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Analysis and Comparison of Multi-story RCC Structure by using Flat slab and Shear wall by Response Spectrum Analysis by using ETAB

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ABSTRACT: The aim of the initiative to simplify the methods used for flat slab designs using the IS 1893-2002 codes testing under various load conditions, especially seismic loads. A flat slab of concrete (without beams) is used as the floor system in a usual form of concrete building construction. Using the Response spectrum analysis methodology for flat slab, flat plate and shear wall analysing and comparing the behaviour of story displacement, story shear comparing Response Spectrum validation of Base reduction and Response reduction performance have less impact in seismic and the better modified structure.

I. INTRODUCTION

In the conventional frame construction use of columns, beams and slab in other way is desirable to overtake building without providing beams In general, columns, slabs, and beams are utilized in regular frame structure this type of construction is known as Flat slab, where their behaviour related to the bending of flat plates. Instead of beams a reinforced concrete slab with or without drops is supported by columns with or without column heads. A flat slab might consist of solid slab or it could have gaps built on the soffit, creating a structure of ribs in each direction. A Filler blocks, which can be either flexible or fixed the recesses.

The RCC structural walls which refuse the lateral forces due to wind and earthquake are referred to as shear walls. The thickness of shear walls differs from 150 mm to 400 mm. Shear walls afford stiffness and high strength to model within the guidance of their adjustment and greatly decrease the lateral movements of the structures. To control twisting in structures, these walls normally beginning at the footing level and through the entire structure height. Shear walls usually offered both along the width and length of the structures.

II. RESPONSE SPECTRUM METHOD

To do this performs the seismic analysis and design on a structure, actual-time history record is important that will be designed in an exact location. The availability of such records everywhere is not possible. Also it is unable to do a seismic study of a structure based upon the optimum value of ground acceleration because a structure's response due to frequency distribution of the motion of the earth and its own motion properties. The best method for structural seismic analysis is the earthquake response spectrum.

This component deals with response spectrum method and its use to different types of the structures. A codal provisions as per IS: 1893 (Part 1)-2002 code for the response spectrum analysis of high-rise buildings is also summarized.

Response-spectrum analysis selecting a structural design to dynamic performance, which is advantageous to design decision-making. Longer structures through greater displacement and shorter structures have superior acceleration. Identifying structural outcomes during the design process and response-spectrum analysis is an advantageous technique.



III. ETAB

ETABS [EXTENDED 3D ANALYSIS OF BUILDING SYSTEM] an isolated structural research system with high-quality constructive elements for structural design and dissection of building frameworks. ETABS is simple to use and simple to understand, and it's far first-rate in the possibility with claiming activities protected inside the remodel for shape analyse what is extra configuration.

It is highly praised for its convenient layout, basic interface, ability to use devices display what is more significant loading, or necessity for offices. The span of those specific business settings provided by ETABS from a view of a structural engineer.

- Model generating facilities
- Model verification facilities
- Load generation capabilities
- Finite elements capabilities
- Dynamic/seismic capabilities
- Analytical capabilities
- Concrete design capabilities
- Steel design capabilities
- Post analysis capabilities

IV. OBJECTIVES

The objectives of the present study on seismic analysis of RC building having openings, bracings and shear walls are as follows.

1. To develop regular RC building model with Flat Slab and Flat Plate by response spectrum analysis
2. To develop regular RC building model with shear walls for better Performing model.
3. To obtain different seismic parameters viz. storey displacement, storey shear, storey Auto lateral loads, and performing models from response spectrum analyses.
4. Evaluating and compare the impact of shear wall due to earthquake for developed RC building models.

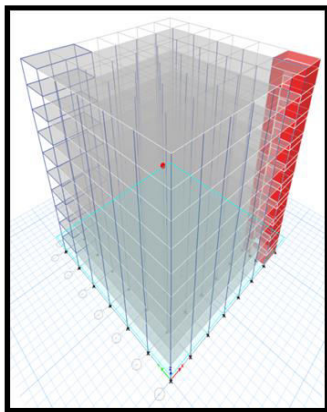
V. METHODOLOGY

The modelling and design of the models were carried out in ETABS software. Model description and parameters were tabulated below.

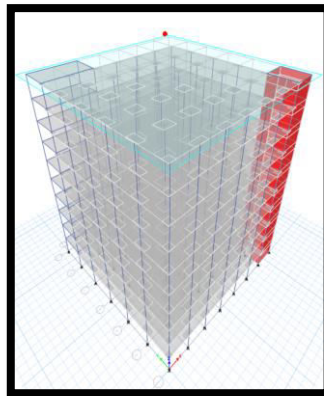
Table 1: Parameters consider for the model

SL. NO	PARTICULARS	VALUES
1	No. of Story	G+10
2	Ground floor height	3.1m
3	Plan area	23m x 27m
4	Thickness of slab	0.2m
5	Thickness of Shear wall	0.23m
6	Drop panel thickness	50mm
7	Drop panel size (Rectangular)	1750mmx1550mm
8	Drop panel size (Rectangular corner edge)	1550mmx1300mm
9	Column size	600mmx450mm
10	Beam size	600mmx450mm
11	Wall thickness	230mm
12	Grade of concrete	M45

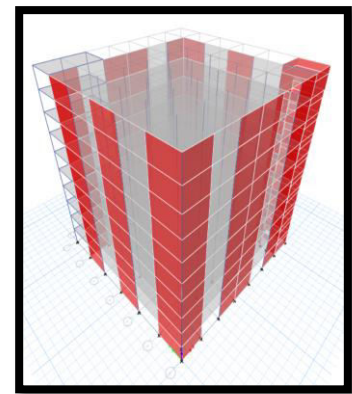
13	Grade of Steel	Fe550
14	Seismic Zone	IV
15	Density of concrete	25KN/m ³
16	Density of motor	20.4KN/m ³
17	Density of solid Brick	20KN/m ³
18	IS codes consideration	1) IS: 1893 (part-1)-2002, 2) IS 456- 2000



Model. 1: 3D Wire frame of Flat Plate



Model. 2: 3D Wire frame of Flat slab



Model. 3: 3D wire frame of flat slab with Shear wall

VI. RESULT AND DISCUSSION

Maximum Value of Story displacement, Story shear, Auto lateral load, and response reduction validation of Base reduction, Response reduction were tabulated and graphs were plotted below

Story Displacement

Story displacement in (mm)		
Model	X direction	Y direction
Flat Plate	29.377	36.185
Flat Slab	37.128	38.599
Flat Plate with Shear Wall	8.923	14.411

Table 2: Comparison of Story Displacement

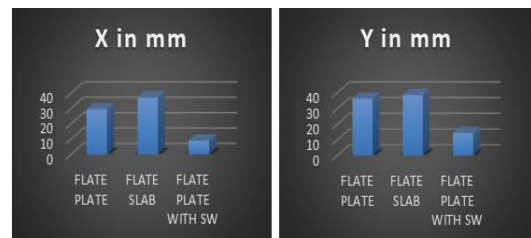


Chart1: Comparison of Story Displacement in X and Y direction of all Models

Story Drift

Story Shear in (KN)		
Model	X direction	Y direction
Flat Plate	354.643	296.755
Flat Slab	346.7459	296.564
Flat Plate with Shear Wall	677.0582	630.799

Table 3: Comparison of Story Drift

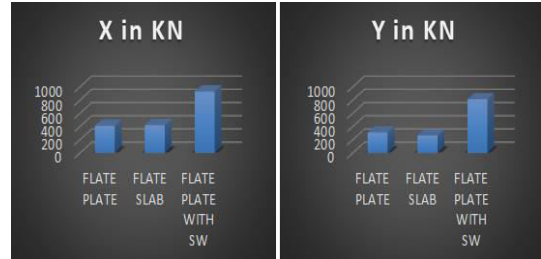


Chart 2: Comparison of Story Drift in X and Y direction of all Models

Auto lateral Load

Auto lateral load in (KN)		
Model	X direction	Y direction
Flat Plate	414.1789	312.078
Flat Slab	421.9207	266.042
Flat Plate with Shear Wall	932.1461	814.403

Table 4: Comparison of Auto lateral Load

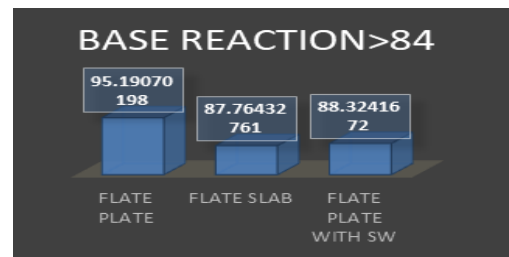


Chat 3: Comparison of Auto lateral Load in X and Y direction of all Models

**Response Reduction Validation
Base reaction**

Base reaction (> 84)			
Model	RSMAX	EQX	BS>84%
Flat Plate	1701.5773	1787.5457	95.190
Flat Slab	1606.1718	1830.0964	87.764
Flat Plate with Shear Wall	3003.452	3400.4872	88.324

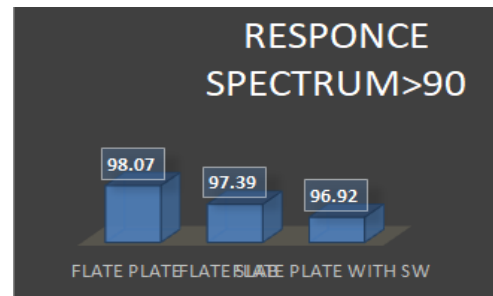
Table 5: Comparison of Base reaction
Response Reduction



Chat 4: Comparison of Base reaction of all models

Response Reduction (> 90)				
Model	SUM UX	SUM UY	UX %	UY %
Flat Plate	0.9462	0.9807	94.62	98.07
Flat Slab	0.9501	0.9739	95.01	97.39
Flat Plate with Shear Wall	0.9491	0.9692	94.91	96.92

Table 6: Comparison of Response reduction



Chat 5: Comparison of Response reduction of all Models

VII. CONCLUSION

1. In conclusion, based over analysis results of G+10 flat slab and flat plate structures using ETABS, it is evident that all models exhibit satisfactory performance in several aspects.
2. The flat slab system may exhibit good Story displacement in Y-direction and auto lateral load, story shear performance in X-direction and Response reduction factor is 97.39% Base reduction factor 87.76% in Y-direction indicating its ability to resist lateral loads and dissipate seismic energy.
3. The inclusion of shear walls in the flat plate model enhances the overall stiffness, stability, and lateral load resistance. This leads to improve displacement performance, especially in the shear wall direction and potentially performance in Base reduction factor 88.32% and Response reduction factor 96.92% in y-direction and better story shear characteristics.

4. Overall, the analysis using ETABS provides valuable insights into the behavior and carrying out the G+10 flat plate and flat slab structures, aiding in their design, construction, and ensuring their ability to withstand applied loads and dynamic forces.

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