Seismic Analysis of RCC Shear Wall Building By Providing Shear Wall At Different Location For Different Shape of Building

Kalp G. Gediya[1], Jay Y. Shah[2], Avani D. Desai[3], Jil B. Patel[4], Prof. Vivek Patel[5]
[1, 2, 3, 4] Dept of Civil Engineering
[5] H.O.D., Dept of Civil Engineering
[1, 2, 3, 4, 5] Alpha College of Engineering and Technology, Khatraj, Kalol, Gandhinagar

Abstract- *A shear wall is a wall that is used to resist the shear Produced due to lateral forces, shear wall are added to the Building at interior or side faces to provide more strength & Stiffness to the building.*

In the following project we are going to analyse the building By providing shear wall as an earthquake resistant measure At different location in building & to find the best possible resistance Offered by the shear wall for the earthquake resistance in Building.

It is necessary to find out the effective location to Find the maximum resistance offered by wall. So for this Purpose analysis of building with different Location of shear wall are studied by using ETABS Software version 17.0.1.

Keywords- Regular& Irregular buildings, Storey displacement, Equivalent Lateral force method, Storey drifts.

I. INTRODUCTION

The rapid growth of urban population & limitation Of available land, scarcity & high cost of available land, the taller structures are prefer now a days. As the height of structure increases then the consideration of lateral load is very much important. For the lateral load resisting system becomes more important than the structural system that resist the gravitational loads.

Under strong motion earthquakes, structures receive various type of damage. The most fatal damage is the loss of lateral strengths of a structure.

In building construction, a rigid vertical diaphragm capable of transferring lateral forces from exterior walls, floor, and roofs to the ground foundation in a direction parallel to their planes. Examples are the reinforced-concrete wall. Lateral forces caused by wind, earthquake, and uneven settlement loads, in addition to the weight of structure & occupants, create powerful twisting forces. This leads to the failure of the structure by shear.

Shear wall are especially important in high rise building subject to lateral wind and seismic forces. Generally, shear walls are either plane or flanged in section, while core walls consists of channel sections. They also provide adequate strength and stiffness to control lateral displacement.

1.1 EARTHQUAKE RESISTANT DESIGN OF A BUILDING

The lateral load resisting systems that are widely used are rigid frame, shear wall, diagrid structural system, wall frame, braced tube system, outrigger system and tubular system. Recently shear wall systems and diagrid structural system are the most commonly. Shear wall is a structural member used to resist lateral forces i.e. parallel to the plane of the wall. For slender walls where the bending deformation is more, Shear wall resists the loads due to Cantilever Action. In other words, Shear walls are vertical elements of the horizontal force resisting system.

1.2 ADVANTAGES OF PROVIDING SHEAR WALL

- These walls provide large strength and stiffness in the direction of orientation.
- They will be Considerably reduces the lateral sway.
- They are easy in construction and implementation.
- It is efficient in terms of construction cost and effectiveness in minimizing earthquake damage.
- Also, provides the strength and rigidity in the direction of alignment.
- These walls minimize the damages to structural and non-structural elements.
- They have enough well-distributed reinforcements.
- They also, requires less construction time.

II. LITERATURE REVIEWS

1. Seismic Analysis of RCC Building with Shear Wall at Different Locations Ashwinkumar B. Karnale and D.N. Shinde 1M. E. Student, Civil Engineering Department, PVPIT, Budhgaon, Sangli Civil Engineering Department, PVPIT, Budhgaon, Sangli The study presents the results for different configurations of shear walls for 6 storey A box system structure that consists of reinforced concrete building. The results compared on the basis of effect observed due to height of structure having shear wall. In this paper. The analysis is done for lateral loading. Loads used are equivalent static load as earthquake load. Results obtained from analysis plotted to compare and to have knowledge of behavior of RCC framed structures with shear walls.

2. Study of Strength of RC Shear Wall at Different Location on MultiStoried Residential Building Syed Ehtesham Ali*, Mohd Minhaj Uddin Aquil *(Department of Civil Engineering, Assistant Professor Deccan college of Engineering and Technology, Hyderabad -01)**.In this paper, therefore, main focus is to determine the solution for shear wall location in multi-storey building. A RCC building of six storey placed in HYDERABAD subjected to earthquake loading in zone-II is considered. An earthquake load is calculated by seismic coefficient method using IS 1893 (PART– I):2002. These analyses were performed using ETABS.

3. Analysis of RCC Building with Shear Walls at Various Locations and In Different Seismic Zones Sylviya B, P. Eswaramoorthi. In the present study, analysis of RCC building has been carried out by changing the locations of shear walls in the building. Also, the effect of variations in seismic zones as per IS codes has been presented. The seismic analysis performed is linear dynamic response spectrum analysis using the well known analysis and design software ETABS16.2.0. Seismic performance of the building has been investigated based on parameters such as storey drift, base shear and storey displacements.

III. OBJECTIVE AND SCOPE OF WORK

1. So, this study mainly focuses on the location of shear wall which can be placed in the building so as to increase the effectiveness of the shear wall.
2. The main objective was to find the location of shear wall in different shapes of building where the center
3. of mass & stiffness is minimum so that there will be minimum damage occurred in the building.
4. The main scope of this work is to verify & compare the seismic response of RC building for different locations of shear wall so that one can choose the best possible location for the constructions against various seismic zones.
5. In regular & irregular structure Different locations of shear wall are being modeled in E-TABS software and the results will give in terms of, storey displacement, storey drift is to be compared.

IV. METHODOLOGY

Once the structural model has been selected it is possible to perform analysis to determine the seismically induced forces in the structures. There are different method of analysis which provide different degrees of accuracy. The analysis process can be classified on the basis of three factors: the external action, the behaviour of the structure or structural materials and the type of structural model selected. The analysis processes can be classified as under.

4.1. CLASSIFICATION OF METHODS FOR PERFORMING SEISMIC ANALYSIS

1. Equivalent lateral force method.
2. Mode super position method.
3. Elastic time limit method.
4. Non- linear static analysis method.

4.2 EQUIVALENT LATERAL FORCE METHOD

The equivalent lateral force for an earthquake is a unique concept used in earthquake engineering. The concept is attractive because it converts a dynamic analysis into partly dynamic and partly static analyses for finding the maximum displacement (or stresses) induced in the structure due to earthquake excitation.

For seismic resistant design of structures, only these maximum stresses are of interest, not the time history of stresses.

The equivalent lateral force for an earthquake is defined as a set of lateral static forces which will produce the same peak response of the structure as that obtained by the dynamic analysis of the structure under the same earthquake.

4.3 PLAN DIMENSIONS & SPECIFICATIONS

- Floor area : 1300 m^2
- Storey height : 3m
- Total storey : G+15
- Beam size : 400 X 500 mm

- Column size: 400 X 400 mm
- Slab thickness :125 mm
- Grade of concrete :M30
- Density of concrete : 25 Kn/m^3
- Live load on floor : 2 Kn/m^2
- Live load on roof : 2 Kn/m^2
- Floor Finish :1 Kn/m^2
- Zone factor (Z) : 0.16 (Zone II)
- Importance factor (I) : 1.5
- Response Reduction factor (R) : 5.0
- Thickness of Shear wall : 250mm

4.4 ETABS MODELS

H- shaped Models

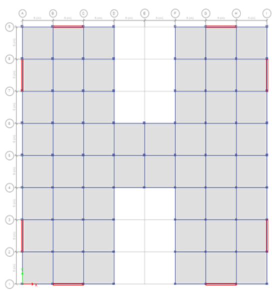
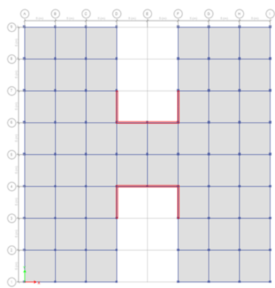



Fig-1 Shear wall at Location 1 Fig-2 Shear wall at location 2

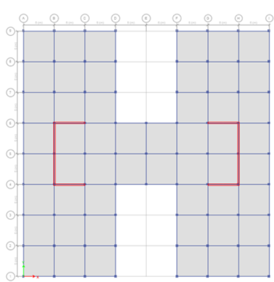
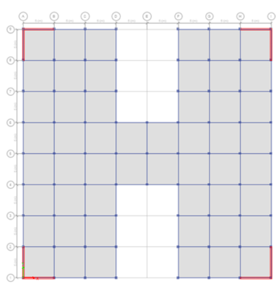



Fig-3 Shear wall at Location 3 Fig-4 Shear wall at location 4

L- Shaped Models

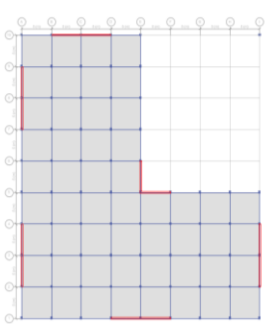
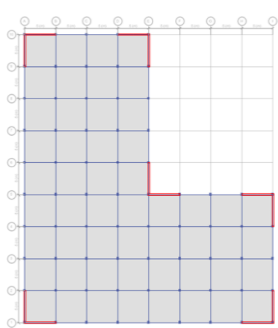



Fig -1 Shear wall at Location 1 Fig- 2 Shear wall at Location 2

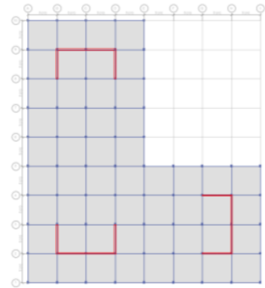
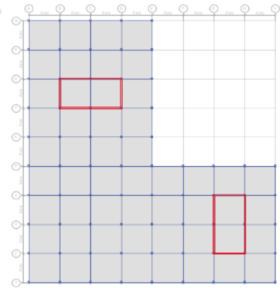



Fig- 3Shear wall at location 3 Fig- 4 Shear wall at location 4

U- Shaped Models

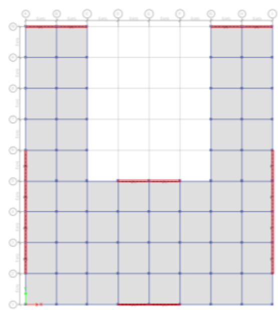
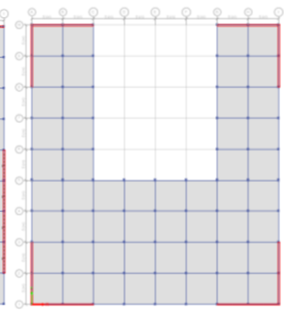



Fig- 1 Shear wall at location 1 Fig- 2 Shear wall at location 2

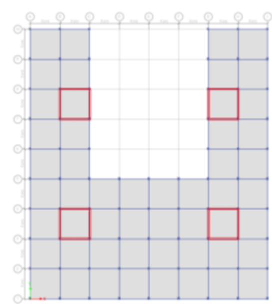
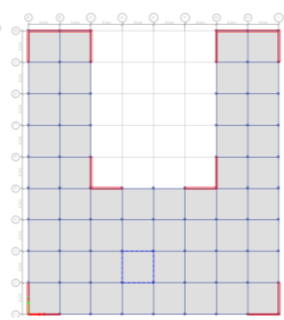



Fig- 3 Shear wall at location 3 Fig- 4 Shear wall at location

T-Shaped Models

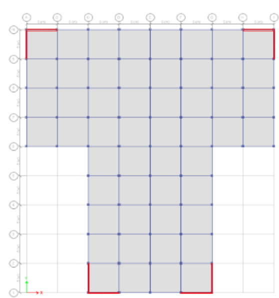
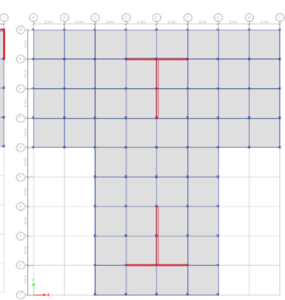
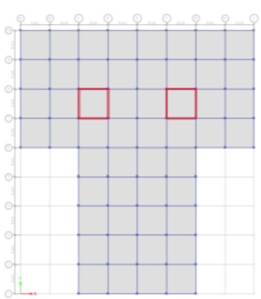



Fig- 1 Shear wall at location 1 Fig- 2 Shear wall at location 2



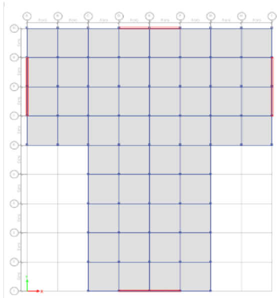
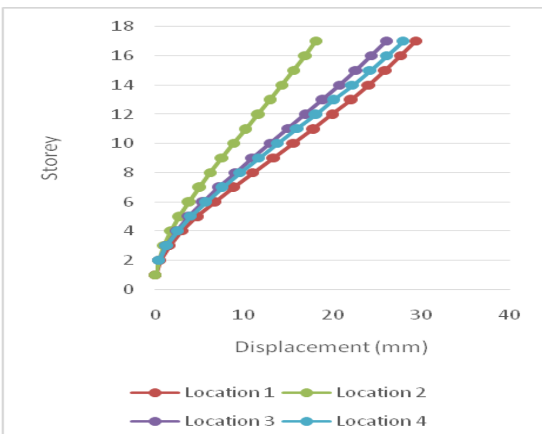


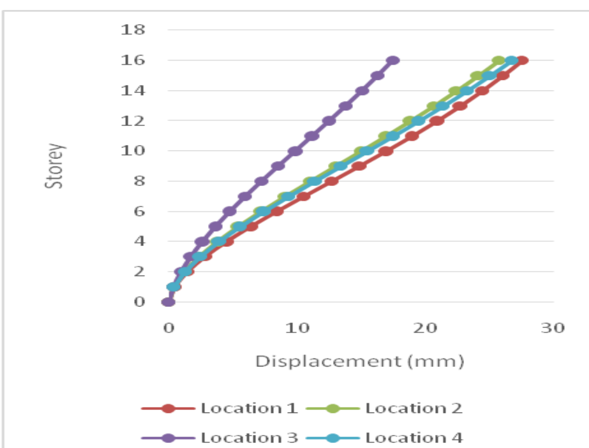
Fig- 3Shear wall at Location 3 Fig- 4Shear wall at Location 4

V. RESULTS

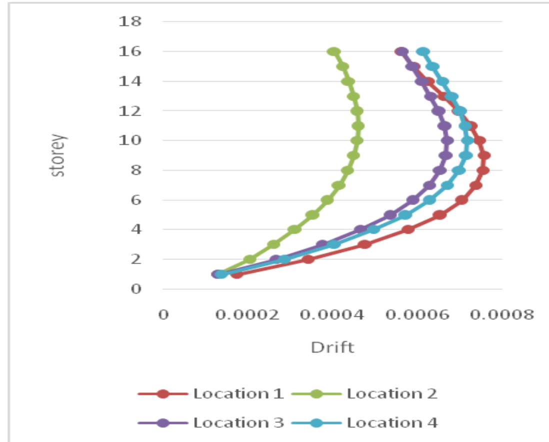
For H section



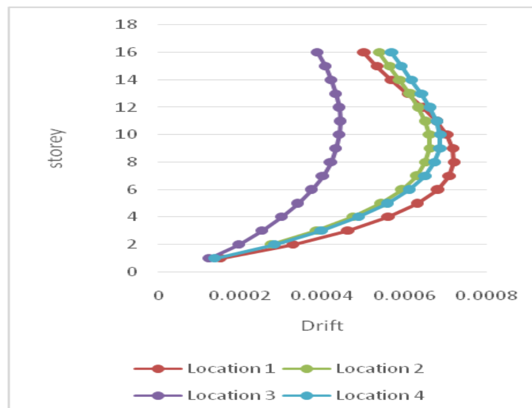
Storey displacement in X direction



Storey displacement in Y direction



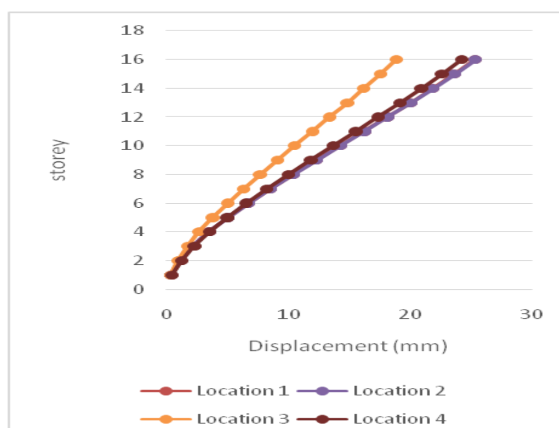
Storey drift in X direction



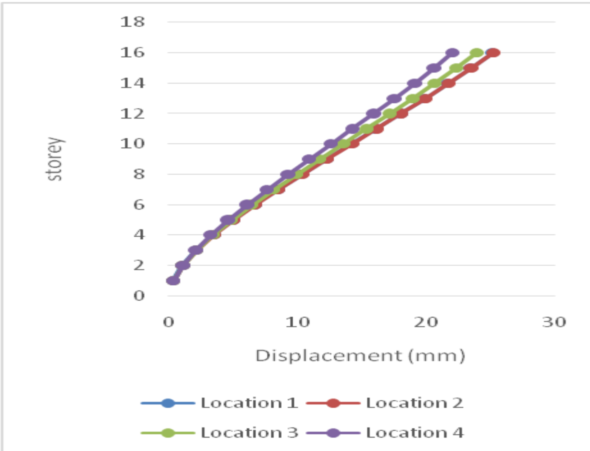
Storey Drift in Y direction

A. For L section

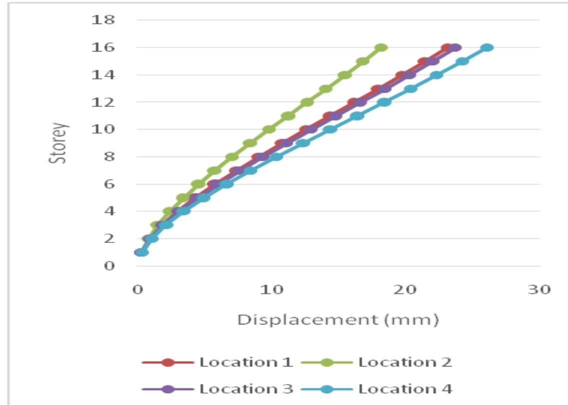
B.



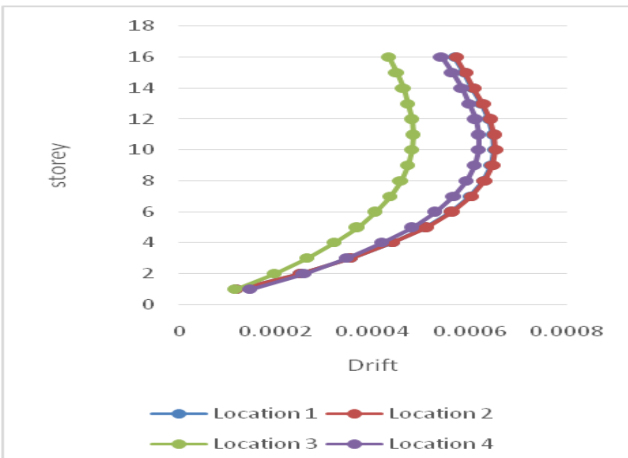
Storey displacement in X direction



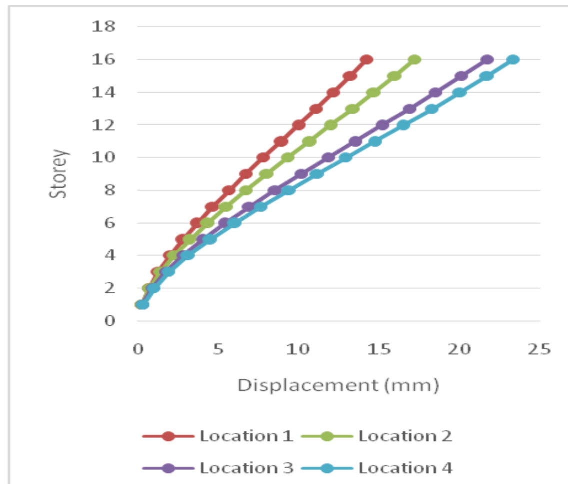
Storey displacement in Y direction



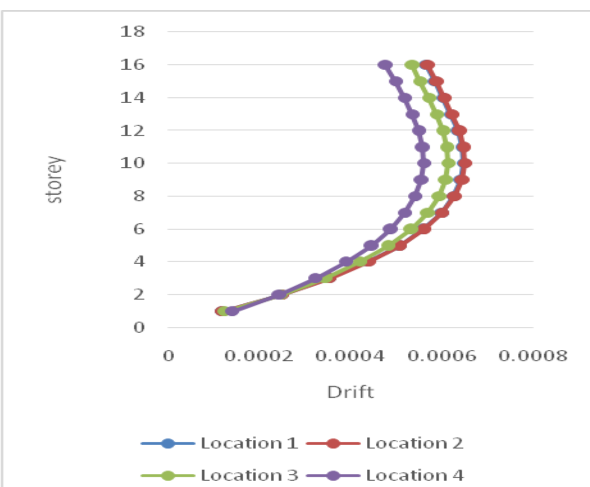
Storey displacement in X direction



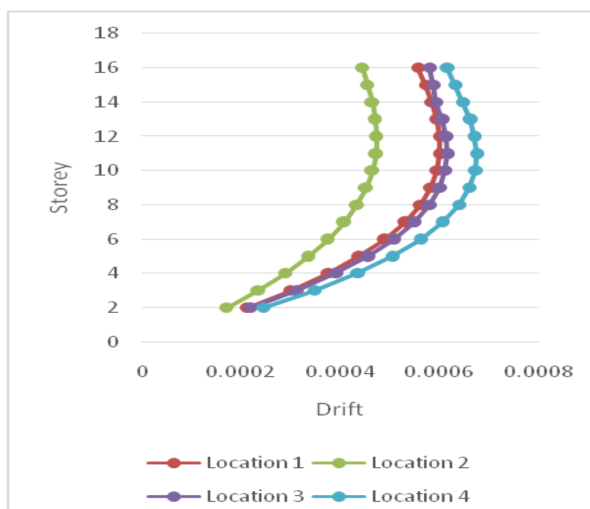
Storey Drift in X direction



Storey displacement in Ydirection

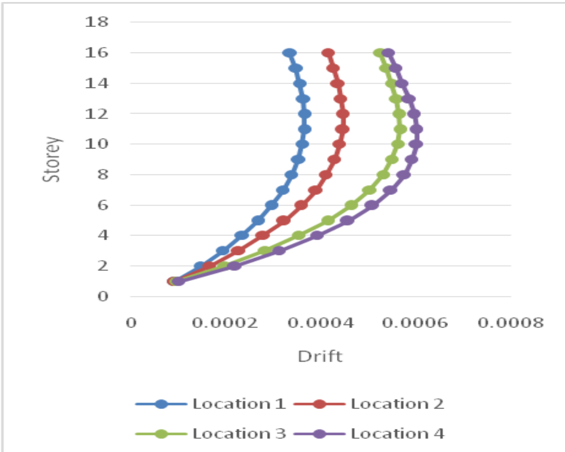


Storey drift in Y direction



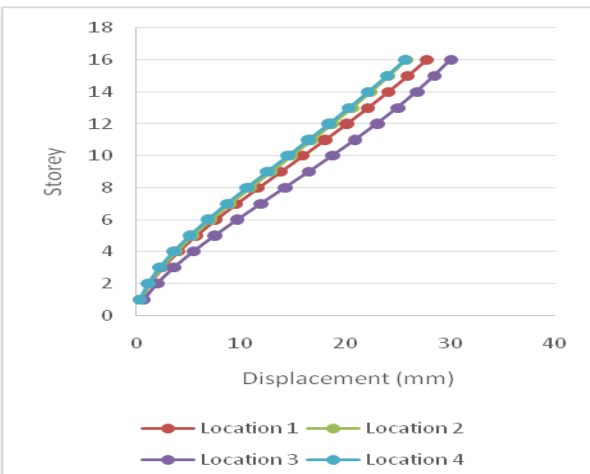
Storey Drift in X direction

For U Section

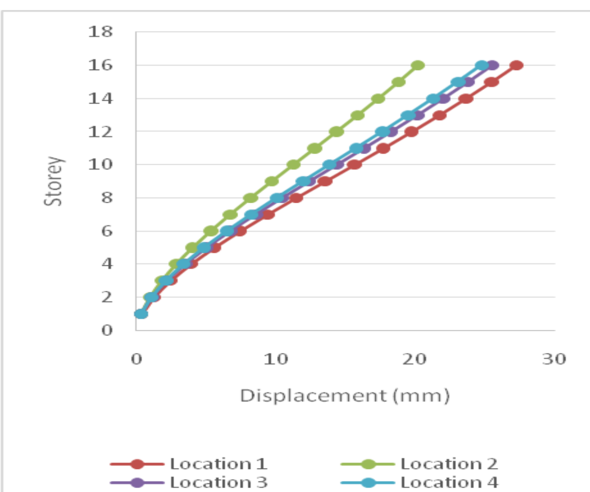


Storey drift in Y direction

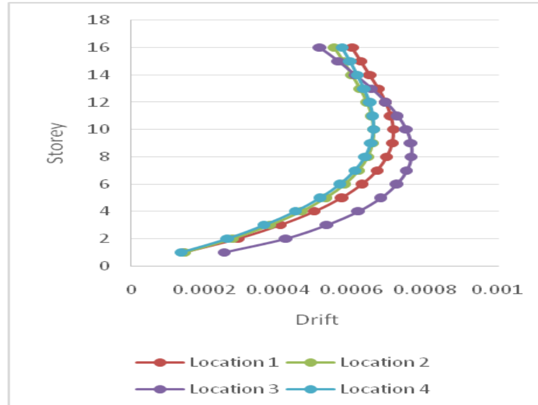
For T section



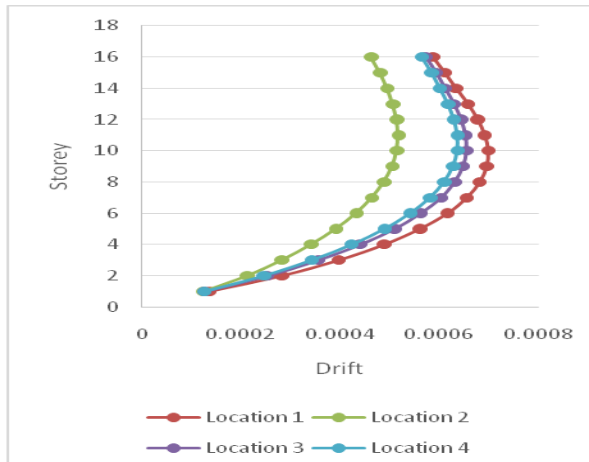
Storey displacement in X direction



Storey displacement in Y direction



Storey drift in X direction



Storey drift in Y direction

VI. CONCLUSIONS

- For reducing the damage to the building in the high seismic zone special load resisting measures are necessary.
- Placing of shear wall in the building increases the lateral stiffness of the structure and has been proved to be effective in reducing the damage to the building.
- It can be observed that by placing the shear walls at different largely affects the displacement for the same plan of the structure as the center of mass and center of rigidity is influenced by the position of shear wall.
- For H shaped building deflection for X direction is minimum when shear is situated at location-2 but for Y direction deflection is minimum when the shear wall is situated at location-3.
- For L shaped buildings deflection in X direction is minimum in for shear wall at location-3 and deflection is minimum when shear wall is placed at location-4.
- For U shaped building deflection for X direction is minimum when shear wall is placed at location-2 and is

minimum when shear wall is placed at location-1 for Y direction.

- For T shaped buildings deflection for X direction is minimum when shear wall is placed at location-4 and for Y direction deflection is minimum when shear wall is placed at location-2.
- It can be observed that deflection along X-direction and Y-direction is different and can be due to the lateral stiffness along that particular direction is more.
- Storey drifts for all the buildings are well within the limits mentioned in the clause 7.11.1.1 of IS codes 1893(Part-3):2000.
- Storey drift for H shaped building is minimum for X direction when shear wall is placed at location-2 and for Y direction when placed at location-3.
- For L shaped building storey drift is minimum when shear wall is placed at Location-3 for X direction and at location-4 for drift in Y direction.
- The top storey drift for U shaped building for X direction is minimum for shear wall at location-2 and minimum for Y direction when shear wall is placed at location-1.
- For T shaped building drift in X direction is minimum when shear wall is placed at location-3 and minimum in Y direction when shear wall is placed at location-2.

REFERENCES

[1] IS 456:2000 Plain and Reinforced concrete- code of Practice.

[2] IS 1893 Part1 2016 Criteria for Earthquake Resistant Design of Structures Part 1 General Provisions and Buildings.

[3] Seismic Analysis of RCC Building with Shear Wall at Different Locations Ashwinkumar B. Karnale and D.N. Shinde 1M. E. Student, Civil Engineering Department, PVPIT, Budhgaon, Sangli Civil Engineering Department, PVPIT, Budhgaon, Sangli.

[4] Study of Strength of RC Shear Wall at Different Location on Multi Storied Residential Building Syed Ehtesham Ali*, Mohd Minhaj Uddin Aquil** *(Department of Civil Engineering, Assistant Professor Deccan college of Engineering and Technology, Hyderabad) ** (Department of Civil Engineering, Assistant Professor Deccan college of Engineering and Technology, Hyderabad.

[5] Analysis of RCC Building with Shear Walls at Various Locations and In Different Seismic Zones (Sylviya B, P. Eswaramoorthi).