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Original Article

Study the Behaviour of G+36 Multistory Building with and WithoutTransfer Slab using Etabs & Safe

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Abstract *-Due to their importance, highrise building playsacritical role against earthquake. Highrise buildings are mostly designed and analysed by different softwares used in the field of structural engineering; such softwares are Etabs, Staad, etc. Here we are going to analyse highrise buildings with Etabs software. The software shows the behavior of the structure, and the most critical parts are analysed as per the given instructions.The transfer structure hasa certain thickness which results in increasing the stability of the structure to construct the no of the floor above the transfer structure.Response spectrum and Equivalent static analysis can be performed,and Different results are found; such results show the performance of the buildings against different loadings and loadcombinations.*

Keywords *- Earthquake,Linear Analysis, Response spectrum, Transfer Slabs, G+36 Story building, ETABs, IS 875, IS-1893,Safe.*

1.Introduction

The multistory buildings are most important to analyse against earthquakes and other lateral and gravitational forces, which give the better behaviour of the building and their safety against human life. So there are so many important parts of the building from which one of the Transfer slabs is used to float the column from a particular floor level and result in increasing the space requirement of the building.This slab is an Rcc slab and rests over the Shear wall or columns, as shown in the figure.

2. Building details

2.1. Architectural details

Building details to find out the behavior of the structure

- Area : 22x48m
- No. of Story :G+36 Story
- Overall height of structure : 108 m
- Storey height : 3 m
- Wall thickness : 150mm assumed
- Slab thickness : 125mm (normal slab)
- Slab depth at transfer floor: 800 mm thick(onthe fifth floor)

2.2. Different codes for seismic analysis

- R.C.C. code : IS 456: 2000
- Dead load : IS875: Part 1
- Live load : IS875: Part 2
- Earthquake Analysis: IS1893: 2016

2.3.Different loadings on the floors

- Live load in floor area : 2 kN/sq m
- Live load in Balcony area :2 kN/sq m
- Live load in passage area : 2 kN/sq m
- Live load in urinals : 2 kN/sq m

Table 1. Details of Columns

	With transfer slab	Without transfer lab
Foundation to 4th	300x750	300x750
5th floor to 12th	300x600	300x600
12th to24th floor	300x530	300x530
24th to36 th floor	300x450	300x450

Table 2. Details of Beams

	With transfer slab	Without transfer lab
Foundation to 12th	300x600	300x600
12th to24th floor	300x530	300x530
24th to36 th floor	300x450	300x450

2.4.Earth Quake parameters

- Zone – V (higher Zone)
- Soil type -1, medium
- Importance factor- 1.5
- Frame Type =OMRF
- Response Reduction = 3

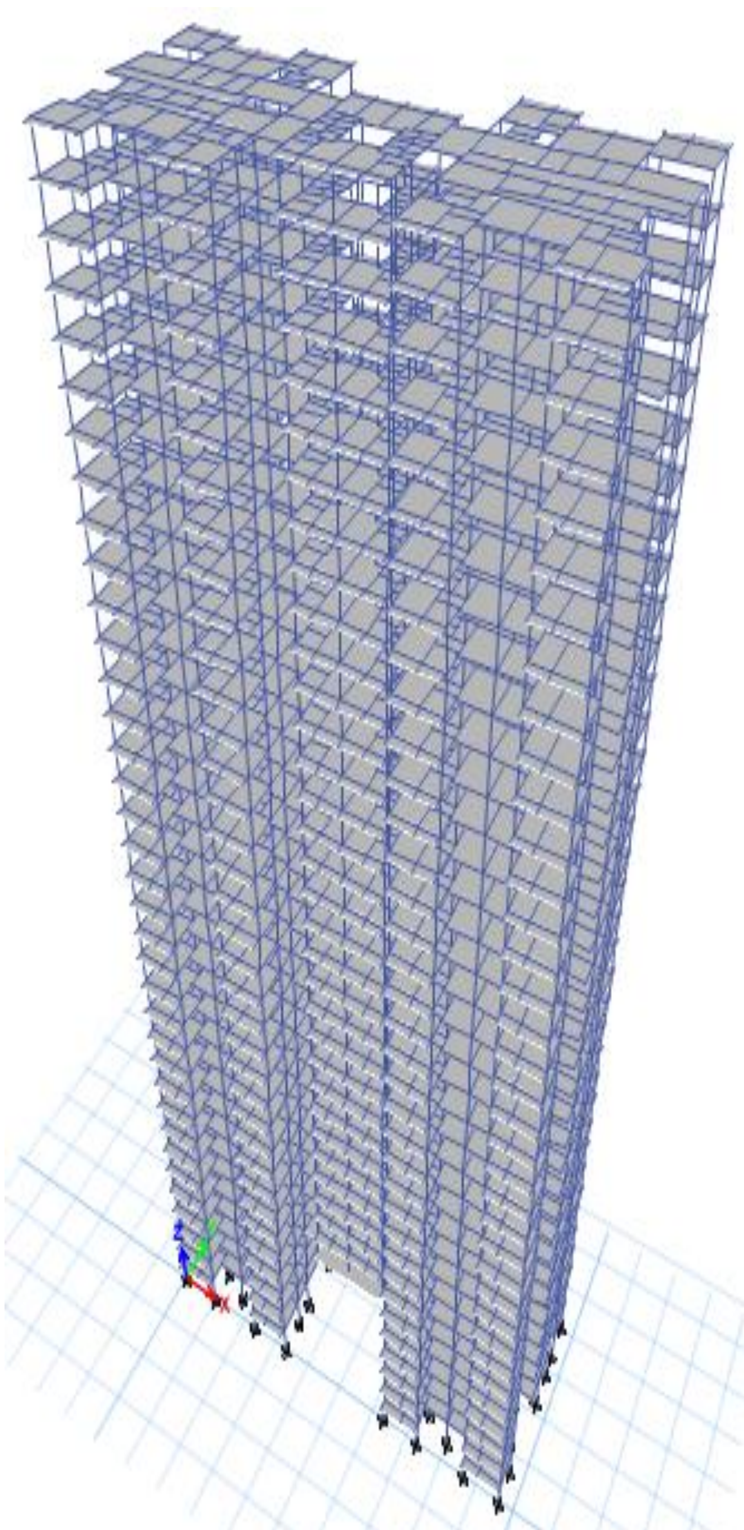

Fig. 1 shows the 3D Skeleton of the Structure

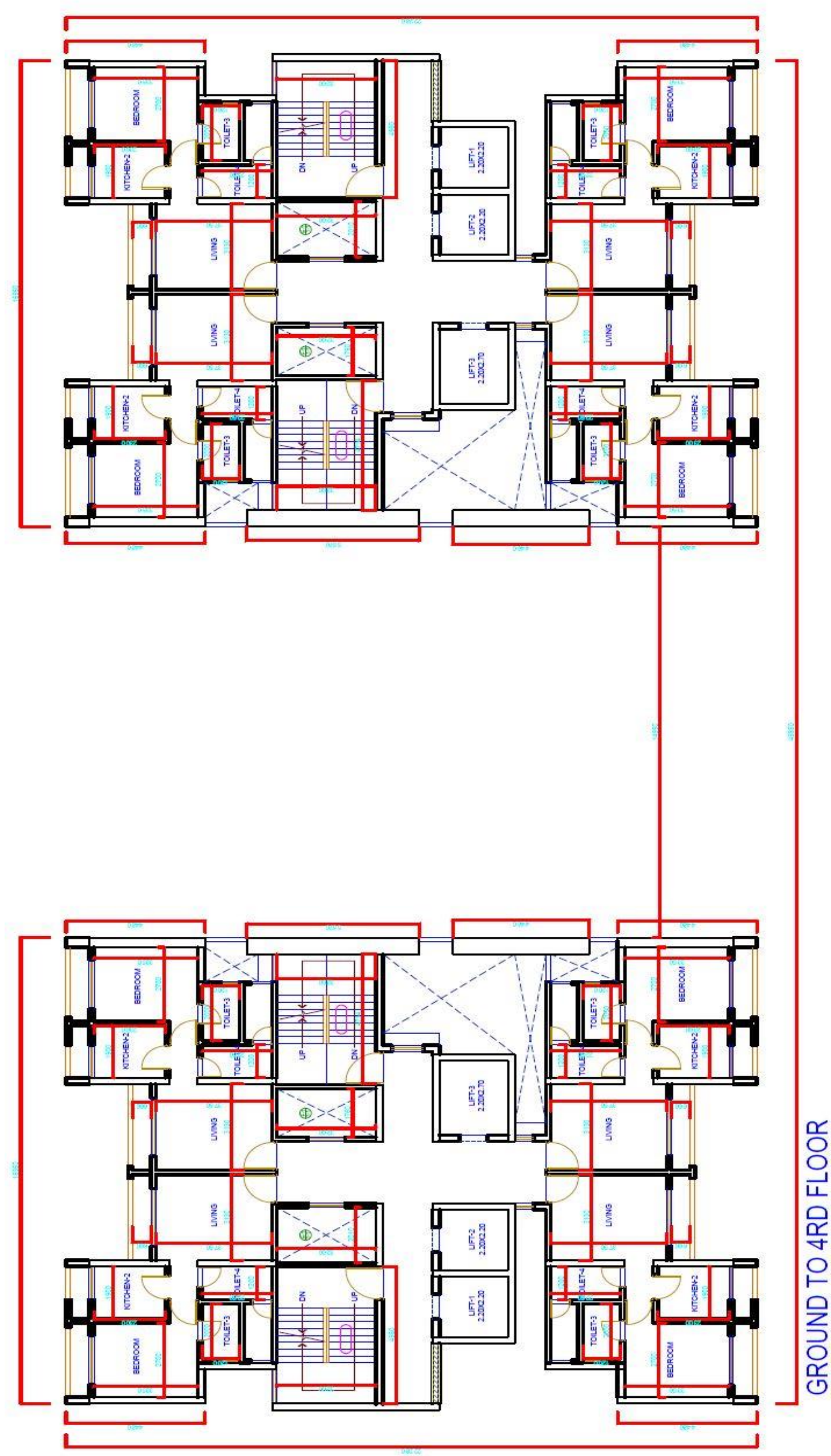

Fig. 2 shows the plan of the building up to the 4th floor without transfer slab building

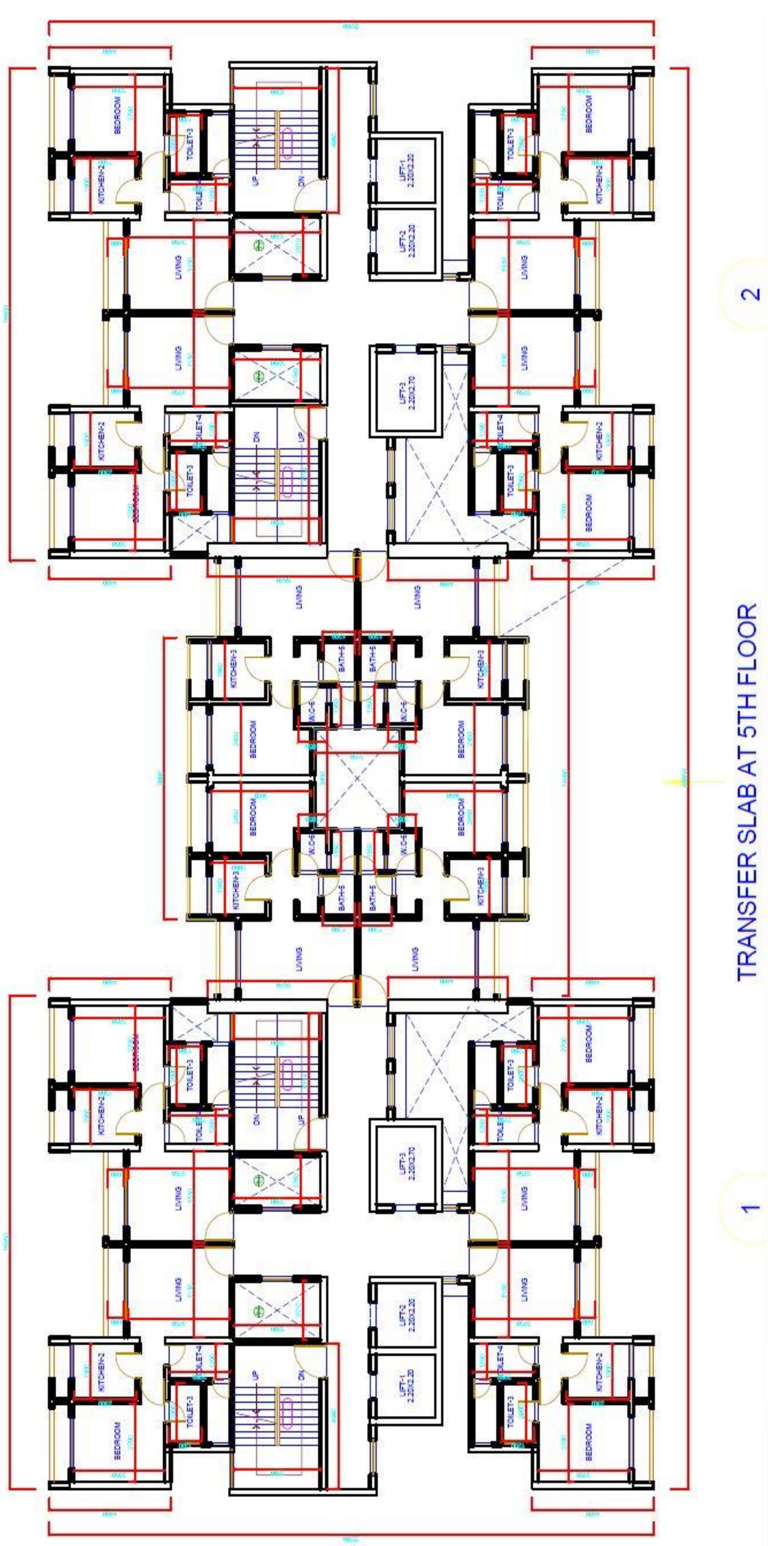

Fig. 3 shows the plan of the building up to the 5th floor and above floors with and without transfer slab building

3. Results

3.1. Modal Time Period

Table 3. Modal Time Period different code

Mode	Without transfer slab	With transfer slab
Mode-1	9.316	9.634
Mode-2	9.115	9.15
Mode-3	8.712	8.723

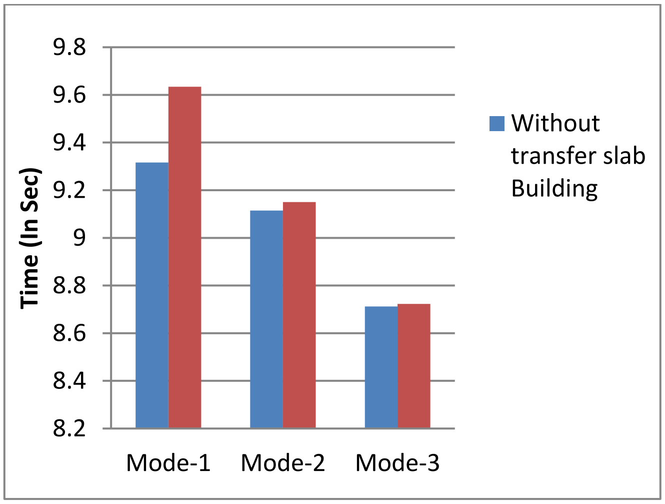

Fig. 4 Comparison of Model time period Values for Different Load Cases

The above graph shows the model time period taken by the building for 3 modes where 1st mode takes 9.31 seconds when the transfer slab is not used and when the model usesthe transfer slab, the time taken for the 1st mode is 9.6 seconds; similarly, other modes show the respective time period for the structure.

3.2. Base Shear Details

Table 4. Base Shear Details for Static Condition in X and Y Direction

Base Shear	Without transfer slab	With transfer slab
Static Ex	55195	54314
Static Ey	24841	24444
DynamicEx	64937	65150
DynamicEy	63811	64104

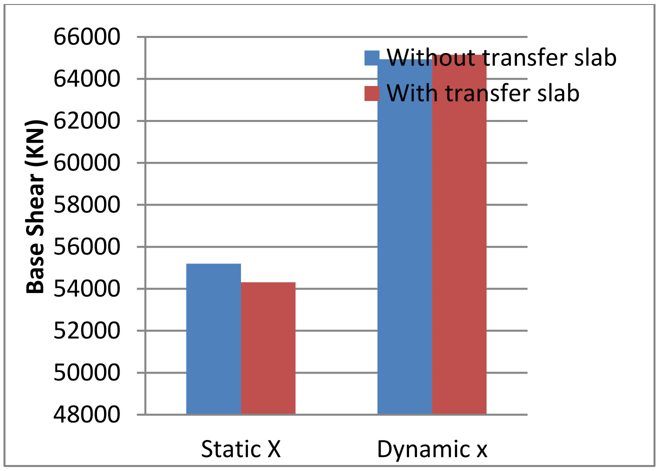

Fig. 5 Base Shear in for static and Dynamic conditions in X, the direction

The graph shows the values of Base shear in the X direction for both Equivalent static, and Equivalent Dynamic cases as the values are lower,as shown in the table in the case of the Equivalent static method. At the same time, the transfer slab is not used, and in the case of transfer slab is used, the Dynamic base shear is increasing, as shown in the above table for Earthquake forces.

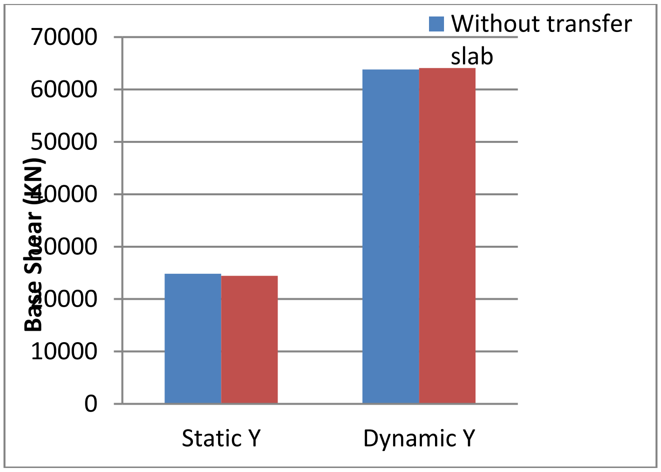

Fig. 6 Base Shear in for static and Dynamic conditions in Y, the direction

The above graph shows the values of Base shear in the Y direction for both Equivalents static and Equivalent Dynamic cases, as the values are lower in the table in the case of the Equivalent static method. At the same time, the transfer slab is used, and in the case of the transfer slab, the Dynamic base shear is increasing, as shown in the above table for Earthquake forces.

3.3. Displacement Details

Displacement	Without transfer slab	With transfer slab
Static Ex	0.2835	0.2791
Static Ey	0.1616	0.1686
Dynamic Ex	0.2883	0.2884
Dynamic Ey	0.3100	0.3379

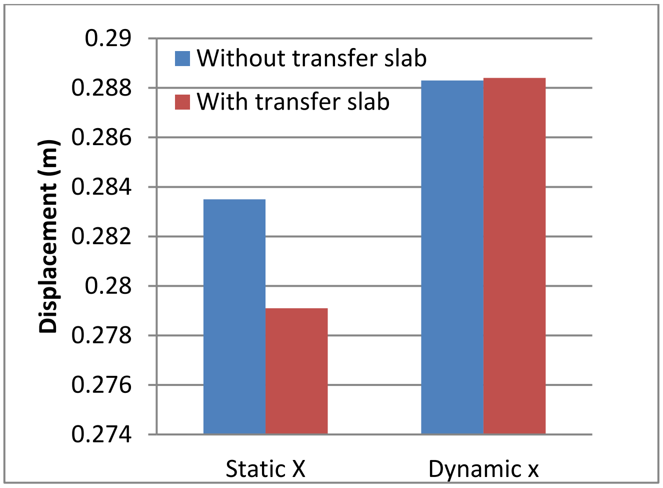

Fig. 7 Displacementfor the static and dynamic condition in X in the direction

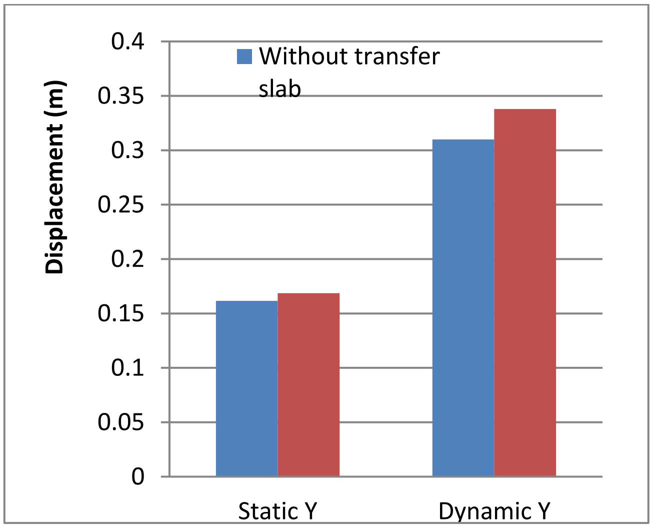

Fig. 8 Displacementfor the static and dynamic condition in Y in the direction

3.4. Drift Details

Drift	Without transfer slab	With transfer slab
Static Ex	0.0355	0.0348
Static Ey	0.0195	0.0200
Dynamic Ex	0.0373	0.0371
Dynamic Ey	0.0375	0.04030

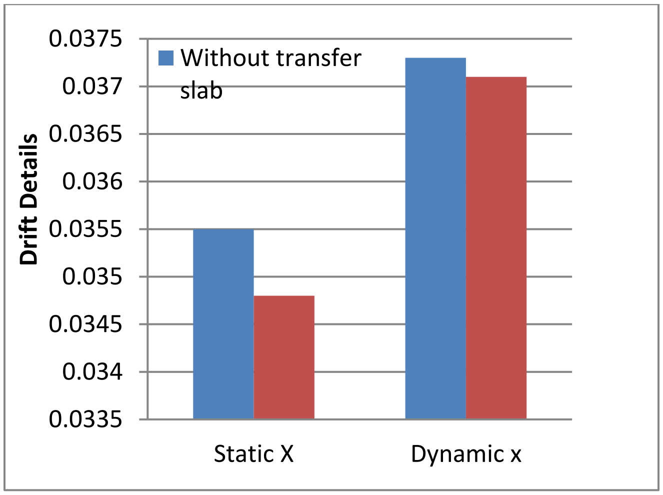

Fig. 9 Driftfor the static and dynamic condition in X in the direction

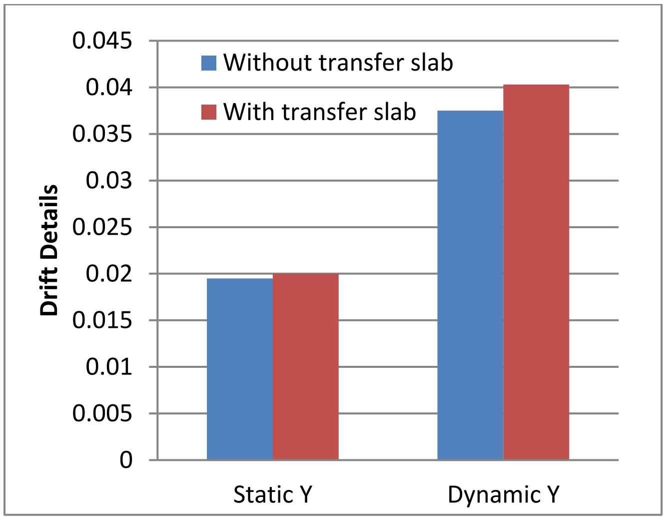

Fig. 10 Driftfor the static and dynamic condition in Y in the direction

3.5. Shear Force details

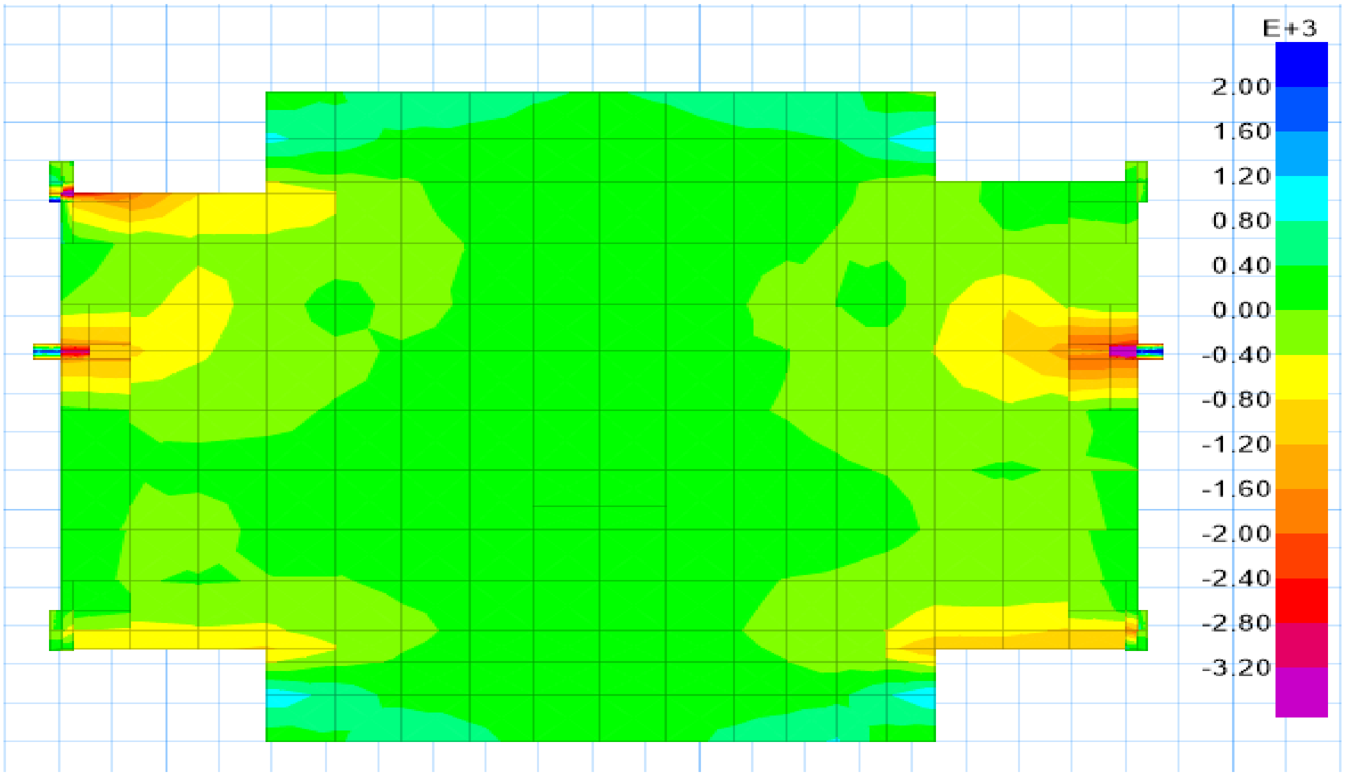

Fig. 11. Shear force deformation details

- Max shear force at transfer slab= 2073.19KN

3.6. Bending moment details

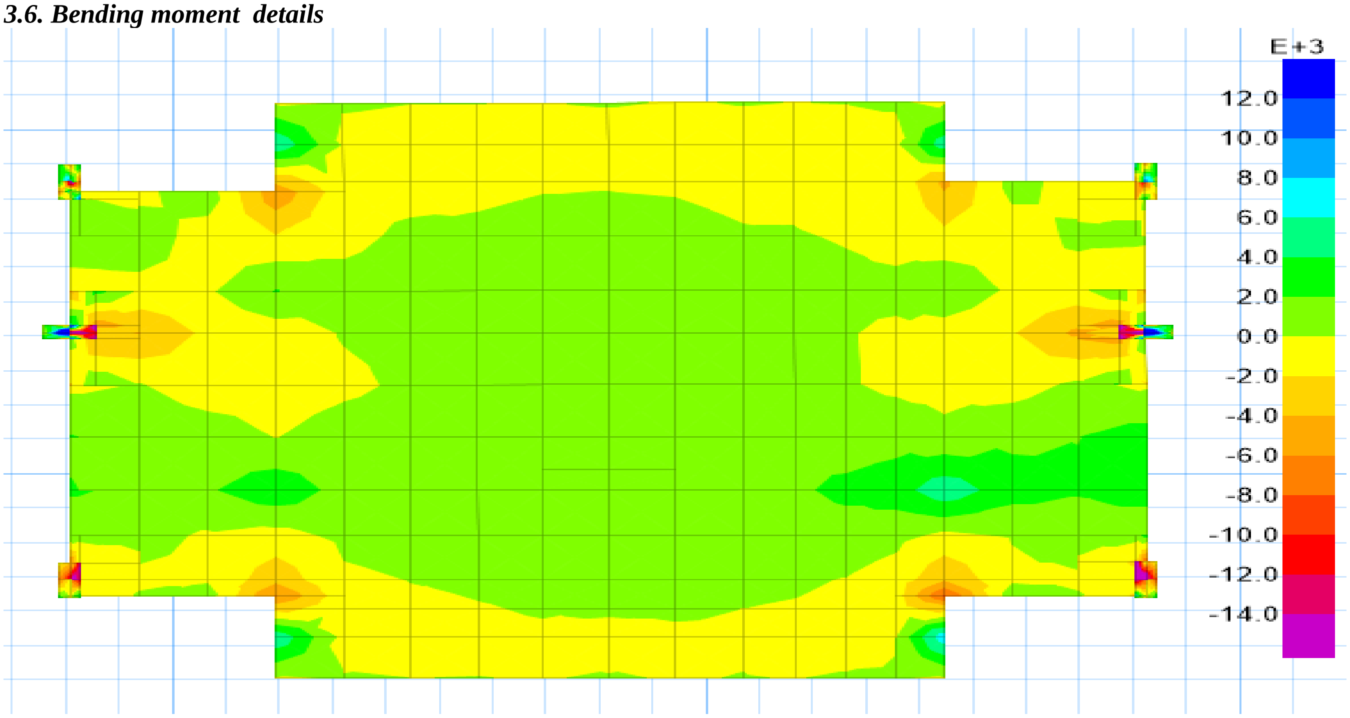

Fig. 12 Bending moment deformation details

- Max Bending moment at transfer slab= 2340.070KN/M

3.7. Punching Moment details in XZ direction (V13)

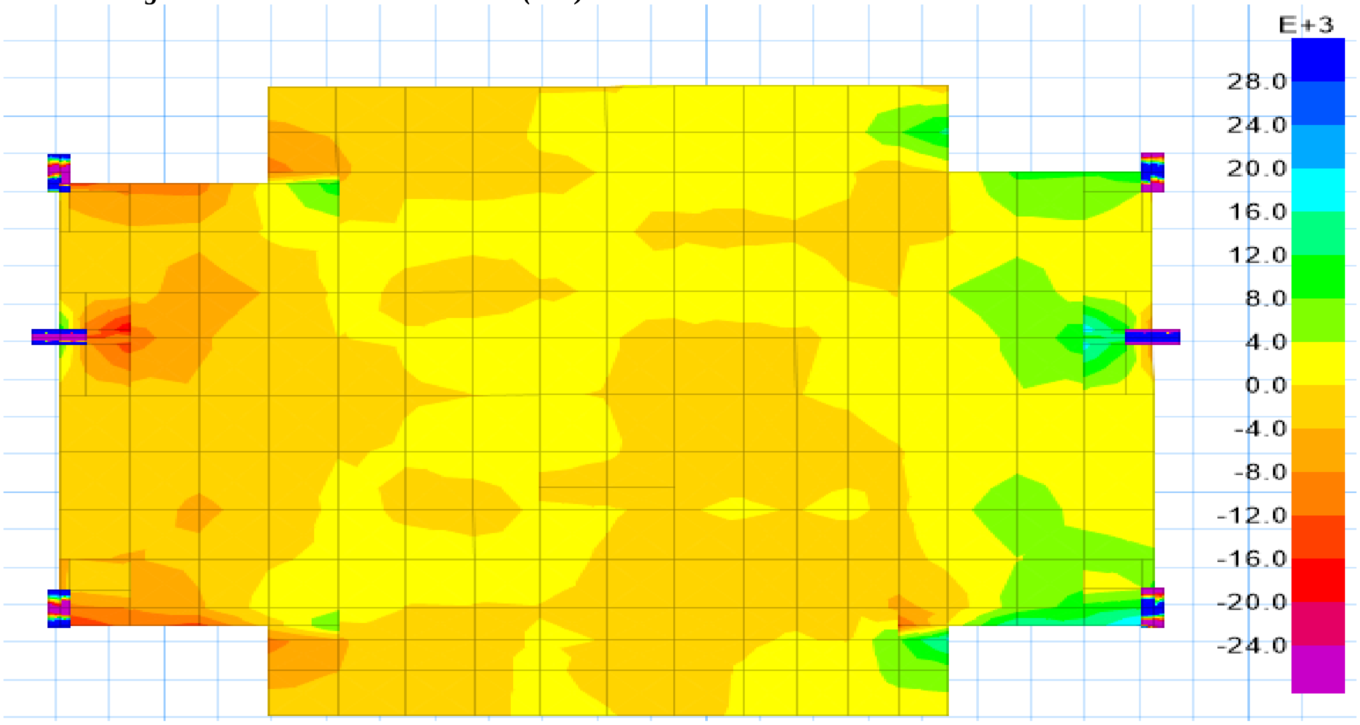

Fig. 13 Punching moment(V13) deformation details

- Max Punching moment at transfer slab= 8010.67KN/M

3.8. Punching Moment details in YZ direction (V23)

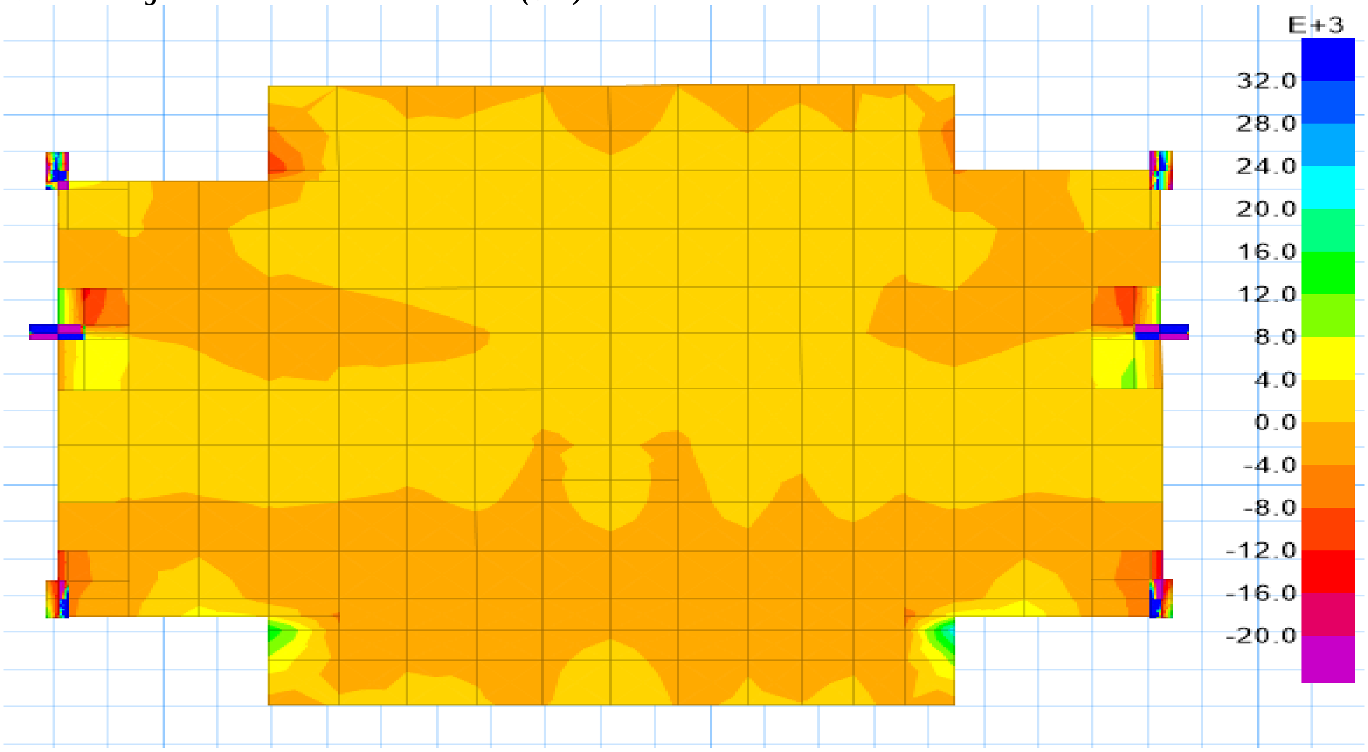

Fig. 14 Punching moment(V23) deformation details

- Max Punching moment at transfer slab= 9802.67KN/M

4. Conclusion

1. The time period values are upto 9 seconds in both models and reduced by 1 second in the second and third modes.Both models have almost the same time period values.as shown in the above table.

2. Base shear is more Without transfer slab cases. (Table 4.2) and less in the Transfer slab model. Due to its mass increase, the base shear values are increasing.

3. Base shear is higher in Static X and Y conditions when the transfer slab is used as the base shear values are based on the structure's mass; that's why the mass of the building is higher without the transfer slab model.

4. Base shear is lower in Dynamix X and Y condition when transfer slab is not used and higher in Static x and y condition because the base shear values are based on the structure's mass; that's why the mass of the building is higher in without transfer slab model.

5. The displacement values are higher in the transfer slab model case and less in the normal mode where the transfer slab is not used.

6. This major effect is obtained over the transfer slab, where the stresses increase due to the floating structure.

7. The stress values such as S11, S12, &S22 (x, y & z) directions will increase by the series when the Transfer slab is used.

8. The punching stress is increasing beyond the limitations of IS codal provision.

Based on the above results, we can conclude that if the building usesa transfer slab, it is necessary to use the safe software because the displacement and punching results are better to understand in such software. We can take remedies for those important members.

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