads in analysis.

1. Live load: - These are the loads that changes with time. Live loads include loads due to the people occupying the floor, the weight of movable person, the weight of furniture and material. Live Load for design purpose is assessed as per IS875:1987 (part II)

2. Dead loads: - Dead loads are the permanent or stationary loads which are transferred to the structure throughout their life span. Dead loads mainly caused due to self-weight of structural members, permanent partitions, fixed equipment, fittings. Load for design purpose is assessed as per IS 875:1987 (part I)

3. Seismic loads: - Seismic loads are one of the basic concepts off earthquake engineering which means application of an earthquake generated agitation to the building structure or its model. It happens at contact surface of a structure either with the ground or with adjacent structure or with gravity waves from tsunami. Earthquake design is done in accordance with IS 1893 (part I):2002

3. RESULT

A G+4 storied building in zone II is modelled using STAAD.pro software and the results are computed. After analysis the results obtained for deflection, shear force and are graphically represented below.

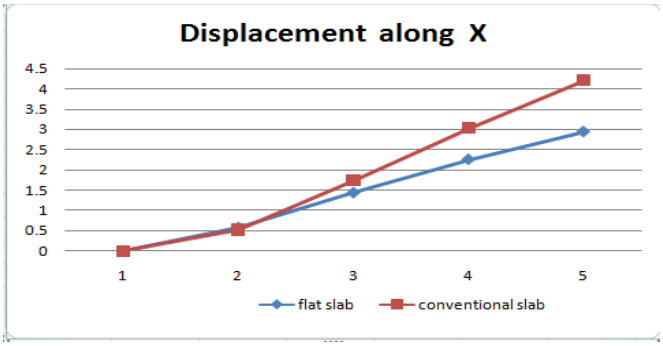


Fig. 3.1 Deflection along X-Direction

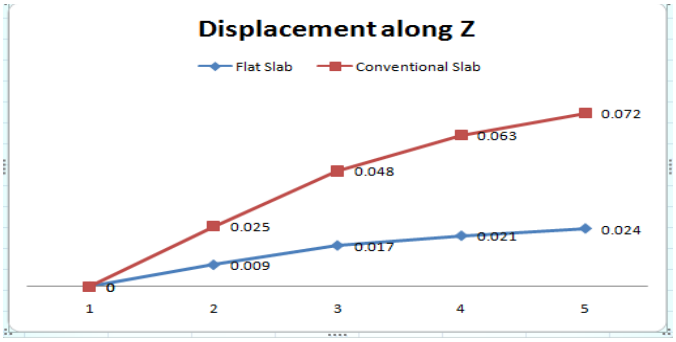


Fig. 3.2 Deflection along Z-Direction

From the above table and figures we got to know that the displacements in conventional slab are more when compared with the displacements in flat slab structure for both earthquakes loading in x- direction and z direction.

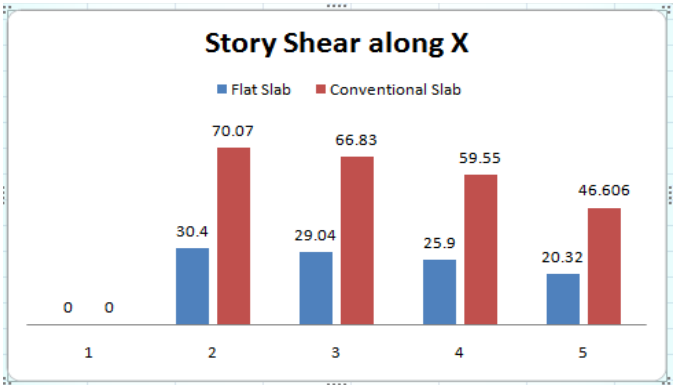


Fig. 3.3 Shear Force along X-Direction

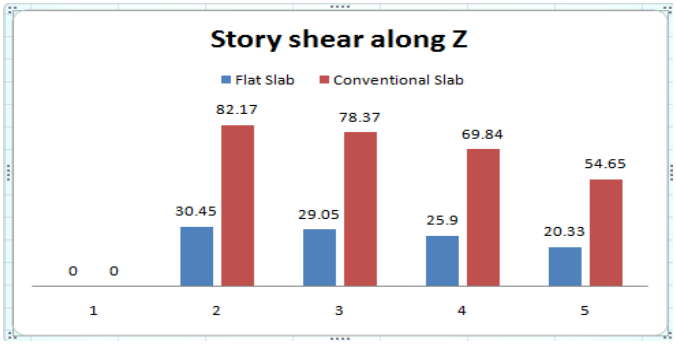


Fig. 3.4 Shear Force along Z-Direction

From the above table and figures we got to know that the story shear in conventional slab is more when compared with the story shear in flat slab structure for both earthquakes loading in x- direction and y-direction.

4. CONCLUSIONS

1) The displacement is maximum in conventional slab structure when compared with flat slab structure.

2) The storey shear is maximum in conventional slab structure than in flat slab structure.

3) Shear forces and column moments are relatively higher.

4) For Flat slab systems, the peak storey lateral displacement (node displacement) is found to be maximum.

5) The displacements and drift of all models are within permissible limit as per IS: 1893:2002.

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REFERENCES

1. Seismic Performance of Flat Slab With Drop and Conventional Slab Structure, Archana Shaga1, Satyanarayana Polisetty M.Tech Structural Engineering Student, Assistant Professor Civil Engineering Department, Anurag Group of Institutions, Hyderabad, India Civil Engineering Department, Anurag Group of Institutions, Hyderabad, India

2. Seismic Analysis of Flat Slab Structure Sukanya Sawant Prof. K. R. Dabhekar M.Tech Student Assistant Professor Department of Civil Engineering Department of Civil Engineering GHRCE Nagpur GHRCE Nagpur

3. Analytical Study of Flat Slabs for High Seismic Zones Jayant Awasthy1, Dhruv Sharma2 1Ujjain Engineering College, Ujjain, Madhya Pradesh, India 2SKITS Indore, Madhya Pradesh, India

4. Studying the Response of Flat Slab and Grid Slabs Systems in Conventional RCC Buildings, Avinash Patel and Seema Padamwar, Department of Civil Engineering, S.S.I.P.M.T., Raipur, Chhattisgarh, India.