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Study on Shearwalls With and Without Openings

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ABSTRACT

Finite Element Modeling now a day is an essential approach in analysis and simulating civil engineering problem numerically. In this thesis Parametric study on shearwalls to apply the finite element modeling in analyzing and exploring the behavior of shear wall with & without opening under seismic load actions and wind load actions. This study is carried out on G+20 story frame-shear wall buildings, using linear elastic analysis with the help of finite element software, ETABS under earthquake loads in equivalent static analysis. The results reveal that stiffness as well as seismic responses of structures is affected by the size of the openings as well as their locations in shear wall. It is also explored that top lateral drift of the system can also be reduced thickening the element in the model around the opening of shear wall

Keywords: Shearwalls, ETABS

I. INTRODUCTION

The achievement of structural system for tall buildings is not an easy task. Where, as building height increases the importance of lateral loads action rises in an accelerating rate. There are two types of lateral loads, wind and seismic loads. Wind load presents the most critical lateral loading for modern tall buildings, which have lightweight skeletons that cause uncomfortable horizontal movements for occupants. Also, wind is not constant either with height or with time and is not uniform over the sides of a building. So, windy weather creates a variety of problems in tall buildings,. Where, excessive vibration due to this load is a major obstacle in design and construction of a modern tall building. it should be limited to prevent both structural and nonstructural damage.

The case-study is a regular-shaped un-symmetrical plan with dimensions 50x19 m. In structural modeling building arranged in 8 bays in X direction and 3bays in Y direction as shownin Fig. 1.The storey height is assumed to be 3 m. The analysis used is a three-dimensional analysis of detailed finite element models. The columns and beams were represented by frame type element,while shear walls and core components were represented byshell-type element.

Building analyzed is a 21 storey(20 storey + Ground story), 64.50 meters tall concrete tower located in india with a gross area of 950 . Unique features of the slender concrete tower presented parmetric study on with and without opening shearwall for seismic design and wind design. Typically, a 64.5 meters tall concrete building in seismic zone 4 would have a lateral system that combines shear walls and moment frames.

II. METHODS AND MATERIAL

A. Shear Walls

Reinforced concrete framed buildings are adequate for resisting both the vertical and the horizontal loads acting on them. However, when the buildings are tall, say, more than twelve storey's or so, beam and column sizes work out large and reinforcement at the beam-column junctions works out quite heavy.

So that, there is a lot of congestion at these joints and it is difficult to place and vibrate concrete at these places, which fact, does not contribute to the safety of buildings. These practical difficulties call for introduction of shear walls in tall buildings.

Shear walls in plan, may be deep straight walls or angular, u- shaped or box-shaped in plan, around stairs or lifts or toilets, where there will be no architectural difficulty in extending them thought the height of the building, care shall be taken to have symmetrical configuration of walls in plan so that torsional effect in plan could be avoided.

Further, shear walls should get enough vertical load from floors, for which reason, nearby columns should be omitted and load taken to the shear walls by means of long span beams if required

B. Data to be Used

shear walls

Without opening :

W300 mm thick at the 11^{th} story and above,

W 400mm thick at the 10^{th} story and below,

With opening : 5% ,10%, 15%, 20%

W300 mm thick at the 11^{th} story and above,

W 400mm thick at the 10^{th} story and below

Columns : C 700x700 mm of M40 grade concrete at 11^{th}

Story and above,

C 900x900 mm of M40 grade concrete at 10^{th}

Story and below

Beams : B400x700 mm of M40 grade concrete at 11^{th}

Story and above

B450x800 mm of M40grade concrete at 10^{th}

Story and below

Slab : S 200 mm of M40 grade concrete for all story

S150 mm of M30 grade concrete on roof

Staircase **:** S150 mm of M 30 grade concrete for all story

Wall : Brickwall 230 mm upto 20^{th} story

: Brickwall 115mm thick at roof

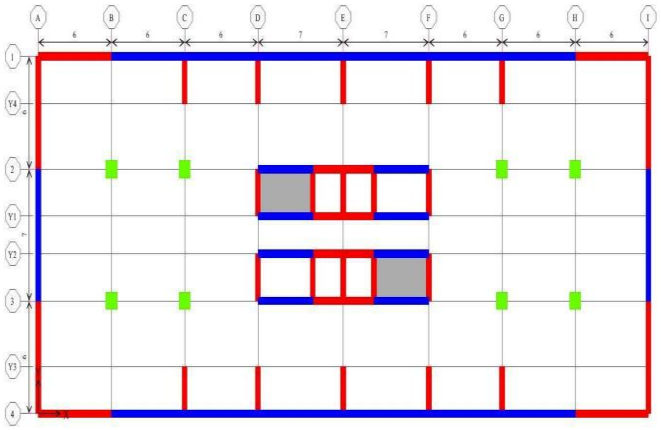


Figure 1 : Plan

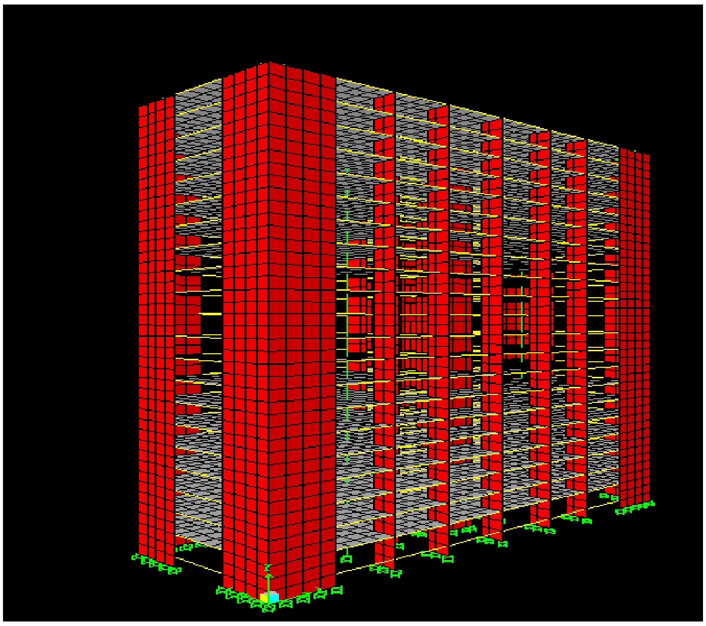


Figure 2 : Three-Dimensional View of Considered Building

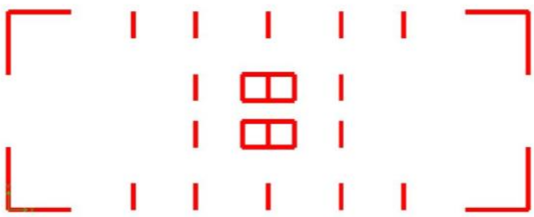


Figure 3 : Plans for Location of Shear Walls In The Building

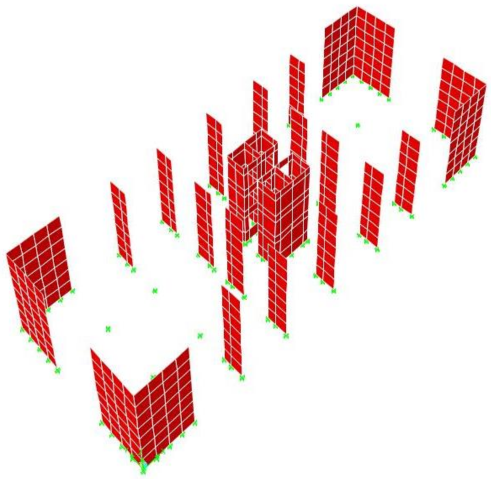


Figure 4 : Without opening of shear walls in building

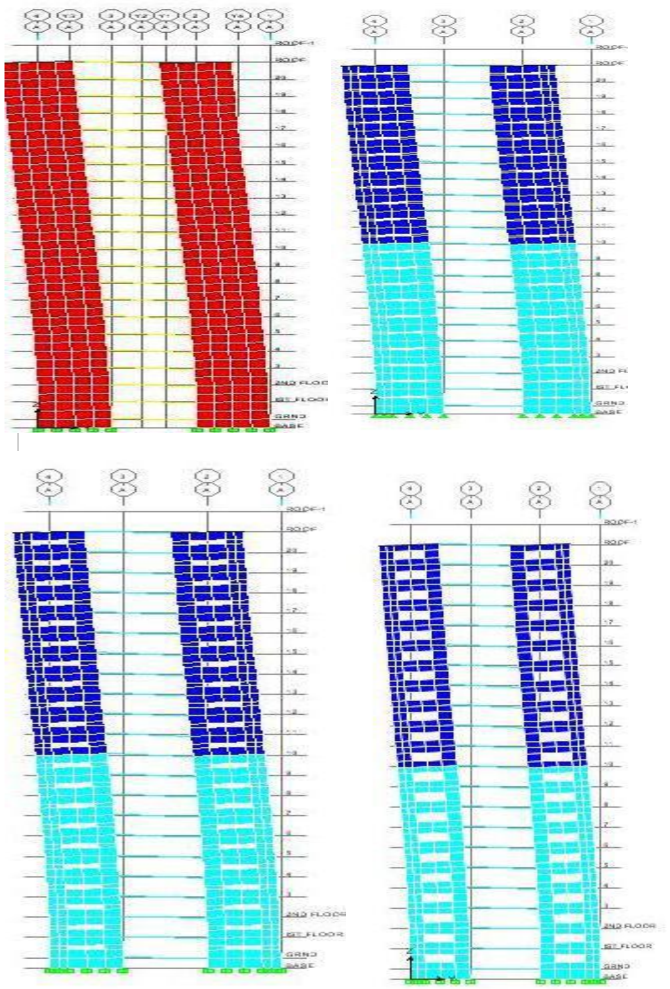
Figure 5 : With opening of shear walls in the building

C. Description

1) Structure building. : Unsymmetrical Irregular
2) Plan dimensions : 50mx19m.
3) Column size : 900mmx900mm (plinth to 10^{th} floor).
   Column size : 700mmx700mm (11^{th} floor to Roof)
4) Beam size : 450mmx800mm.(Gl to 10^{th} floor)
   : 400mmx700mm (11^{th} to Roof)
5) Slab thickness : 200mm.
6) Shearwalls : W300 mm thick at the 11^{th} story and above,
   : W 400mm thick at the 10^{th} story and below
7) Brick walls : W230 mm upto 20^{th} story
   : W115mm thick at roof
8) Typical floor Height : 3m
9) Plinth level Height : 1.5m
10) Floor : G+20 Upper Floor
11) Support : Fixed
12) Type of Soil : Medium Type II (1S:1893)
13) Zone : IV

III. RESULTS AND DISCUSSION

A. Modes Shapes For With & Without Shear Walls



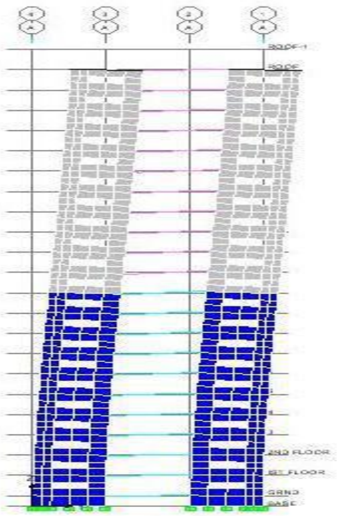


Figure 6 : Mode 1 period in seconds for with & without opening of shear wall

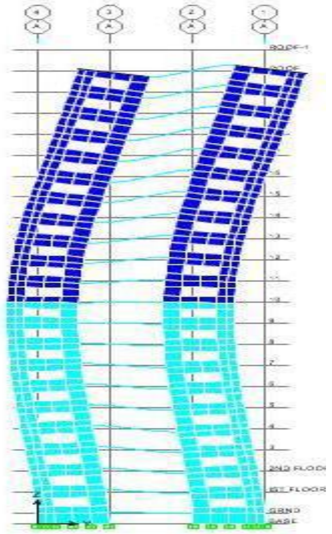
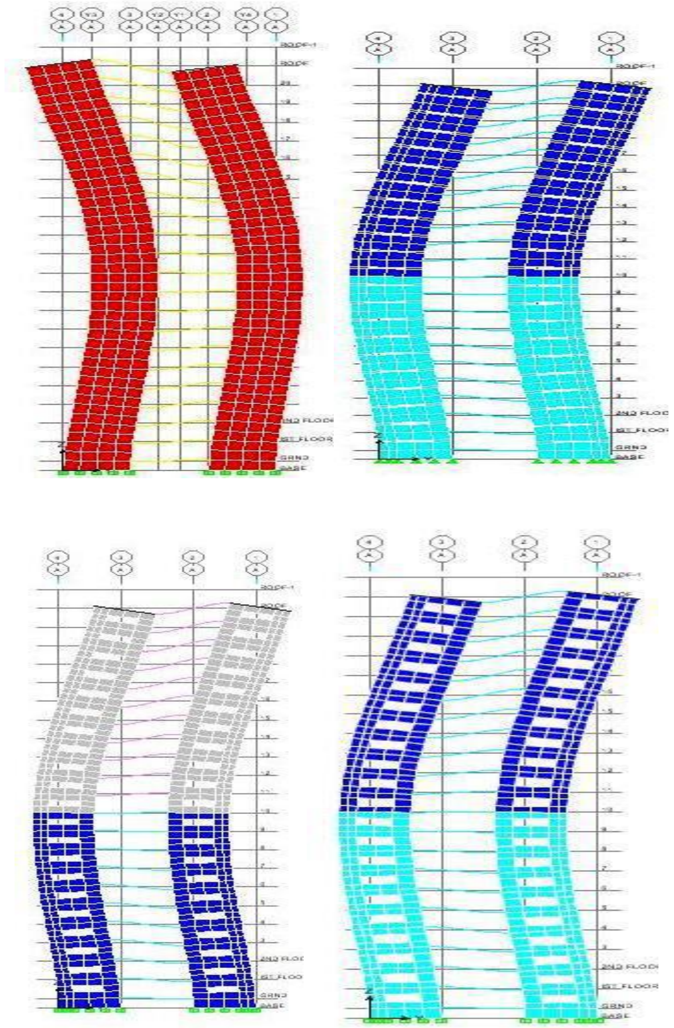
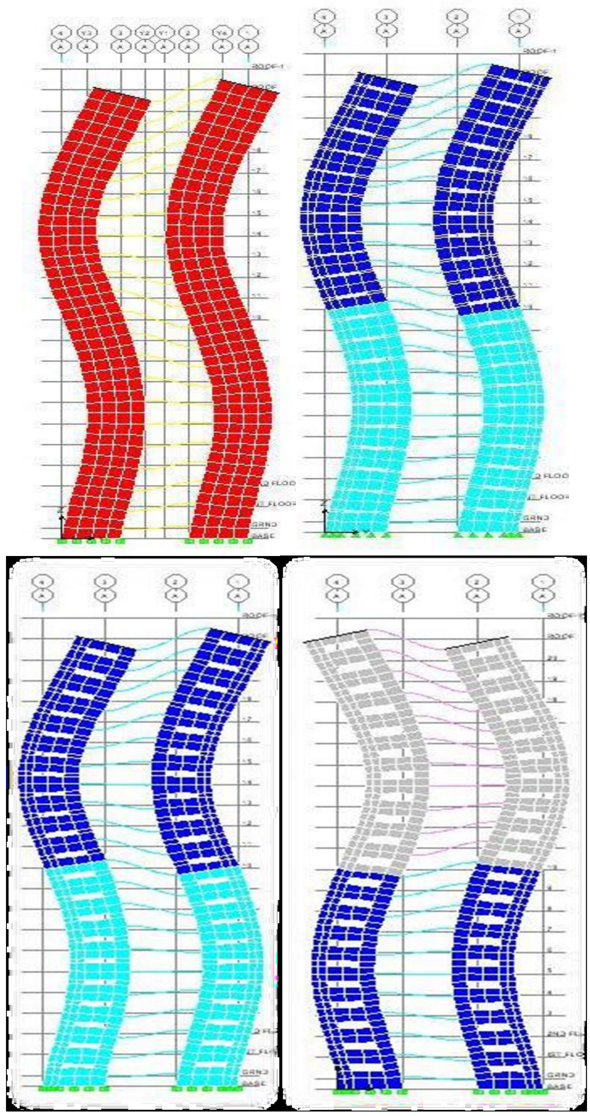


Figure7 : 6^{TH} Mode Shape for with & Without Opening of Shearwall of Period in Sec





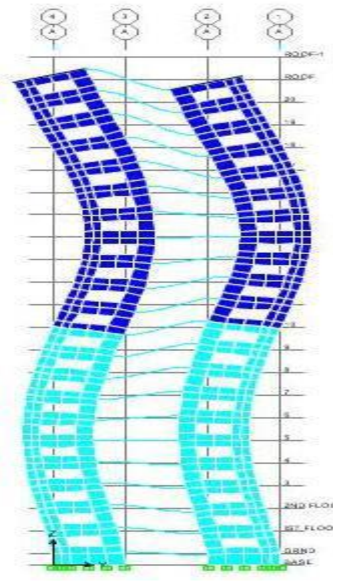
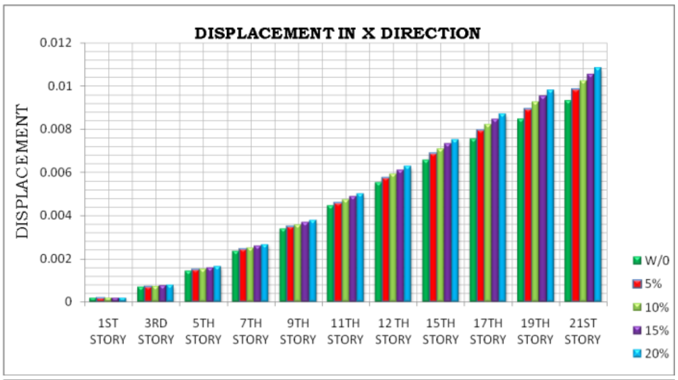
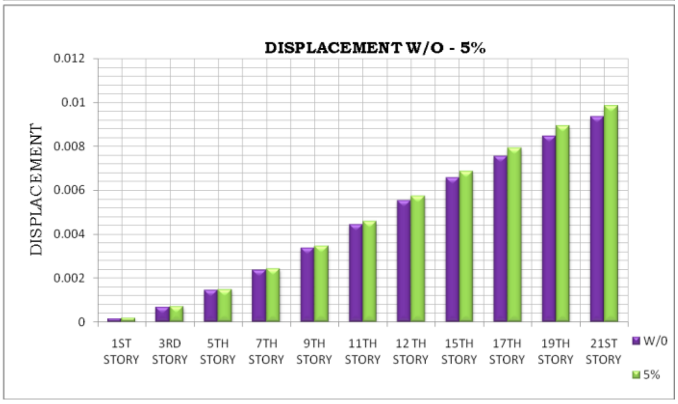
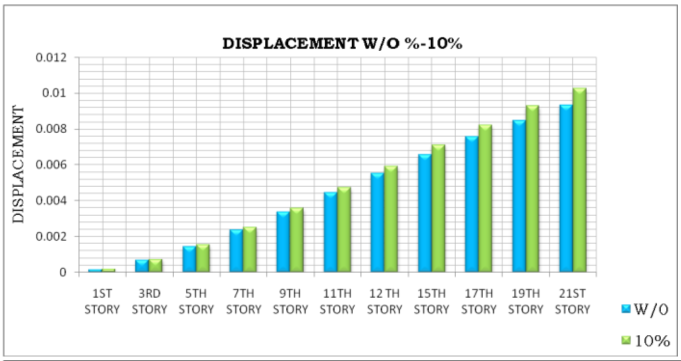


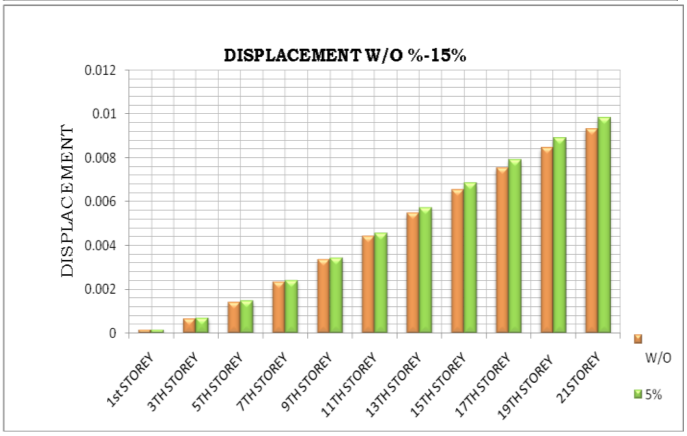
Figure 8 : 9^{TH} Mode period in seconds for with & without opening of shear wall

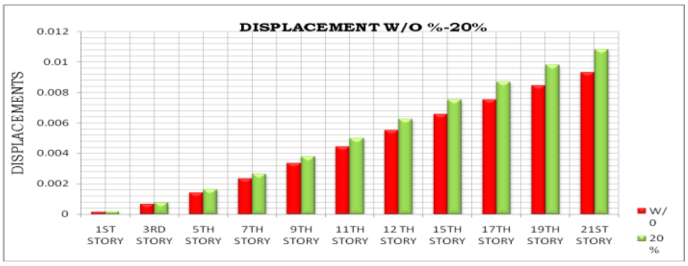
B. Displacement graph for different size openings

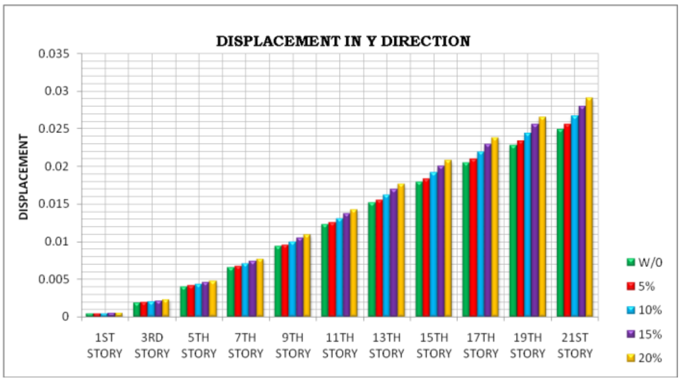


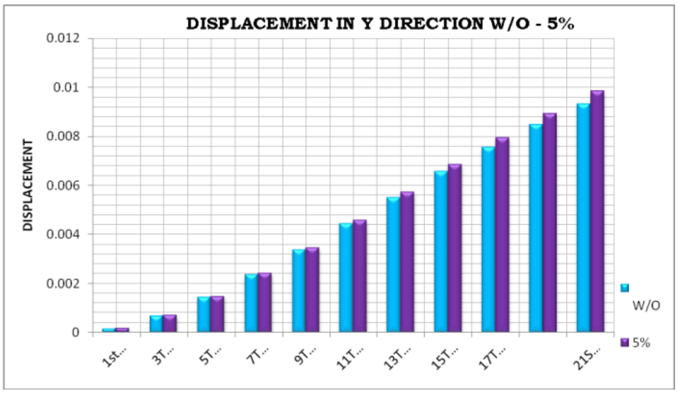


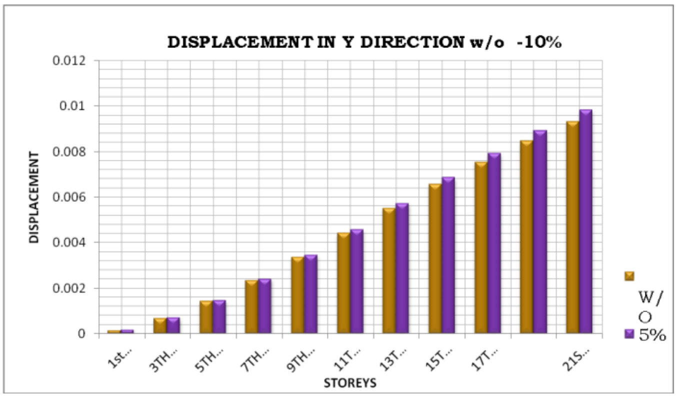


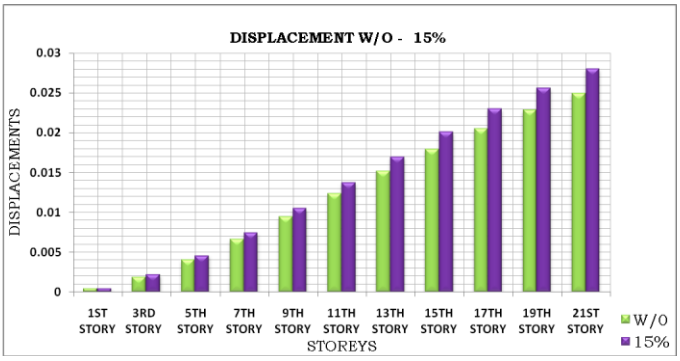












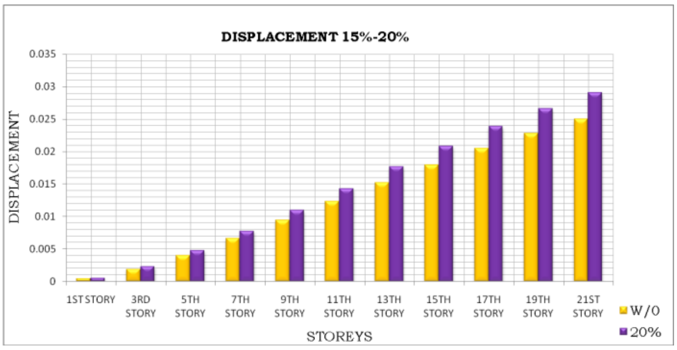
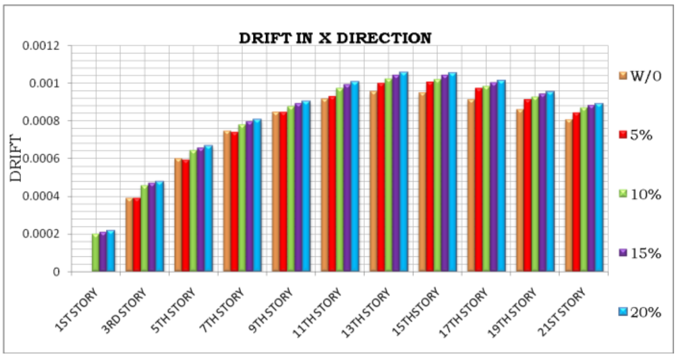
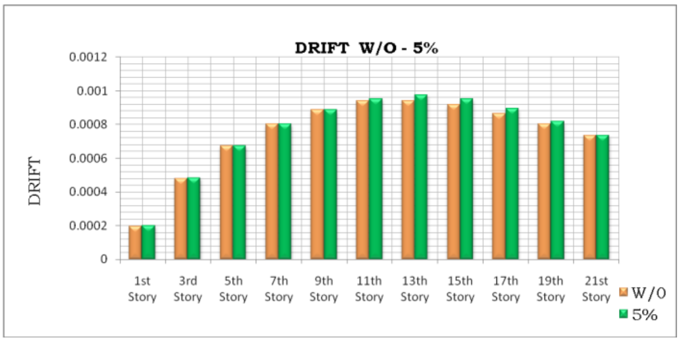
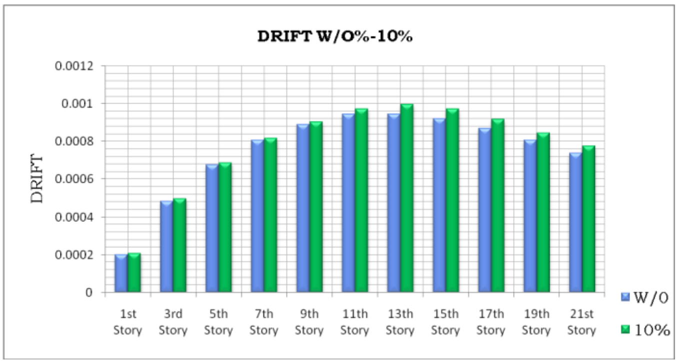
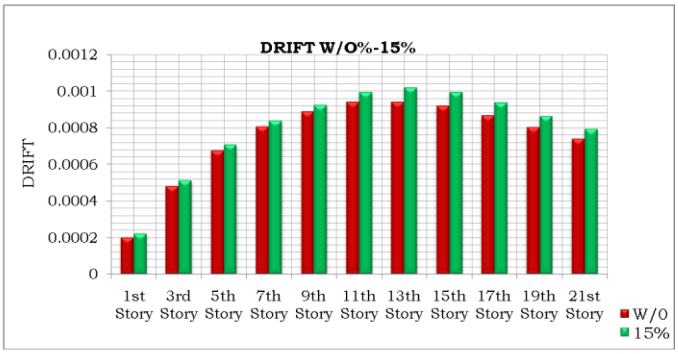


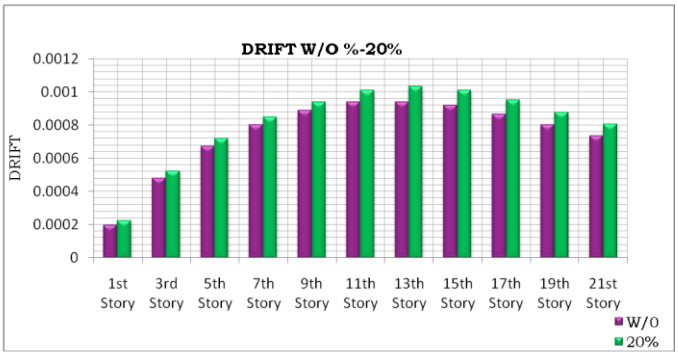
Figure 9 : Storey drift graph for different size openings :











Comparision of Hand Calculation Values Of Base Shear With Etabs

Load	Manually	Etabs	Variation In Percentage %
EQx	18187.40	17531.33	3.6
EQy	11244.35	10812.52	3.8
Wx	6127.5	5732.28	6.4
Wy	2328.45	2181.41	6.3

IV. CONCLUSIONS

1. From the study of parametric study on shear walls without & with 5%,10%,15% and 20%,Openings it is observed that the Displacements are increasing with the increase in the percentage of opening.
2. From the study of parametric study on shear walls without & with 5%,10%,15% and 20%,Openings it is observed that the Drift are increasing with the increase in the percentage of opening.
3. it is observed that the stiffness of the shear wall are decreasing with the increase in the percentage of opening.
4. it is observed that the torsion are neglible due to the location of 'L' shape shearwalls at the corners

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