EVALUATION OF BUILDING RESPONSE FOR LATERAL LOADS USING ETABS

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Abstract: Buildings are becoming more and more slender, vulnerable to sway, and hence unsafe during earthquakes. By offering an adequate lateral load resisting system, this sort of building can be strengthened. in the buildings' seismic architecture. Shear walls made of reinforced concrete serve as important earthquake-resistant structural components. An effective bracing stem and source of lateral load resistance are structural walls. It was crucial to assess the seismic reaction of the walls properly because the characteristics of the seismic shear-walls dictate the response of the buildings. The (G+10) story building was examined in this study using various shear wall configurations. The modelling was done in accordance with IS:1893-2002 to explore the impact of various instances on seismic parameters for the zone-II in medium soil, such as base shear, lateral displacements, lateral draughts, and model time period.

Keywords:- Structural wall, shear wall, lateral load resisting system, base shear, lateral displacement, story drift, time period, E-TABS.

1. INTRODUCTION

During the course of their useful lives, buildings are subject to a variety of loads. Gravity loads and lateral loads make up the majority of the loads. According to Ali and Patil (2013), supporting gravity loads is the primary function of all types of structural systems in buildings. Dead load, active load, and snow load are three typical loads brought on by the effect of gravity load. Other side buildings are likewise exposed to lateral loads brought on by wind pressure and seismic force. The structural system of the building has to resist both the gravity load and lateral load. The vertical framing system, which is made up of beams and columns and transfers the lateral load to the foundation, and the horizontal raming system, which consists of beams and slabs, are the two components that make up the structural system of the building.

The flexural stiffness of various components determines how the lateral forces exerted on any structure are distributed. Shear walls are concrete constructions designed to withstand lateral forces operating on the building. They are vertical components of systems that resist horizontal forces. These walls function much like wide, vertically oriented beams that convey earthquake loads to the base. Due to the height of the shear walls, which would be just adequate in resisting the lateral loads as well as the shear walls having complete height equivalent to the height of the building itself, these wall systems are frequently utilised to withstand the lateral forces brought on by seismic excitation.

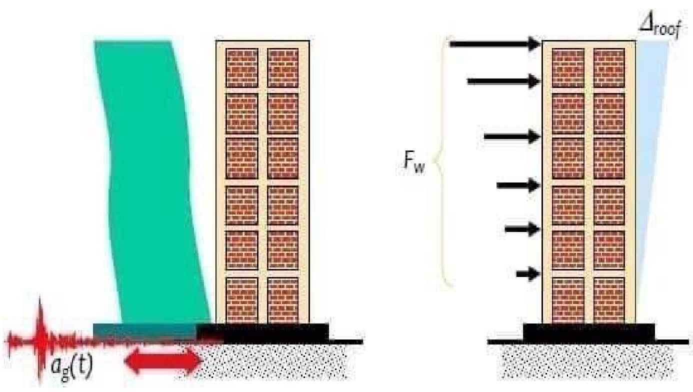


Fig1: Effect of seismic load/ Earthquake on building

1.1 WINDLOAD

When the wind hits a building, it creates a force that acts on the elevations; this force is known as the wind load. In order to prevent structural collapse, the building's structural design must safely and effectively absorb wind forces and transfer them to the foundation.

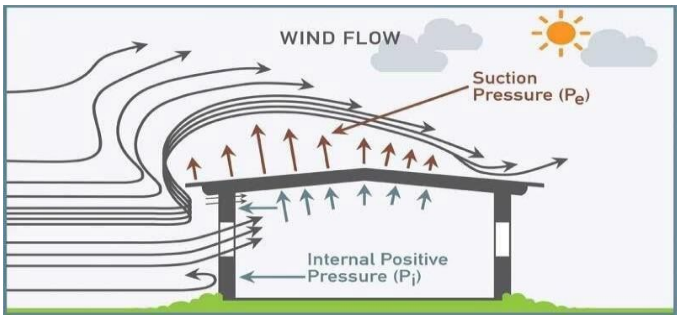
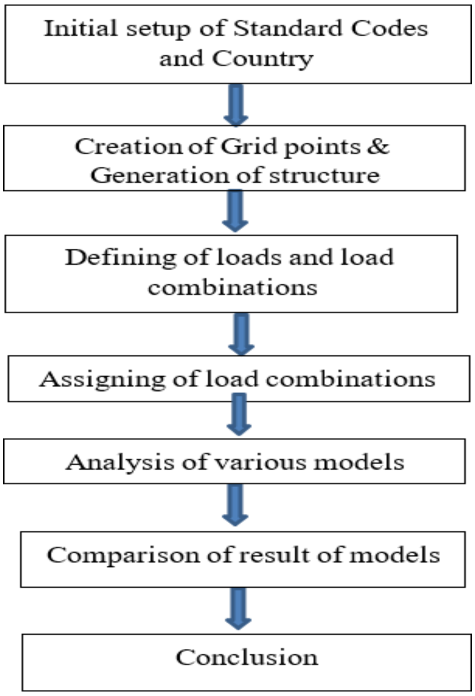


Fig2: Lateral Load on building

1.2 Factors to be considered for stability of lateral loads on building

- Stiffness and strength.
- Regularity
- Redundancy
- Foundation

2. METHODOLOGY



2.1 BRACINGS

A secondary but crucial component of a bridge's structure is its bracing system. The bracing system helps to distribute load effects, stabilize main girders during construction, and restrain compression flanges or chords in places where they may otherwise buckle laterally. Bracing for stability and lateral load resistance may be made of diagonal steel members or a concrete core. Beams and columns in braced construction are only intended to withstand vertical loads, presuming the bracing system would support all lateral forces.

Devices or any materials used to observe vibrations are known as bracings. The fundamental purpose of the bracings is to disperse these vibrations and lessen the reactivity of the structure.

2.1.1Types of bracings

i. Diagonal bracing

ii. V type bracings.

iii. Inverted V type bracings

iv. X type bracings

i. Diagonal bracing.

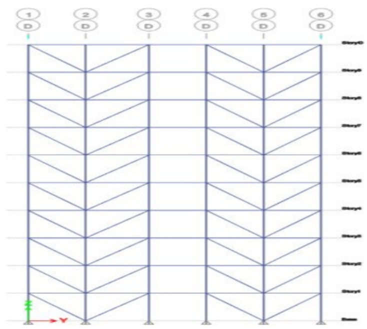
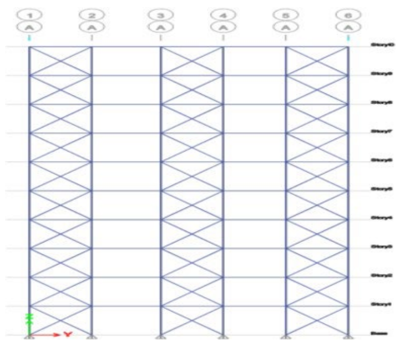


Fig 3 View of Plan, Elevation and 3d-model

ii. X Type bracing



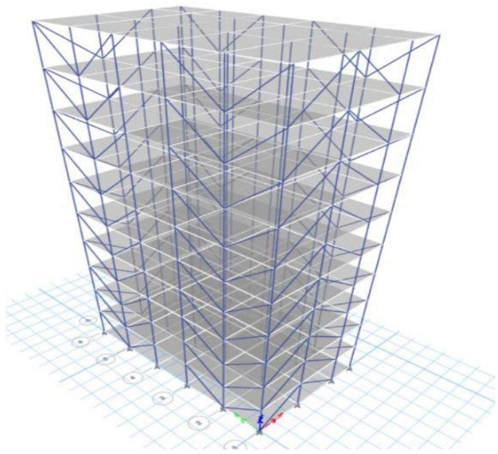


Fig 4 View of Plan, Elevation and 3d-model

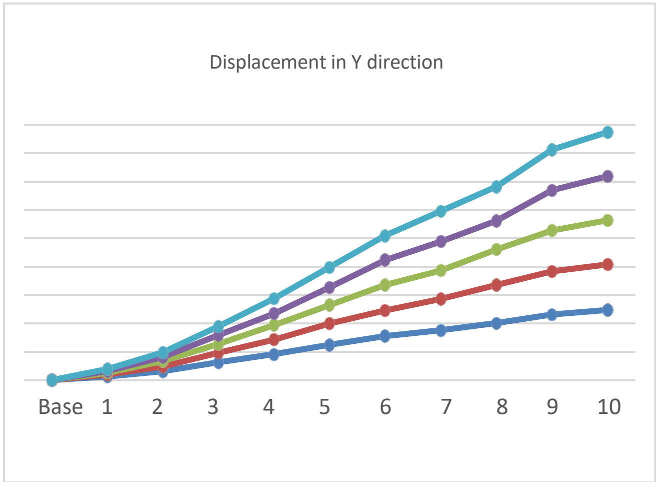
3. RESULT AND DISCUSSION

1.6.1 Maximum story displacement with along X-direction

Story	Bare building	Diagonal bracing	V bracing	Inverted Vbracing	X bracing
Base	0	0	0	0	0
Story1	2.764	1.054	1.41	1.015	0.935
Story2	6.786	2.493	3.87	2..844	2.441
Story3	10.345	4.321	6.117	4.939	3.978
Story4	16.284	7.874	8.543	6.185	6.694
Story5	22.705	11.587	12.053	13.433	9.447
Story6	28.990	13.214	15.554	15.535	12.149
Story7	33.012	16.214	17.963	18.354	14.749
Story8	37.987	19.452	21.208	19.775	18.241
Story9	41.828	22.012	23.216	22.705	20.469
Story10	44.587	24.241	24.971	25.176	22.562

1.6.2 Maximum story displacement with along Y-direction

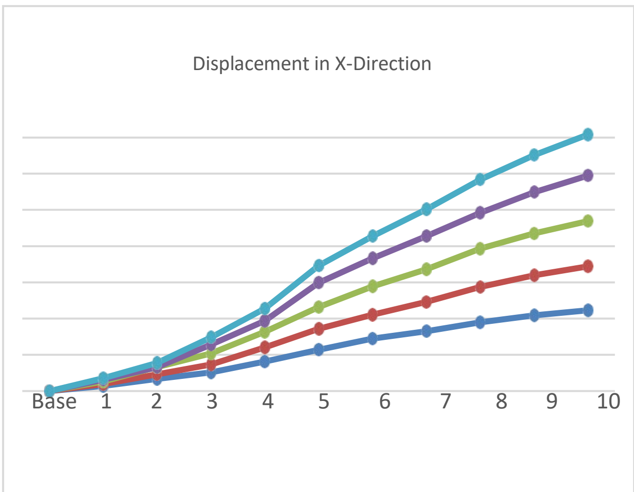
Story	Bare building	Diagonal bracing	V bracing	Inverted Vbracing	X bracing
Base	0	0	0	0	0
Story1	2.451	1.487	1.321	1.210	1.324
Story2	6.214	3.417	3.74	3.012	3.241
Story3	12.412	6.897	6.214	6.214	6.214
Story4	18.214	10.458	10.147	8.148	10.489
Story5	24.781	15.321	12.874	12.589	14.021
Story6	31.051	18.214	17.897	17.523	17.214
Story7	35.124	22.108	20.141	20.362	21.410
Story8	40.214	27.021	24.987	20.214	24.012
Story9	46.214	30.541	28.987	28.174	28.676
Story10	49.471	32.142	31.214	31.021	31.011



Graph 1: Graphical representation of displacement at Y Direction

1.6.3 Lateral displacement due to Wind Load along X-direction

Story	Barebuilding	Diagonal bracing	V bracing	Inverted V bracing	X bracing
Base	0	0	0	0	0
Story1	0.632	0.123	0.128	0.12	0.446
Story2	1.726	0.349	0.279	0.184	0.128
Story3	3.012	1.734	0.686	0.609	0.246
Story4	3.995	2.271	2.069	1.051	0.413
Story5	5.165	4.554	3.391	1.314	0.570
Story6	6.985	5.067	4.987	1.865	0.67
Story7	8.147	7.093	6.135	2.047	0.86
Story8	9.354	8.143	7.997	2.657	1.061
Story9	10.978	9.997	8.247	3.148	1.263
Story10	12.146	10.141	9.997	3.881	1.46



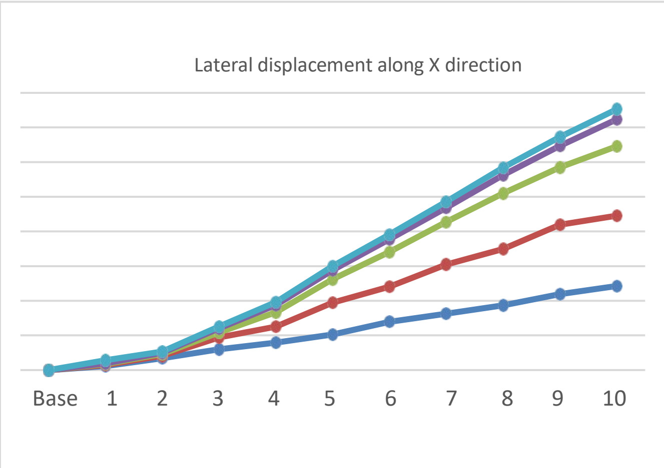
Graph 2: Graphical representation of displacement at X Direction

1.6.4 Lateral displacement due to Wind Load along Y-direction

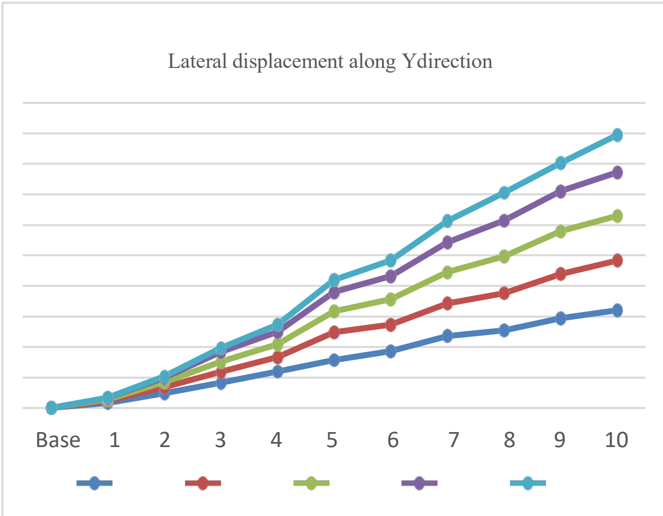
Story	Barebuilding	Diagonal bracing	V bracing	Inverted V bracing	Xbracing
Base	0	0	0	0	0
Story1	0.826	0.35	0.223	0.215	0.075
Story2	2.4	1.01	0.802	0.727	0.24
Story3	4.1619	1.765	1.645	1.596	0.661
Story4	5.993	2.325	2.124	2.024	1.209
Story5	7.874	4.521	3.430	3.134	2.032
Story6	9.324	4.355	4.102	3.805	2.577
Story7	11.769	5.358	5.124	4.874	3.514
Story8	12.72	6.124	5.978	5.88	4.586
Story9	14.72	7.235	6.982	6.564	4.671
Story10	16.02	8.134	7.328	7.113	6.157

1.6.5 Base shear for wind load in X direction

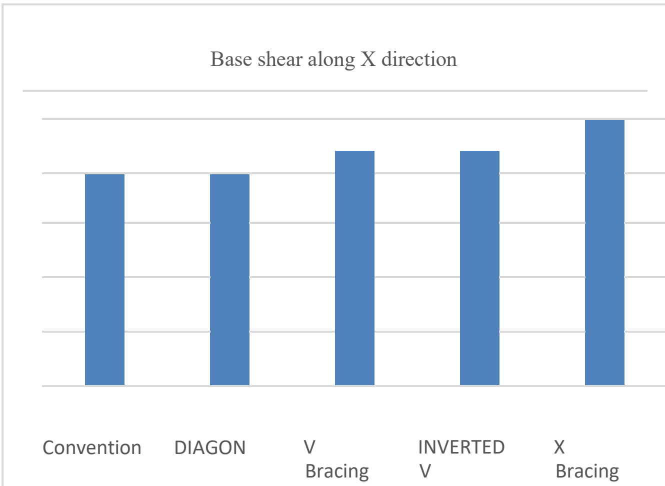
Bracings	FY
Conventional building	76057.92
DIAGONAL	78639.85
VBracing	88713.14
INVERTEDV	87024.25
XBracing	98252.28



Graph 3: Graphical representation of Lateral displacement at X Direction

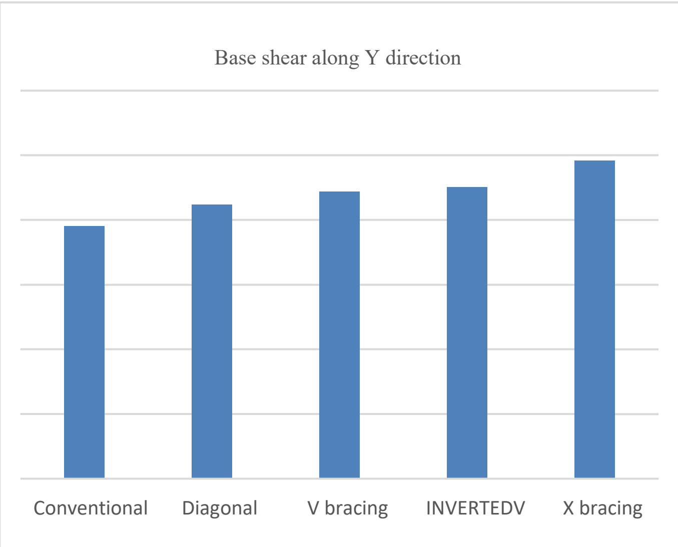


Graph 4: Graphical representation of Lateral displacement at Y Direction



1.6.6 Base shear for wind load in Y direction

Bracings	FY
Conventional building	78057.92
DIAGONAL	84639.85
V Bracing	88713.16
INVERTEDV	90024.25
X Bracing	98252.28



Graph 5: Graphical representation of Base Shear at Y Direction

CONCLUSION

- In Final comparison we can Clearly say the displacement stability increases as the zone values increases. This linear increase in the Displacement with respect to the zone value implies that the Structure with inner core can with stand in all zones considered.
- In the graph also displacement values also we can clearly see that the graph linearly Increases as per the zone values. Hence we can see the stability of the structure without any variation the values constantly varies.
- For maximum story displacement along X direction wegotforbarebuilding44.587,diagonalbracing24.241, V bracing 24.971, Inverted V barcing25.176, X bracing 22.562
- For maximum story displacement along Y direction we got for bare building 49.471,diagonal bracing 32.142,Vbracing31.214,InvertedVbarcing31.021,Xbracing31.011
- For maximum story drift along X direction we got for bare building 0.00115, diagonal bracing 0.000819, V bracing 0.00833, Inverted V barcing 0.000838, X bracing 0.000874
- We can Clearly say the for story shear also the stability increases as the zone values increases. This linear in crease in the story shear with respect to the zone value implies that the Structure with inner core can withstand in all zones when the shear values are considered.
- In the graph for the shear values also we can clearly see that the graph linearly Increases as per the zone values. Hence we can see the stability of the structure with out any variation the values constantly varies.

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