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Comparison of Static and Dynamic Analysis of Multi-Storey Building

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Abstract - *Vibration of ground is the main cause of earthquake damage to building structures. There are many factors responsible for the strength of earthquake shaking at a site including the earthquake's magnitude, the site's proximity to the fault, the local geology, and the soil type. The natural disasters have been fast recurring all over the world causing great concern and damage to man and their properties. Among these disasters Earthquake is an endogenous natural disaster, which occurs suddenly without any warning. The vast devastation of engineering systems and facilities during the past earthquakes has exposed serious deficiencies in the prevalent design and construction. Shear wall is one of the most commonly used lateral load resisting in high rise buildings. Shear wall can be used to simultaneously resist large horizontal load and support gravity load.*

In the study, one tall RCC building of 13 stories is assumed to be situated in seismic zone V is analyzed using two methods (Static and Dynamic Analysis). The share walls are taken at different position of building. The comparison of the different shear wall models is studied in this work against the different parameters like time period, bending moment, shear force, storey drift, displacement.

***Key Words*: Static Analysis, Dynamic Analysis, Earthquake, Share Wall**

1.INTRODUCTION

A shear wall is a vertical element of a earthshattering force resisting system. It is designed to resist plane lateral forces, typically seismic and wind loads. A shear wall resists loads parallel to the plane of the wall of building. Shear walls are typically braced wooden or light-framed walls with reinforced masonry walls, shear panels, or steel plates. It can be used for giving more strength and protection to the structure when the structures are subjected to external loads such as earthquake loads and wind loads. These types of walls basically play a main role for the construction of the tall structure. The location of shear wall can influence the seismic conduct of structure to extensive degree and the shear wall increases the strength and stiffness of the structure.

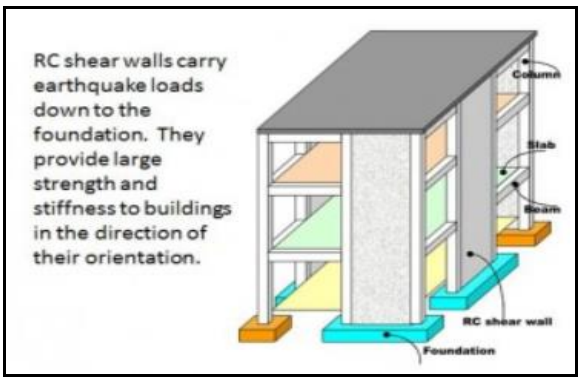

Fig -1: Share Wall

1.1 Advantages of Share Wall

1) Provide large strength and stiffness.
2) Fast performance of building structure.
3) Conspicuously reduces lateral sway.
4) Construction time is fast.
5) Cost effective.
6) The shear wall is very Light-weight.
7) Enough well-distributed reinforcements.

1.2 Aim of Study

1) To understand the basic principles of structures by using IS Codes.
2) To prepare the three-dimensional model of the structure by using the ETABS Software for detailed analysis and design.
3) Sustain all loads and deformations of normal construction & use.

1.3 Objectives

1) To develop, design and analysis model of the High-rise structure in ETABS.
2) To compare displacement, story drift, base shear, time period and frequency
3) The main objective of this study is to analysed and design a G+13 building with share wall using ETABS software.

4) Design of structural components like beam, slab, column and footing using ETABS.

1.4 Required IS Code

1) IS: 875 (Part 1) 1987 - this code includes the dead load.

2) IS: 875 (Part 2) 1987 -this code involves the imposed load or live load.

3) IS: 875 (Part 3) 1987 -This IS code includes the wind load for a structure.

4) IS: 875 (Part 5) 1987 - The different combination of dead load, live load, wind load is given in this code

5) IS 1893 (Part 1) 2002 - IS 1893- 2002 is the main code for the earthquake resistant design which provides the seismic design force, seismic zone map and different factors and coefficient like importance factor, seismic zone factor, related to the soil on which structure rests, which are essential in earthquake resistant design.

6) IS 13920-1993 - In India, reinforced concrete structures are designed and detailed according to IS 456 (2002).

2. METHODOLOGY

A model of G+12 storeyed is developed, analysed and design using ETABS software. Building plan size is 3150 cm X 2450 cm. In the earthquake zone V, the building is situated. Coefficient of seismic zone is taken as 0.36 as per IS code.

Table -1: Structural Parameters

Sr No	Parameter	Dimension
1	Plan dimension	3150 cm X 2450 cm
2	Number of stories	G+12
3	Column size	500 mm X 500 mm
4	Beam size	300 mm X 450 mm
5	Thickness of share wall	200 mm
6	Thickness of slab	150 mm
7	Storey height	3500 mm
8	Zone factor	0.36
9	Concrete grade	M 25
10	Steel grade	Fe 415

2.1 Modeling

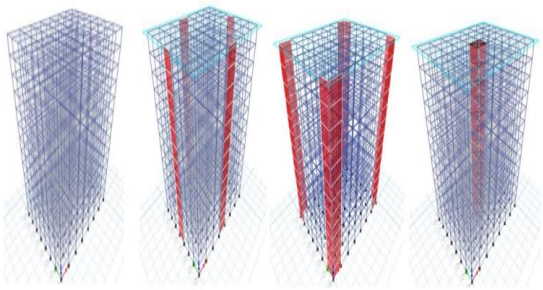

Fig -2: Structures with Share Wall

3. RESULT AND DISCUSSION

3.1 Time Period

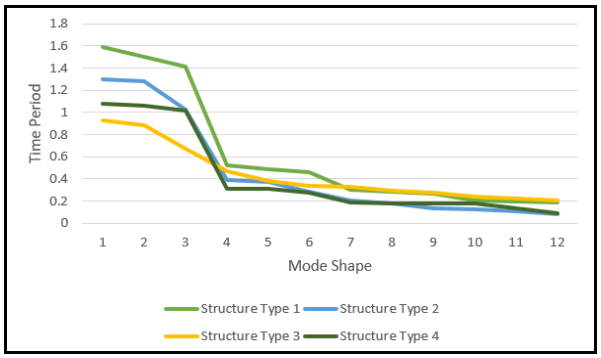

Chart -1: Time Period

In structure 2 time Period is reduced by 80% and 60% in structure 3.

3.2 Lateral Force on Share Wall in X Direction

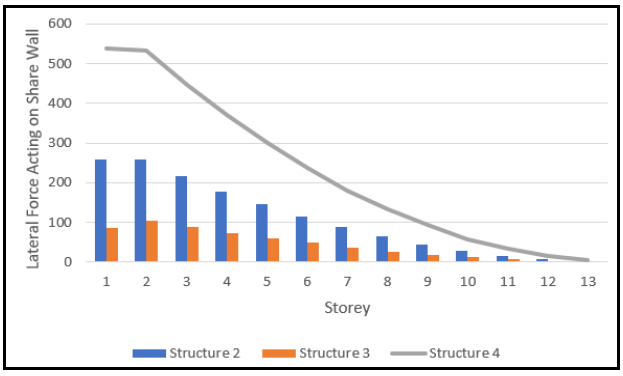

Chart -2: Lateral Force on Share Wall in X Direction

3.3 Lateral Force on Share Wall in Y Direction

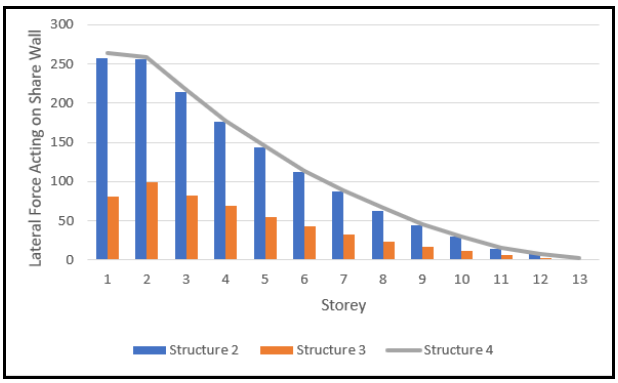

Chart -3: Lateral Force on Share Wall in Y Direction

3.4 Static Analysis (Storey Drift)

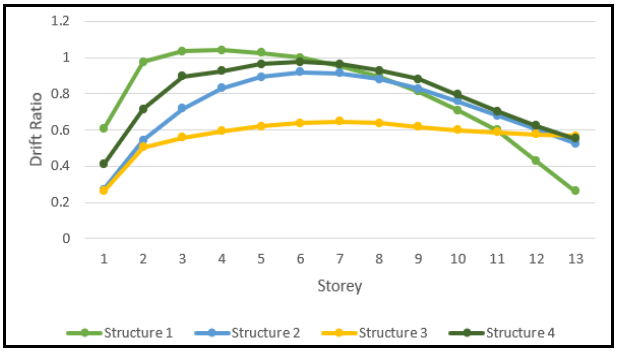

Chart -4: Static Analysis (Storey Drift)

In static analysis, the structure 1 of building having the maximum storey drift value as compare to structure 3.

3.5 Dynamic Analysis (Storey Drift)

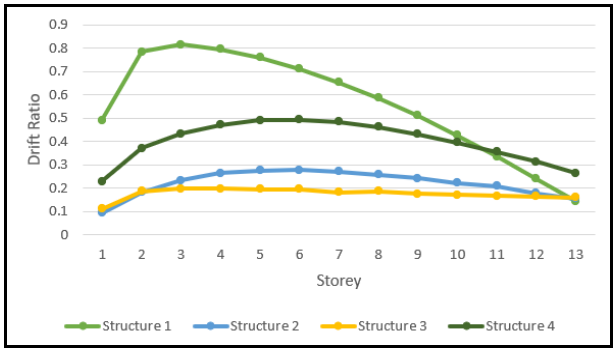

Chart -5: Dynamic Analysis (Storey Drift)

In dynamic analysis, the structure 1 of building having the maximum storey drift value as compare to structure 3.

3.6 Bending Moment-

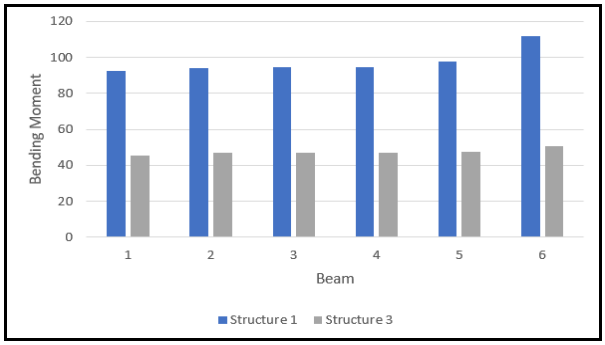

Chart -6: Bending Moment

By considering the structure 1 and structure 3 the moment values are compared, and it is observed that the structure 3 is 46% lesser value as compared to structure 1.

4. CONCLUSION

In the static and dynamic analysis, the value of structure 3 is less than structure 1, structure 2 and structure 4 of building. In structure 2 time Period is reduced by 80% and 60% in structure 3. In static and dynamic analysis, the structure 1 of building having the maximum value and structure 3 of structure is having the less storey drift ratio values. In above study we conclude that by providing share wall is more effective for resisting lateral force. Share wall at corner is more effective location for building.

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[8] IS:875-1987(Part-1 to 3)- (Dead Loads, Live Loads or Imposed Loads and Wind loads) Code practice of Design loads for buildings and structures.