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Efficient Position of Single Outrigger Wall Connection and Wall Belt Supported System in Multistory Building under Earthquake loading

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ABSTRACT

The requirements of multi-story structure with architectural impression are rises day by day in all over the biosphere. The multistory building improvement has spread rapidly around the world because now, people try to live in multi-storey structures. A Structure is said to acceptable if it satisfies the design criteria in it to resist the lateral foresees. Loads mainly from severe earthquakes. The shear wall was implemented to resist lateral loads. To fulfill these aspects the Outrigger & wall belt system should be used in the structure. In this project a G+20 Storey structure is analyzed using six different cases named as OTS1 (Horizontal plan1) to OTS6 (horizontal plan 6). 1 to 6 indicates ground level to 20 storeys. In this study a multi storey building consist of structure made up of G+ 20 storey's building in Zone III. The plinth area is taken as 900 m2. The 5 bay & 6 bay with grid spacing is taken 5 m. & 6 m in x and y direction respectively. For determination of Performance of structure under efficient location of single outrigger wall connection and wall belt supported system over horizontal plane in CSI-ETABS different levels of building is major objective of project. The project concluded that Optimum height for placing shear wall belt to increase lateral load handling capacity from above objective parameters will be at 11.50 m i.e. structure with shear strip at 3rd floor. Two more location also predominate in it ie 3rd & 6th floor. Analytically If N no. of story is taken than optimum location.

Keywords – OTS (Horizontal Plan), outrigger, wall belt, CSI-ETABS, multi-storey

Introduction

An earthquake test by designing software developed revealed that whenever the R.C.C. a multistory building has surrounded the area where any earthquake erupts, the waves making a detrimental effect on it. Therefore, resistance to lateral strength in the construction of tall buildings, strength parameters to be maintained, resistance to lateral deviations, stability to avoid structural damage and non-construction. For construction requirements, building inspectors have provided new systems to maintain the upper limits should use shear wall, truss systems, moment resistance frames, isolation systems and one of which is outrigger systems and support belts. In this system, when the structure rotates against the lateral effects it passes through the deviation and rotation. To counteract this, a strong context is given in the file of
in the middle of a building connected by strong arms that oppose the whole structure and pass all the rear loads around the column connection. The operation of a multi-storey building therefore depends on the strength of the system.

The sustainability of tall buildings requires some adjustment to it because the lack of land creates demand for tall buildings such as high-rise buildings and high-rise buildings. As it has been observed that competition continues between countries. Since loads in a structure such as vertical and horizontal loads themselves produce a large integrated load that somehow produces the structure and that load must be carried by the frame itself. As earthquakes create landslides from the ground connected to the building and the most effective method used to resist the building with these combinations is the use of external ones, a belt-supported system and an outrigger system with a support belt.

Aims of the project:

Following heads shows the point of comparison of result parameters between various models during earthquake forces for building and its various cases. They are as follows: -

1) To determine Base shear response when seismic forces are applied in X and Z direction to the structure when conducting single outrigger and wall belt supported system.

2) To find member Shear Forces values in Beam with efficient case of single outrigger and wall belt supported system.

3) To examine Bending Moment values in Beam with efficient case of single outrigger and wall belt supported system.

4) To determine and compare member Torsion values in Beam members.

5) To examine column Axial Forces for total 8 cases with efficient case to determine minimum axial force case of single outrigger and wall belt supported system.

6) To find member Shear Forces values in Beam with efficient case of single outrigger and wall belt supported system.

7) To examine Bending Moment values in Columnwith efficient case of single outrigger and wall belt supported system.

8) To determine and compare member Torsion values in Beam with efficient case of single outrigger and wall belt supported system.

9) To analyze the maximum nodal displacement case in X-direction with most efficient case of single outrigger and wall belt supported system.

10) To obtain the maximum nodal displacement values in Z direction with most efficient case of single outrigger and wall belt supported system.

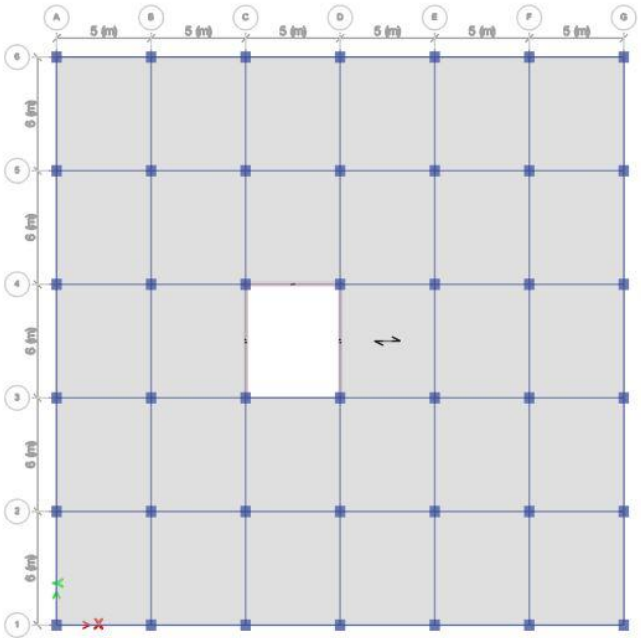
To demonstrate and recommend the effectof stability of multistoried buildingby implementing the single outrigger and wall belt supported dual structural system.

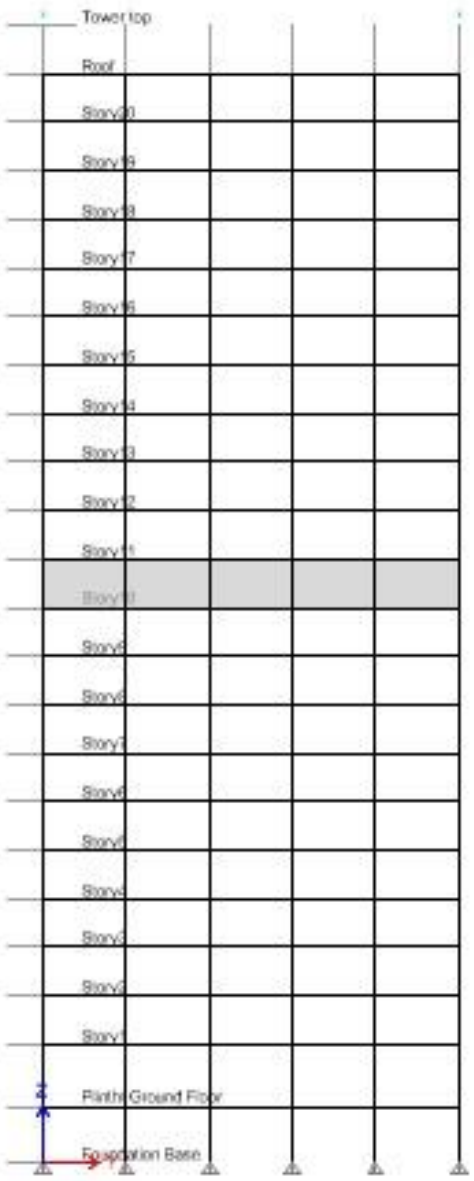
Modeling and Analysis:

Results are shown both in tabular form as well as in graphical form are as follows:

5.2.1 Results for Regular structure with no outriggers support
5.2.2 Results for Outrigger and wall belt supported system at B1
5.2.3Results for Outrigger and wall belt supported system at C1
5.2.4Results for Outrigger and wall belt supported system at D1
5.2.5 Results for Outrigger and wall belt supported system at E1
5.2.6 Results for Outrigger and wall belt supported system at F1

Plane, Elevation & Section




Tower top
Roof
Story20
Story19
Story18
Story17
Story16
Story15
Story14
Story13
Story12
Story11
Story10
Story9
Story8
Story7
Story6
Story5
Story4
Story3
Story2
Story1
Plinth/Ground Floor
Foundation Base

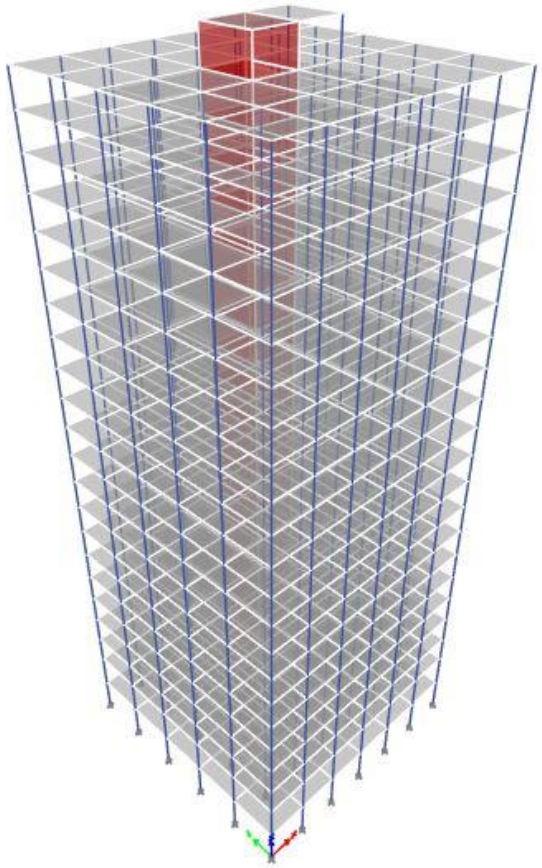


Figure 1: G+5 Storey with Plane, elevation & 3D view

Structural Parameters used in G+ 5 storeys:

Table 1 &Table 2 shows the basic parameters used in the analysis of building.

Table 1. Structural Parameters

S. No.	Element Name	Description
1	Building Types	Residential
2	No. of Storey	G+20
3	Plinth Area	900 m2
4	Floor Height	4.5 GF & 3.5 each floor
5	Dimensions of Beam	0.55 m. x0.45 m.
6	Dimensions of Column	0.60 m. x 0.55 m.
7	Slab Thickness	0.150 m.
8	Shear wall	0.155 m.
10	Grade of Concrete	M25 & M30
11	Steel Used	Fe 500
12	Outrigger and wall belt supported at	1,2,3,4,5 Storey
13	Grid Spacing in X- Direction	5 m.
14	Grid Spacing in Y- Direction	6 m.
15	Time Period	1.3474 Second
16	Analysis Software used	CSI-Etabs

Earthquake Parameters used in G+5 Storey:

Table 2. Earthquake Parameters

S. No.	Parameters	Description
1	Earthquake Code	IS 1893(Part 1):2016
2	Earthquake Zone	III
3	Response Factor (RF)	4
4	Importance Factor (IF)	1.2
5	Soil Types	Medium
6	Damping	0.05
7	Structural Type	RCC Framed Building
8	Earthquake method	Response Spectrum Method

Result & Discussions

The Following results are to be obtained from the modeling and analysis of Multi storey building of G+20 Storey building in CSI-ETabs software. The results are as follows:

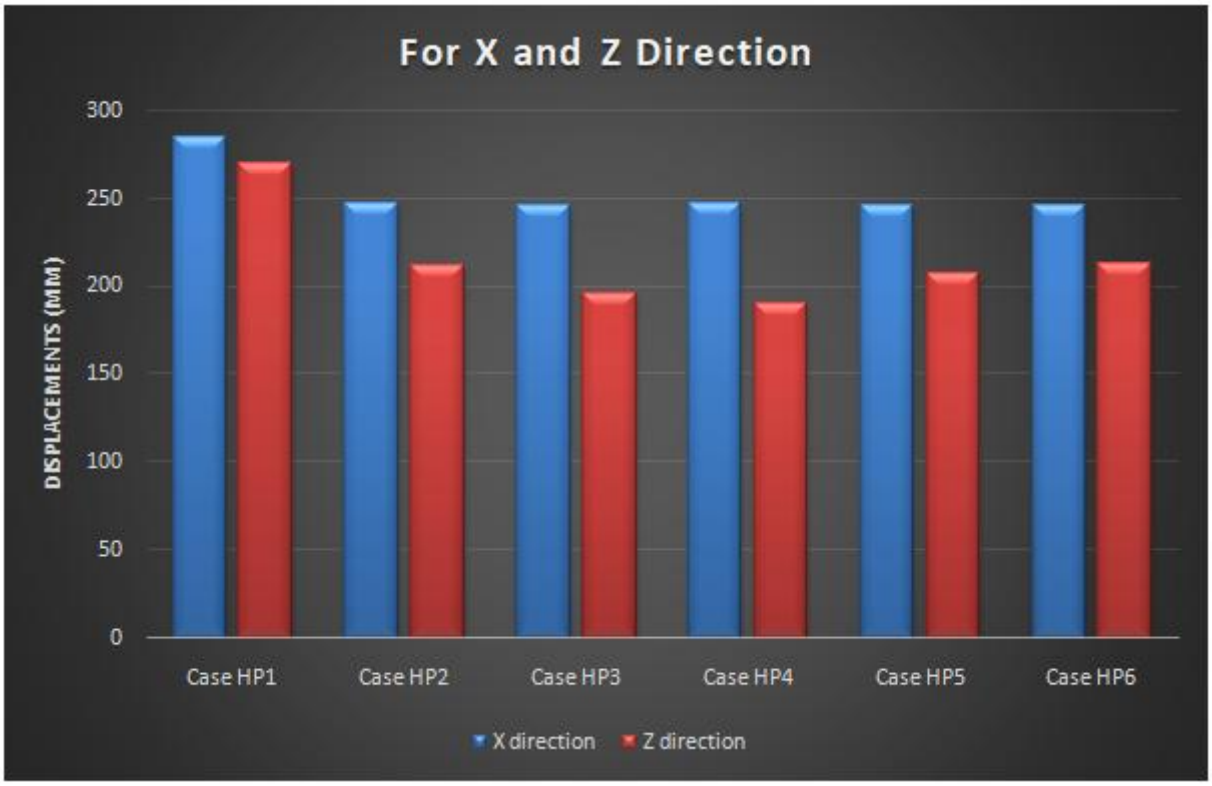


Figure 2: Bar chart of Displacement under OTS1 to OTS6

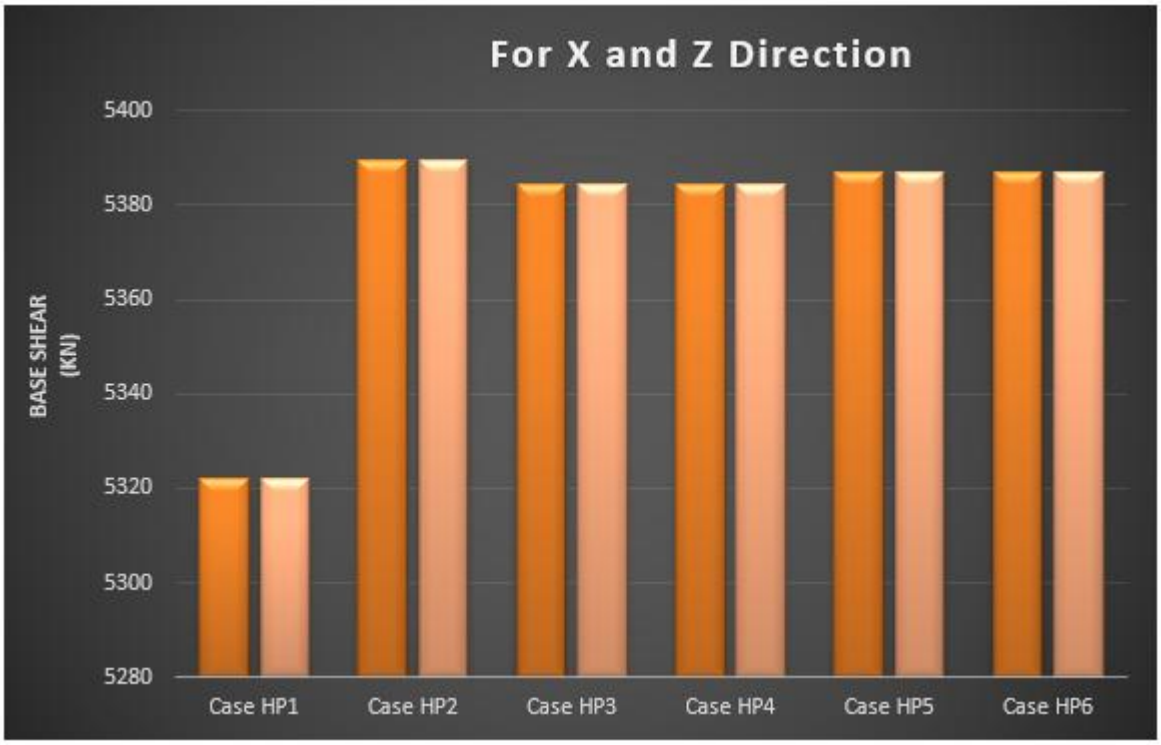


Figure 3: Bar chart of Base Shear under OTS1 to OTS6

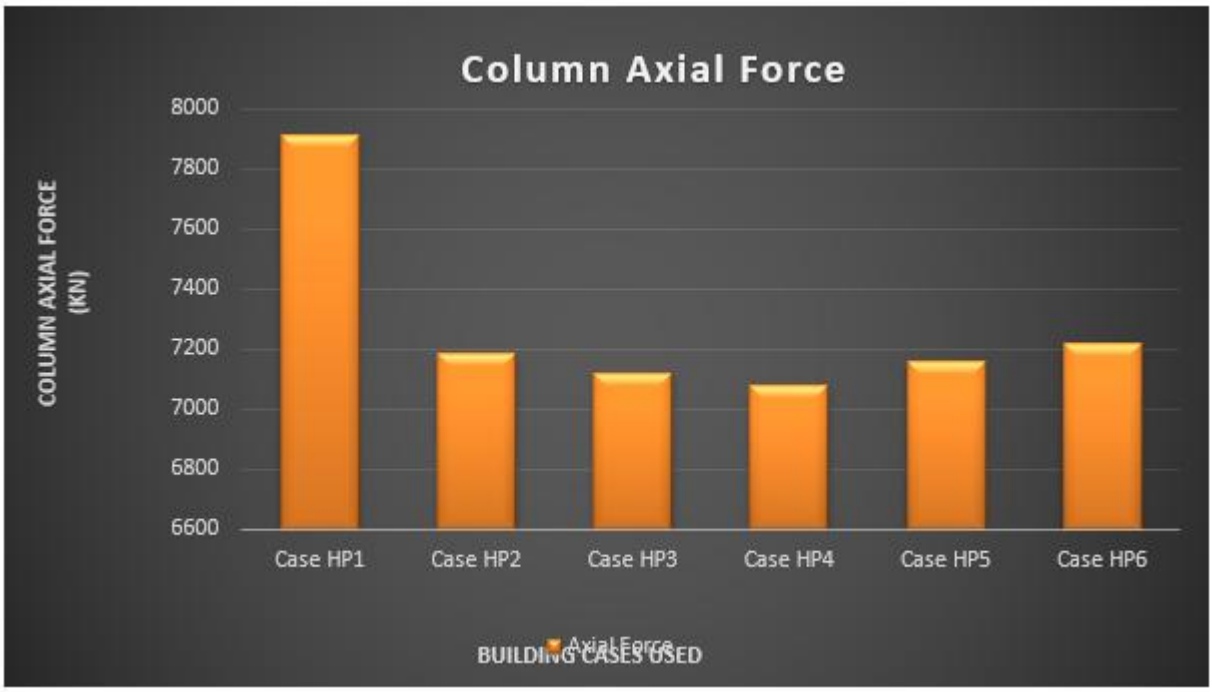


Figure 4: Bar chart of Axial Forces under OTS1 to OTS6

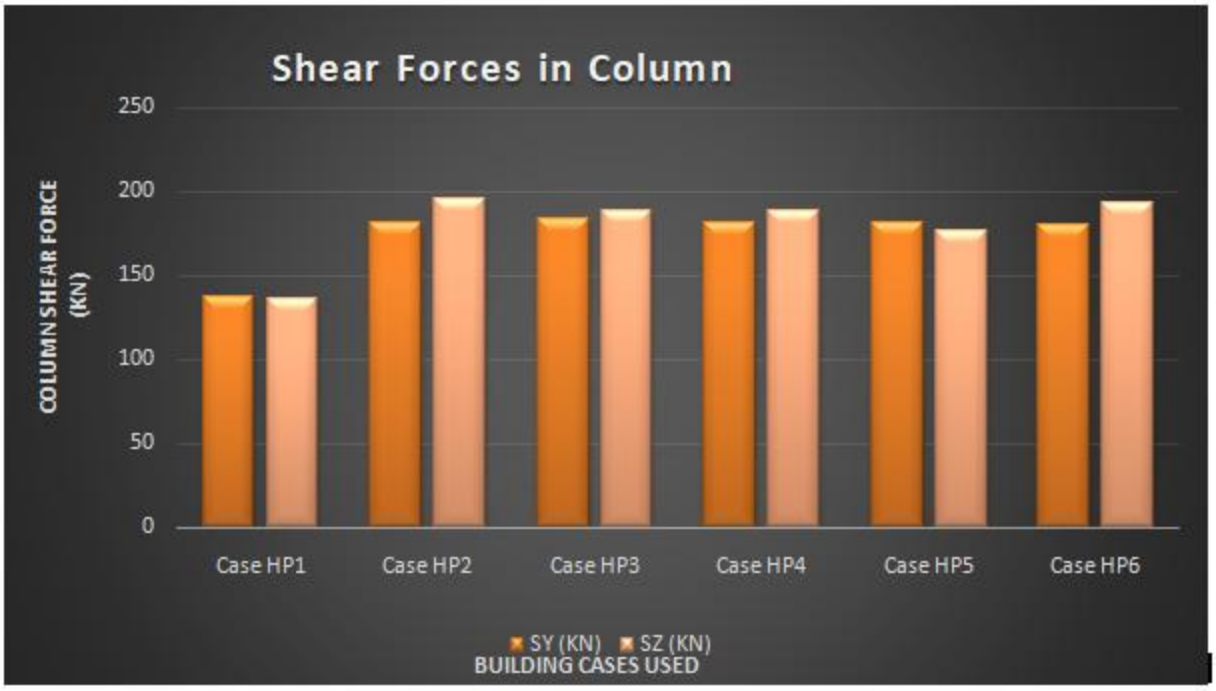


Figure 5: Bar chart of shear Forces under OTS1 to OTS6

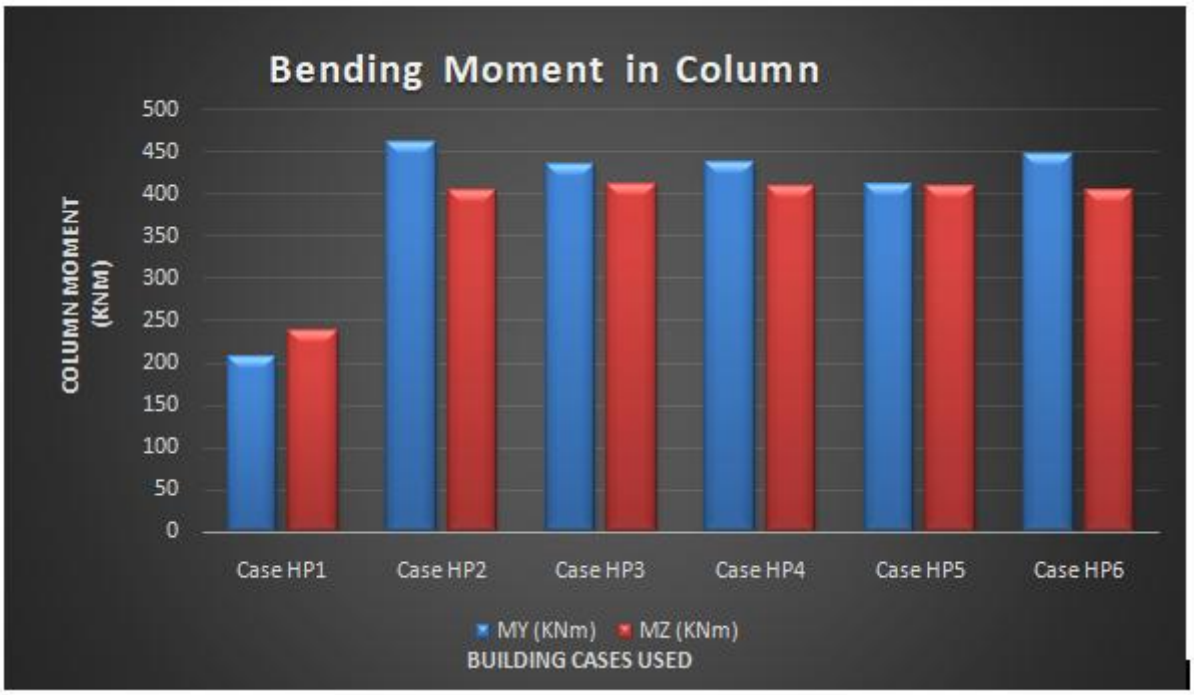


Figure 6: Bar chart of Bending Moment in column under OTS1 to OTS6

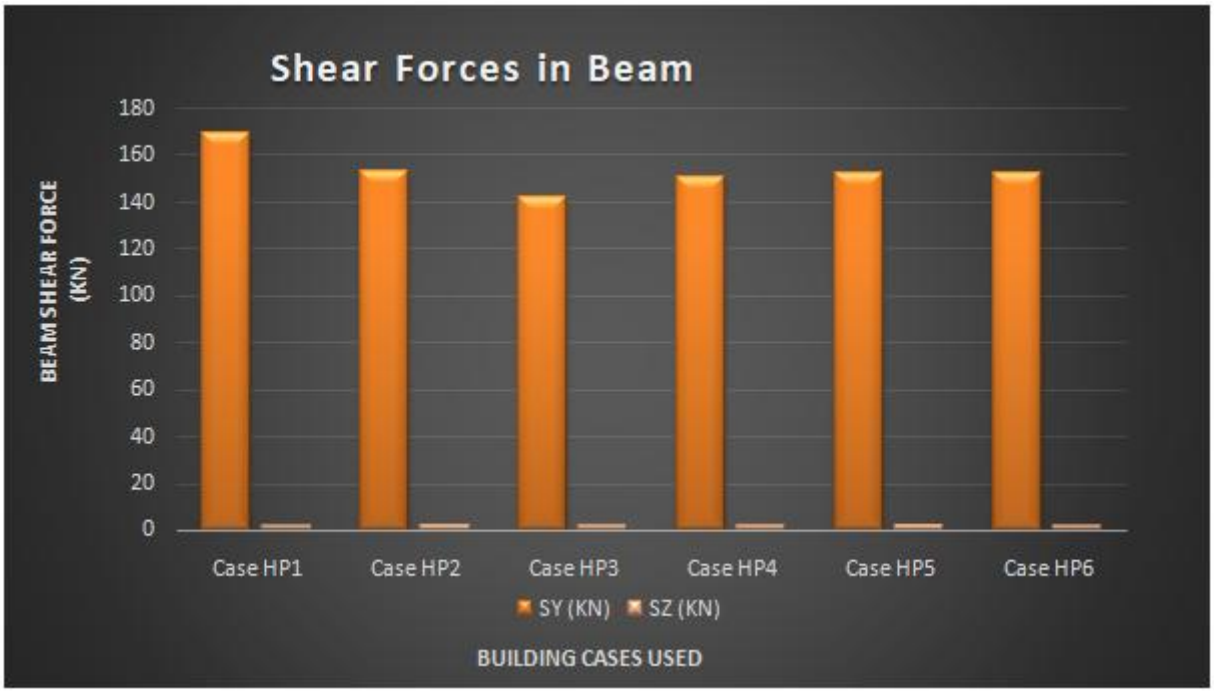


Figure 7: Bar chart of shear force in beam under OTS1 to OTS6

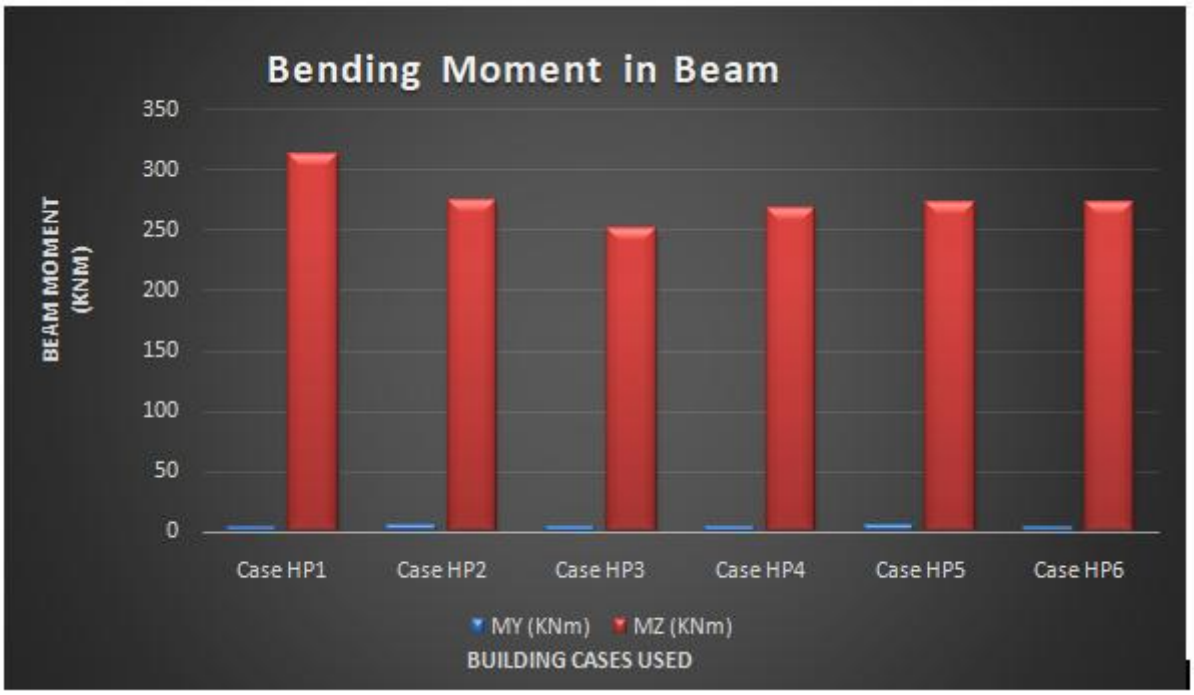
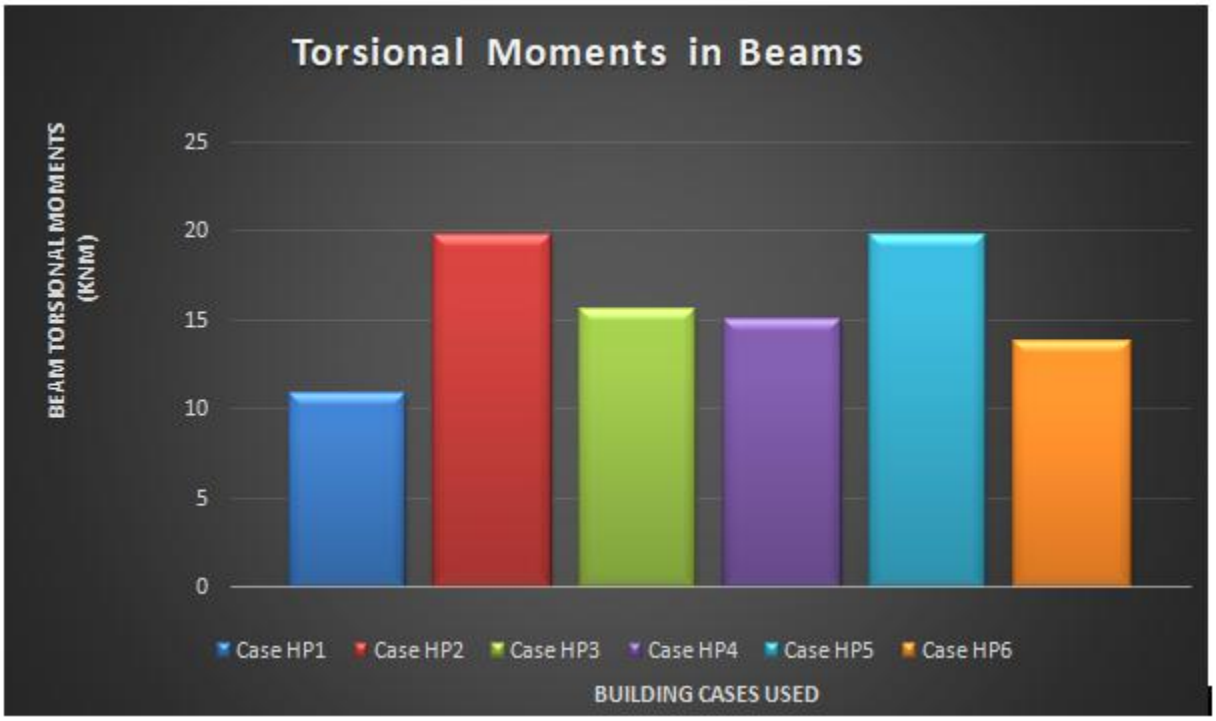


Figure 8: Bar chart of Bending Moment in beam under OTS1 to OTS6



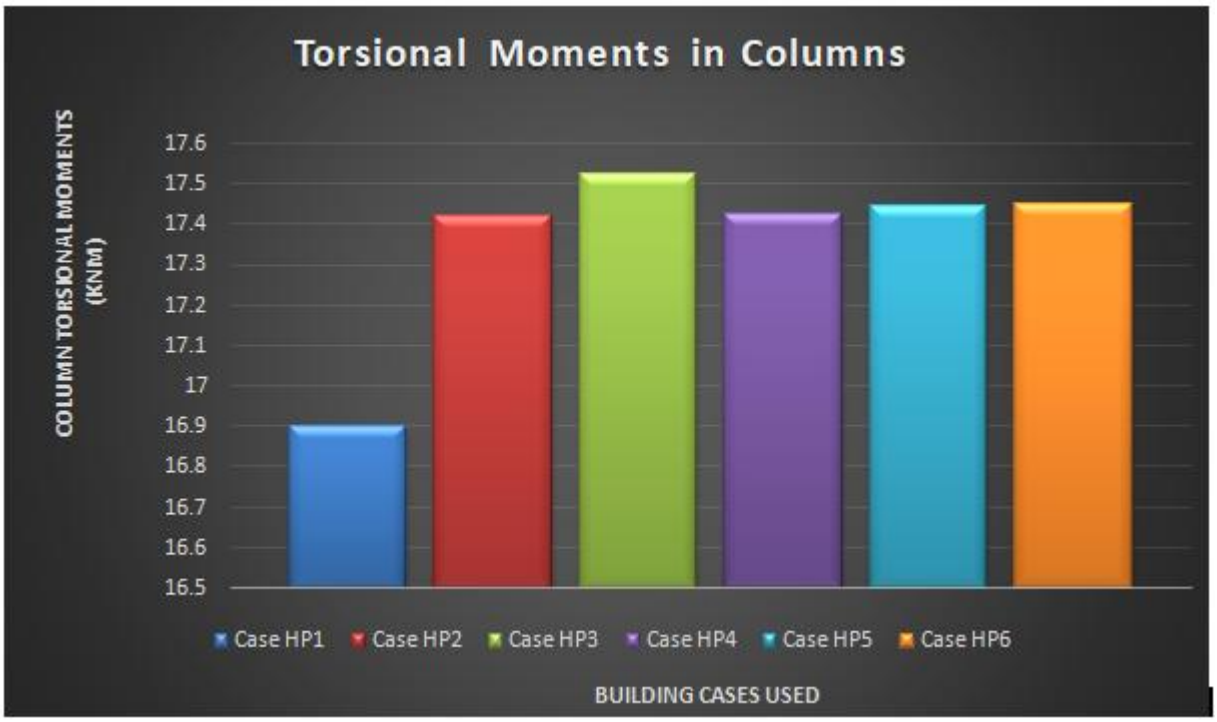
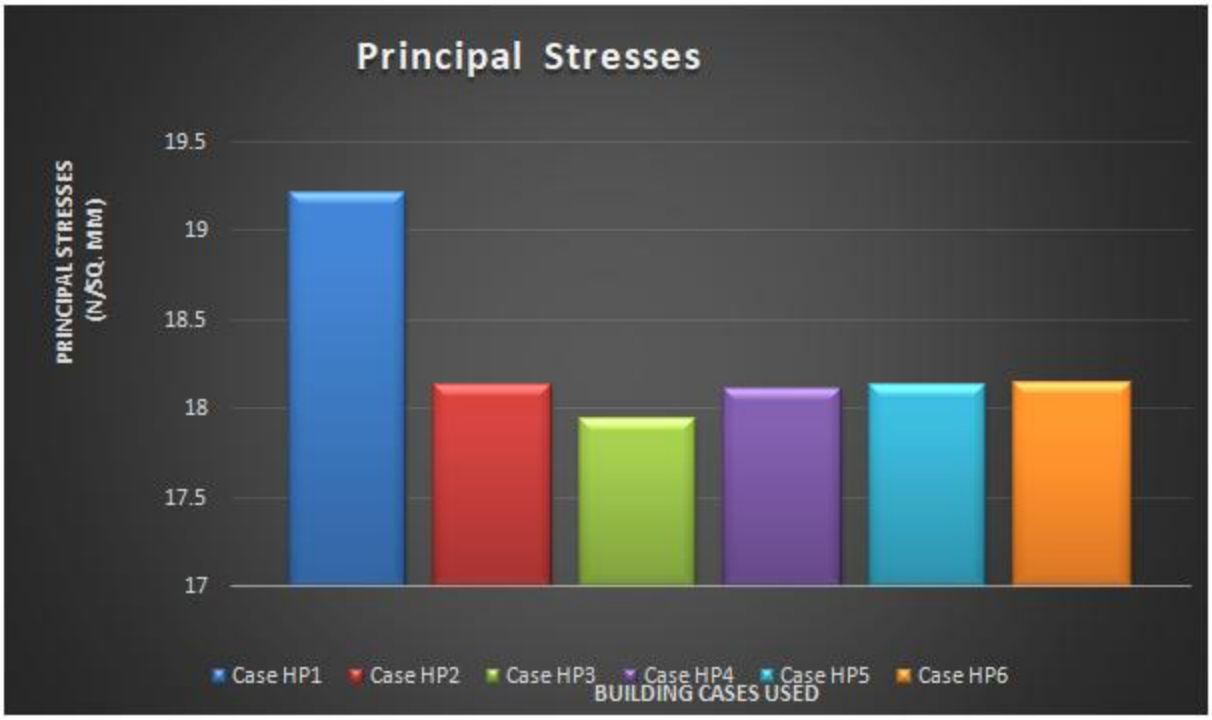
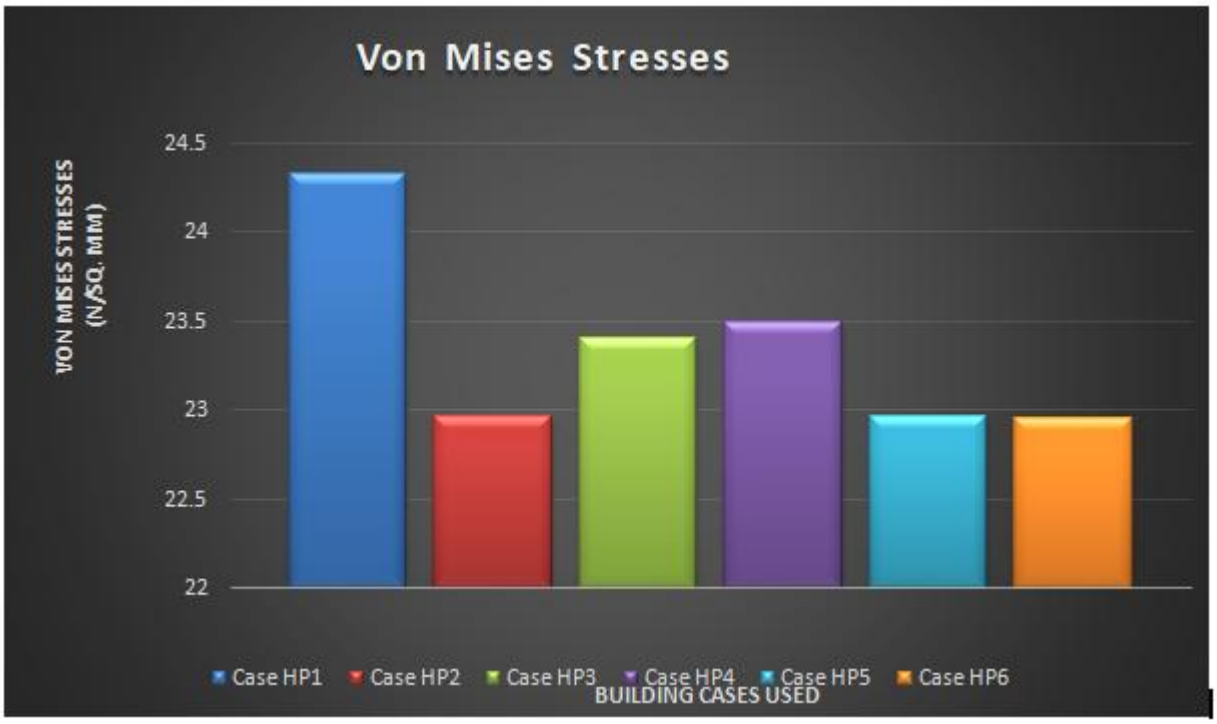


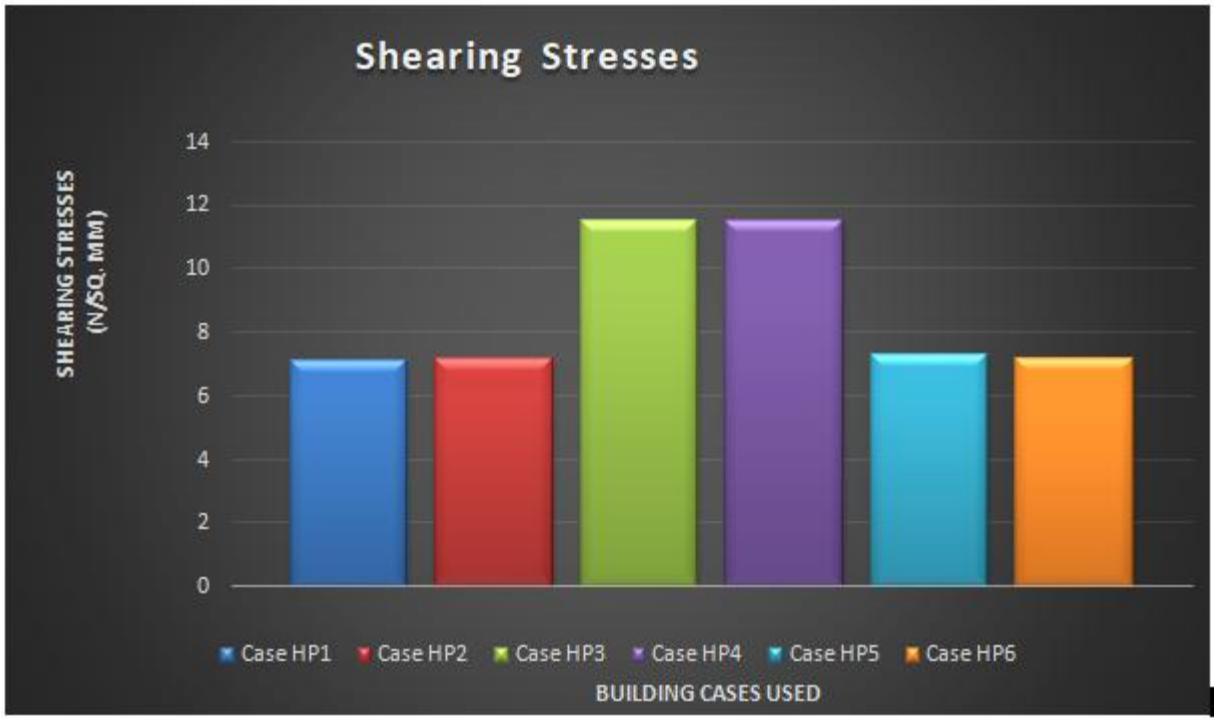
Figure 9: Bar chart of Torsional Moment in Beam & Column under OTS1 to OTS6


Principal Stresses
PRINCIPAL STRESSES (N/SQ. MM)
19.5
19
18.5
18
17.5
17
Case HP1
Case HP2
Case HP3
Case HP4
Case HP5
Case HP6
BUILDING CASES USED

(a)


Von Mises Stresses
VON MISES STRESSES (N/SQ. MM)
24.5
24
23.5
23
22.5
22
Case HP1
Case HP2
Case HP3
Case HP4
Case HP5
Case HP6
BUILDING CASES USED

(b)



(c)

Figure 10: Bar chart of Stresses developed- Principal Stresses (a), Von Mises Stresses (b) & Shearing Stresses (c) under OTS1 to OTS6

Conclusions

We studied about Location of Efficient Single Outrigger Wall Connection and Wall Belt Supported System Over Horizontal Plane and there are 6 cases in ETABS model. In this research work we study about Location of Efficient Single Outrigger Wall Connection and Wall Belt Supported System Over Horizontal Plane. On the basis of above parameters following results are obtained from this comparative study.

1. On comparing various cases with respect to OST1 which is without outrigger support it has been concluded that the displacement in X direction obtained 15.58% higher than OTS1 respectively again displacement in Z direction obtained for case OTS4 with a 40.41% higher than OTS1.
2. As per comparative results cases with respect to OST1 which is without outrigger support, Case OTS4 and OTS3 for base shear forces in X direction and Z direction values are respectively for both 1.27% lower than the OST1.
3. As per comparative results in axial force results cases with respect to OST1 which is without outrigger support, Case OTS4 is 11.18% higher than the OST1.
4. As per comparative results cases with respect to OST1 which is without outrigger support, Case OTS6 and OTS5 for Column shear forces in X direction and Z direction values are respectively 31.64% and 44.10% lower than the OST1.
5. As per comparative results cases with respect to OST1 which is without outrigger support, Case OTS5 and OTS6 for Column beam bending in X direction and Z direction values are respectively 121.64% and 69.08% lower than the OST1.
6. As per comparative results cases with respect to OST1 which is without outrigger support, Case OTS3 and OTS5 for Beam shear forces in X direction and Z direction values are respectively 19.69% higher and 26.40% lower than the OST1.
7. As per comparative results cases with respect to OST1 which is without outrigger support, Case OTS6 and OTS3 for Beam Bending Moment in X direction and Z direction values are respectively 31.37% lower and 24.32% higher than the OST1.
8. On analyzing comparative results cases with respect to OST1 which is without outrigger support the Torsional Moment in beams Case OTS6 is 27.85% higher than the OST1 and Torsional Moment in column case OTS4 is 39.66 higher than the OST1.
9. As per comparative results comparative results cases with respect to OST1 which is without outrigger support in Smax stress, SVM stress and S12 stress values are Case OTS3, Case OTS2 and Case OTS6 respectively 7.11% higher, 15.55% higher, 61.23% lower than the OST1.
10. Comparing all the cases Case OTS6 and case OTS3 are the efficient case among all cases.

Recommendation-

The following conclusion has been investigated by comparing various cases are as follows: -

- Base Shear shows minimum response value other than general structure which seems very effective under seismic effect is Regular building with shear core. To resist moment, buildings are recommended to be designed as Shear Core outrigger and wall belt supported system shows least value among all cases.

- If column design is the main criteria, building axial forces shows a least value when only Shear Core system will be used.
- Shear Core outrigger and wall belt supported system will again be effective in shear forces for both Y and Z directions in members.
- Overall parameter controlling case among all is Shear Core outrigger and wall belt supported system.
- Wall belt system is more effective than truss belt system which has seen in this work.

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