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COMPARATIVE STUDY OF FLAT SLAB AND CONVENTIONAL SLAB USING ETABS SOFTWARE FOR DIFFERENT EARTHQUAKE ZONES IN INDIA

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Abstract - *In India, IS 1893-2002 provides the rules and precautions for various types of building construction that is seismic resistant. Buildings such as Conventional RC Frame structures are common in practice but due to highly advanced technologies, beamless slab called Flat slab is in use these days. flat slab possess many advantages over conventional buildings when dealing with seismicity, the flat slab is far less potentially strong to resist for seismic conditions. In the present work the comparison of Conventional building and Flat slab in different zones, using ETABS software. Therefore, the characteristics of a seismic behavior of Flat slab and Conventional RC frame building measures for guiding the concept and design of these structures and for improving the performance of buildings during seismic loading. In Present work, a good amount of information regarding parameters such as Storey Displacement, Storey Shear, Overturning Moment,and Storey Drift for Flat Slab and Conventional Slab is provided and its variation of these parameters in different zones is also detailed.*

Key Word: **flat slab, conventional slab, storey shear, storey drift , overturning moment , drop**

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. There are several elements are modified to make work faster and economical also like introducing flat slab construction which reduces dead weight, and makes beams invisible, enhances floor area.. To know the performance of the structure it should be subjected to all type loadings, all seismic zones factors, various soil categories then only we can extract best choice or suitability parameter for the structures.

Slab supported on walls or beams is called Conventional Slab. Conventional slabs are generally rectangular in shape, but they also occur any irregular shape such as triangular, circular, trapezoidal etc.

Flat slab is system of construction is one in which slab is directly rest on the column. The slab directly rests on the column and load from the slab is directly transferred to the columns and then to the foundation. To support heavy loads, the thickness of slab near the support is increased and these are called drops and columns are generally provided with enlarged heads called column heads or capitals.

1.1 OBJECTIVE

- To study the performance of flat slab and conventional slab structure subjected to various loads and conditions.
- To the study the behavior of both structure for the parameters like story shear, story displacement ,time period, story drift, overturning moment
- Comparisons of flat and conventional building for the above parameters.
- In the present work the performance of flat slab and Conventional slab structures for various loads all seismic zones factors have been studied.

1.2 MATERIAL PROPERTIES

Table 1: Material properties

Types of material	Grade of material	Unit weight (KN/M^3)	Modulus of elasticity (N/mm^2)
Concrete	M25	25	25000
Steel	Fe500	78.5	$2x10^5$

1.3 APPLIED LOADS

Table 2: Applied loads

Load pattern	Type of slab	
	Conventional slab	Flat slab
Dead load(KN/M^2)	1	1
Live load(KN/M^2)	3	3
Super dead load(KN/M^2)	2-on slab 9-on beam	2-on slab
Seismic load (KN/M^2)	0	0

1.4 METHODOLOGY

The analysis of flat and conventional slab structure has been done by using ETABS software package. Before analysis all the required elements of the structure needs to be defined earlier like material properties, loads, load combinations, size of members, etc. once the analysis has been done we can extract the results like displacement, storey shear, bending moment, drift ratio, axial forces for comparing the performance of flat and

conventional slab building. The following flow chart shows the steps involved in the analysis by ETABS.

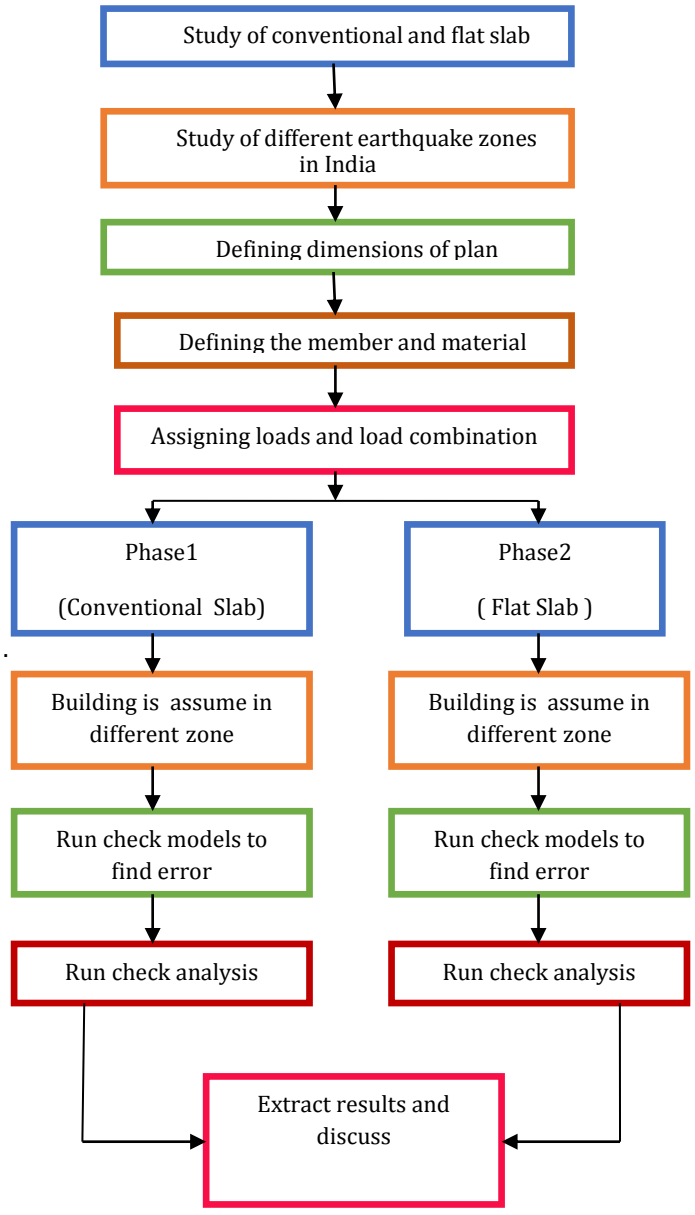

Fig .1: Methodology of structure

2. DATA REQUIRED FOR CONVENTIONAL SLAB

- Beam size=300X450mm
- Column size=300X600mm
- Slab thickness=150mm
- Seismic zones=Zone5(IS1893:2002)
  Zone4(IS1893:2002
  Zone3(IS1893:2002)
  Zone2(IS1893:2002)
- Soil type is selected is type 2 as per IS1893:2002
- No of story=G+6
- Story height=3m
- Length of building=16m
- Width of building=16m
- No of grids in X-direction=5
- No of grids in Y-direction=5
- Total height of building=22.5m

2.1 PLAN & 3D VIEW OF CONVENTIONAL SLAB

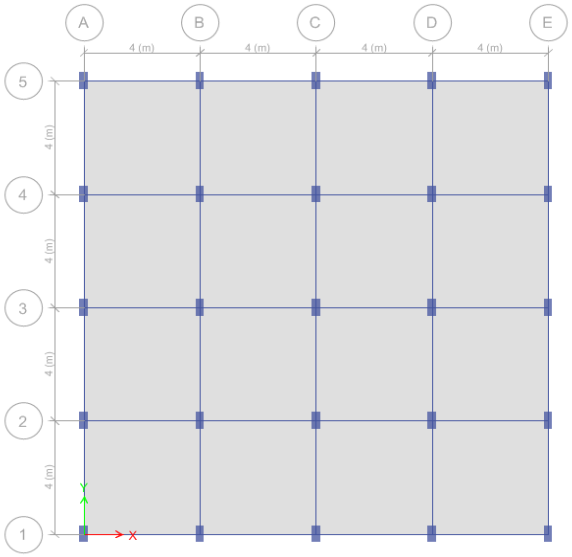

Fig 2 : Building plan for conventional slab building

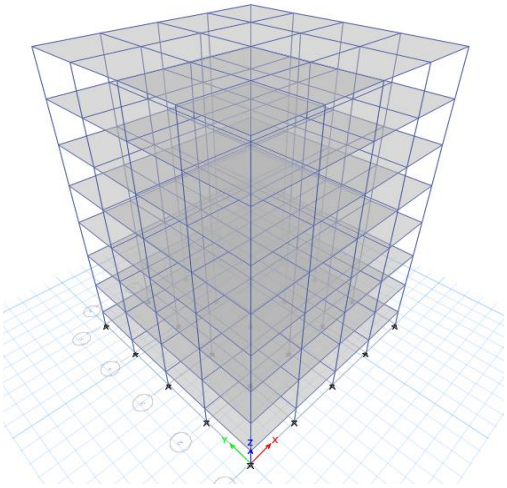

Fig.3: 3D view of conventional slab building

2.2 DATA REQUIRED FOR FLAT SLAB

- Column size=300X600mm
- Size of drop panel=2x2m
- Slab thickness=200mm
- Drop panel thickness=115mm
- Seismic zones= Zone5(IS1893:2002)
  Zone4(IS1893:2002
  Zone3(IS1893:2002)
  Zone2(IS1893:2002)
- Soil type is selected is type 2 as per IS1893:2002
- No of story=G+6
- Story height=3m
- Length of building=16m
- Width of building=16m
- No of grids in X-direction=5
- No of grids in Y-direction=5
- Total height of building=22.5m

2.3 PLAN & 3D VIEW OF FLAT SLAB

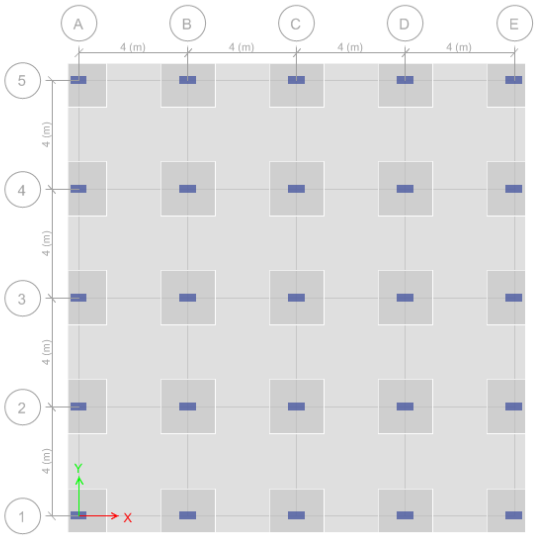

Fig.4: Building plan for flatl slab building

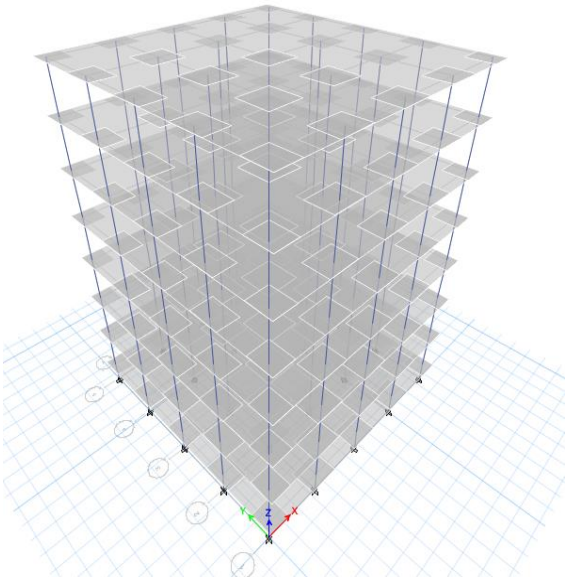

Fig.5: 3D view of flat slab building

3.0 RESULTS AND DISCUSSION

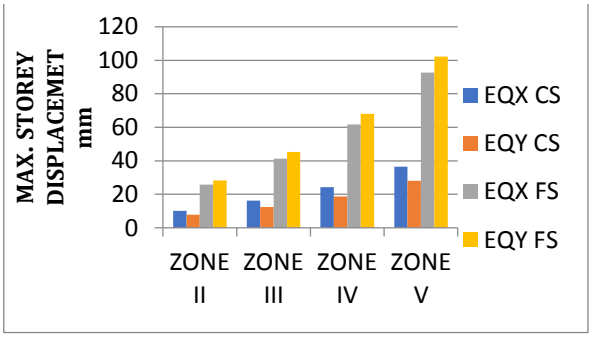

Chart 1: comparison of max. storey displacement for conventional slab & flat slab for different earthquake zone

From chart 1 it can be observed that Maximum storey displacement increases as the risk of earthquake increases in both slab and it is more in flat slab as compare to conventional slab.

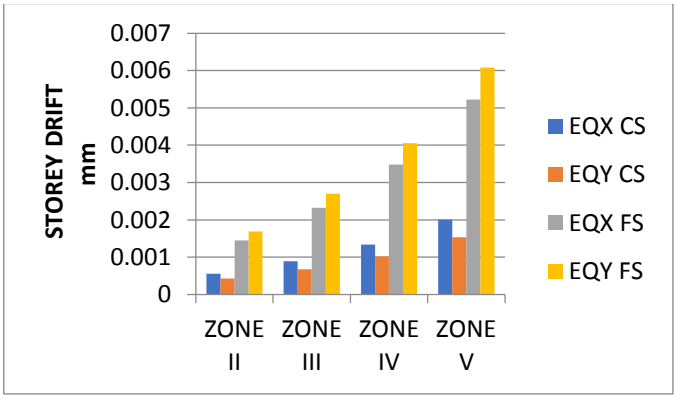

Chart 2: comparison of storey drift for conventional slab & flat slab for different earthquake zone

From chart 2 it can be observed that Storey drift increases as the risk of earthquake increases in both slab and it is more in flat slab as compare to conventional slab.

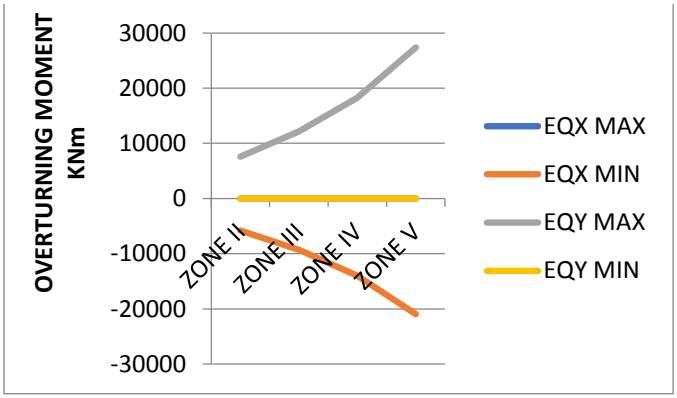

Chart 3: comparison of overturning moment for conventional slab

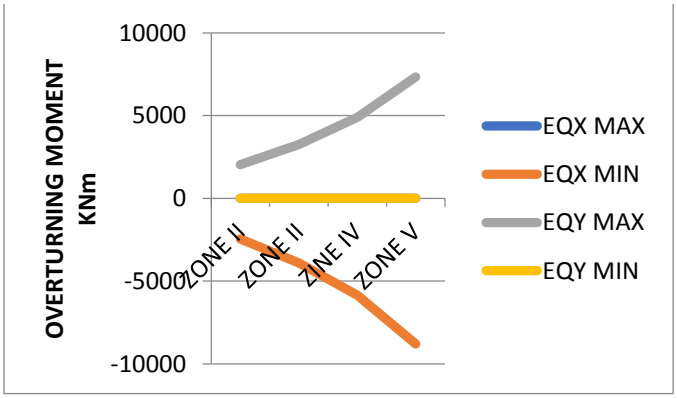

Chart 4: comparison of overturning moment for flat slab

From above chart 3 & 4 it can be observed that overturning moment decreases along X direction and it increases along Y direction as earthquake risk increases in both conventional and flat slab but it is more in conventional slab as compare to flat slab.

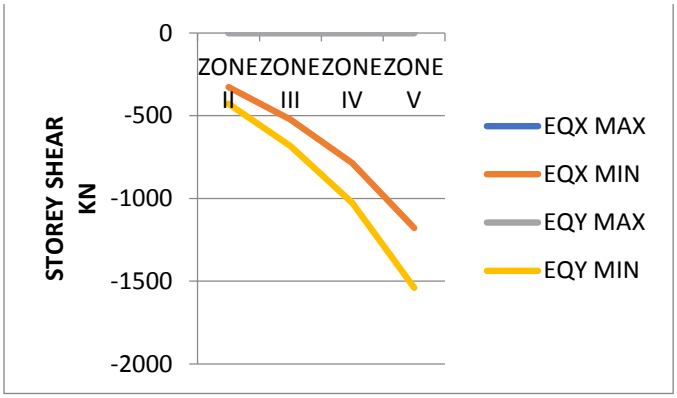

Chart 5: comparison of storey shear for conventional slab

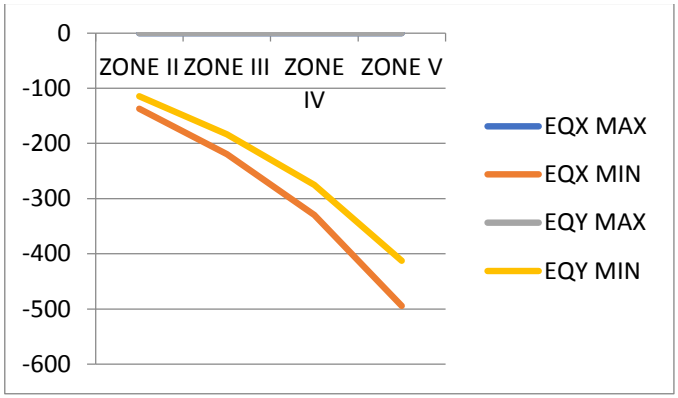

Chart 6: comparison of storey shear for flat slab

From chart 5 & 6 it can be observed that storey shear along both X& Y direction in both slab decreases as the risk of earthquake increases and it is more in flat slab as compare to conventional slab.

4. CONCLUSION

A. Storey displacement is goes on increasing from base to roof & hence maximum at roof & minimum at base & it is higher in high seismic risk zone and lower in low seismic risk zone in both slabs. From above results we conclude that storey displacement is more in case of flat slab structure in all zones as compared to conventional slab.

B. Storey drift is more at middle floors in case of flat slab & storey drift is more at 1st floor in case of conventional slab structure. Storey drift is more in flat slab as compared to conventional slab.

C. overturning moment decreases along X direction and it increases along Y direction as earthquake risk increases in both conventional and flat slab but it is more in conventional slab as compare to flat slab.

D. Maximum storey shear is zero in both slabs & minimum storey shear is more in flat slab as compared to conventional slab.

E. By comparing all above parameters it was found that conventional slab building has superior performance in case of earthquake as compared to flat slab building.

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