International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 07 | July 2022 www.irjet.net p-ISSN: 2395-0072

STUDIES OF ANALYSIS AND DESIGN FOR MULTI-STORIES STRUCTURES WITH TRANSFER PLATES IN HELP OF ETABS

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Abstract - *In saturated cities, high-rise buildings are more common for residential and commercial purposes. The land becomes premier in highly populated cities, space allocation for vehicle parking and other purposes will be a major challenge for engineers, and to overcome this, tackle Transfer plates are widely employed in many high-rise buildings. It has been provided at a certain elevation from the ground its level about five to six stories above ground level having a thickness around 600mm to 3500mm. heavy floating columns are raised from this plate for residential floors above. this research paper mainly focused on the analysis and design of the multi-story building with transfer plate with help of Etab software.*

Key Words: Transfer plate, Etabs, analysis, plate analysis, transfer girder.

1. INTRODUCTION

In a saturated cities high rise building are more common for residential and commercial purposes, land become premier in a highly populated cities, space allocation for vehicle parking and other purposes will be major challenge for engineers, to overcome this tackle Transfer plates are widely employed in many high-rise buildings. It has been provided at certain elevation from ground its level about five to six stories above ground level having thickness around 600mm to 3500mm.heavy floating columns are raised from this plate for residential floors above.

In general transfer plates are often supported by well-spaced columns as it is intended to allow more free space for parking at below levels, whereas above floors columns are closely spaced for flexible residential layouts thereby producing lighter structural elements in a residential area that resulting overall economy of the building, Despite of their advantages responses of the high rise building with Transfer plates will be significant. , In most of the cases floating story just above the transfer plate having higher stiffness than lower floor, therefore careful structural arrangements of supporting walls and elevation of transfer plates are playing vital role to retain structural benefits of transfer floors.

TRANSFER PLATE

Presented in the introduction it is a slab, thickness around 600mm to 3500mm, heavy floating walls are directly sitting on the slab plate. Behavior of the slab idealized based on the aspect ratio and load distribution path. Thickness of the section often controlled by the shear stress at the section, such as one-way shear and punching shear, they are the crucial criteria for transfer plate design. Although, it is hard to satisfy one-way shear with tension steel alone vertical contribution of the steel is needed to satisfy over all shear demand of the section therefore, vertical shear links has to be design moreover, total strength of the section is limited to 2.5N/mm2 for the sake of low rebar congestion and constructability. Minimum reinforcement shall be provided as 0.12%bd for tension zone and 0.06%bd for compression zone when post-tensioning is active in the transfer plate.

1.2 OBJECTIVE OF THE PROJECT

This work intended to study behavior of high rise building with transfer plate at some elevation. Arriving the favorable layout or arrangements of the shear walls for the sake of prevention of soft story mechanism. Lateral response of the building with transfer plate is envisioned to evaluate.

1.3 SCOPE OF THE PROJECT

To Study Lateral Response of the building with transfer plate

To Study Response of the transfer plate against Construction sequence

To Study Natural Load path of the Transfer Plate

2. LITERATURE REVIEW

This paper had dealt with Behavior Transfer Plate subjected to seismic loading for different practical scenario. The following four major objectives were studied 1. Responses of the Transfer Plate for seismic Loading 2. Level of Seismic resistance of the building with transfer plate 3. Formation of Soft story mechanism 4. Modes of failure for cycles of linear time history analysis. Experiments are done

with 1:20 Scaled model also pseudo dynamic test was done with 1:40 model and result are verified with numerical models developed through the computer applications. In which simplified uncoupled approach is followed to obtain accurate result. Based on this approach it has been identified that story stiffness at apparently increased when coupled all vertical walls/columns with Transfer. With the Experimental and numerical result, it has been identified that transfer plate in high rise building having sufficient strength for moderate earthquakes. From that it has been recognized that structural failure of the building may be occurs just above the transfer Plate. Some of the national codes are highlighted which are claims the same points that relative stiffness alone defining the presents of soft story mechanism in high rise buildings where another approach ratio of deflection and inter story drift is use to predict the soft story failure.

3.1 METHODOLOGY:

Analysis and design were done in Etabs Software. The flow of analysis and design were given below flow chart below.

1.estabillishement of structural planning and layout

2.construction/altering the Etabs model with transfer plate

3. Application of vertical and lateral forces in Etabs model

4. Validation of seismic responses

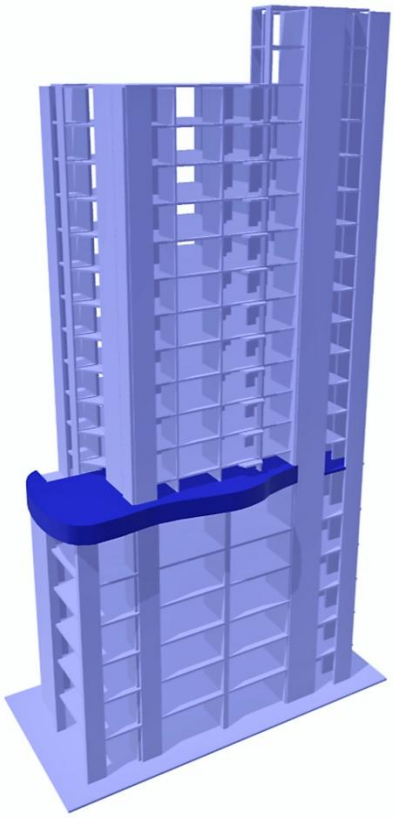
5. Preparation of final result design report and drawing

3.2 ABOUT THE BUILDING CONFIGURATION

This transfer plate design check consists of 6 Parking Floors and 15 Residential floors; The Transfer Plate is intended to support 15 floors above on it, which is located at 6th level of the building. Parking floor height 4m and residential floor height 3.05m

4.1 ANALYSIS

Analysis was done viz, global model analysis. The global model analysis was done with ETABS Software where full building was modeled for gravity and lateral loading comply with Indian Standards.



Global View of the Building

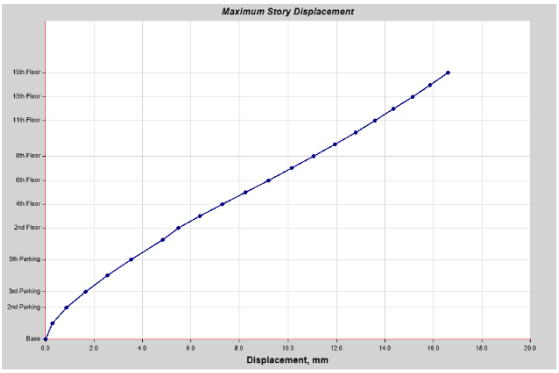
4.2 GLOBAL RESPONSE OF THESTRUCTURE FROM ETABS

Table-1

Case	Mode	Period sec	UX	UY	UZ
Modal	1	1.817	0.0482	0.463	0.000006787
Modal	2	1.654	0.5912	0.0357	0.00002535
Modal	3	1.016	0.0009	0.1517	0.00001425

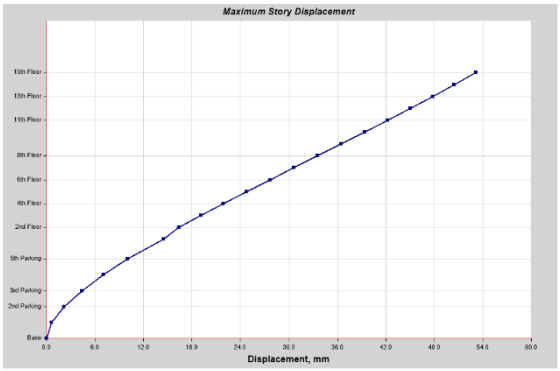
Time period check- Offset between time period of 1st and 2nd modes of the building response is found be 9% which within the limit specified by IS 1893 2016. And translations were found in first and second modes respectively torsion still prevailing in 3rd mode which is found in accordance of high-rise building code IS 1893 2016.teherfore building dynamic responses are fine.

4.3 LATERAL DISPLACEMENT VERIFICATION



Lateral Displacement for Wind-X

Since Building being stiffer in X-direction the maximum story displacement is being 16.6mm which is found to be very less with acceptable Limit of L/250 stipulated by IS 1893:2012.

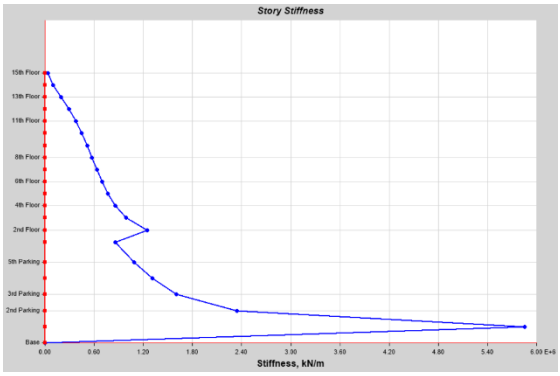


Lateral displacement for Wind-Y

The maximum story displacement due wind action in y-direction is being 53.2mm which is found to be less with acceptable Limit of L/250 stipulated by IS 1893:2012.

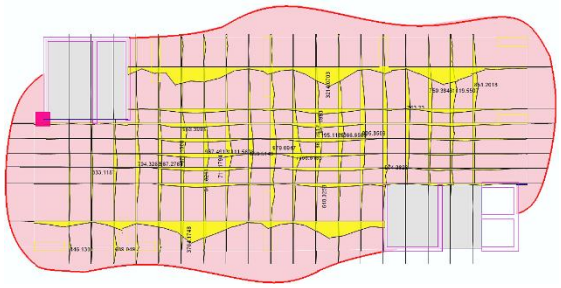
4.4 STORY STIFFNESS

Disposition's columns right above the transfer plate are abruptly changing from below floors for the sake of closer spaced walls for residential floors, this configuration results possibility of soft story mechanism. Which would take place when lateral forces are in relay especially where stiffness of above story is much higher than the below story. Therefore IS 1893 :2016 had laid tolerable criteria that stiffness of above story should not greater than 70% of stiffness of below story. In our study the relative stiffness found to be 68% which reveals soft story mechanism is not leading the failure.

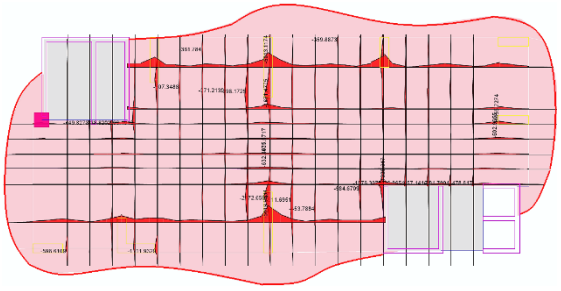


4.5 PLATE RESPONSE FROM ETABS

Bending Moment Diagram as Per Etabs Model



Maximum Sagging moment X&Y-Direction



Maximum Hogging moment X&Y-Direction

Maximum Sagging Moment Found to be 3704 kN.m and Maximum hogging Moment found to be 5619kN.m which has been compared with the plate analysis done from adapt.

5. CONCLUSION

In the recent past High-Rise Buildings are growing in a breakneck phase owing to the paucity of land space. Land cost becomes more and more, eventually, it pushes the engineering towards compact buildings with all amenities within the building itself. Transfer Plates are employed for those buildings to meet the demand. This study had shown that relative story stiffness is significant if the Transfer Plates are present in the building, although this is not only the crucial criteria for failure of such high-rise structures unless shear walls are properly proportioned, also the

elevation of the Transfer Plate with respect to ground plays a significant role in controlling soft story mechanism.

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