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Analysis Of Transfer Girder By Using Etabs

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Abstract: In many high-rise buildings, architectural requirements may result in a variable configuration for the vertical structural elements between the stories of the building. A comparative analytical study for structural performance of high rise building with transfer floor is presented. A number of models are analyzed using elastic linear response spectrum technique using three-dimensional finite element models on ETABS 2018. The analyzed models have different transfer floor system: transfer slabs and transfer girders. Global seismic response of the buildings such as storey shear and bending moment distribution and inter-storey drift are numerically evaluated. The numerical analysis is carried out to investigate which floor system improves the global behavior of structure.

***Index Terms* - Transfer girder, Response spectrum analysis, Storey displacement, Storey drift, ETABS 2018.**

I. Introduction

The transfer system is divided to deep girders or thick slabs while structural irregularity are divided into mass, stiffness and geometrical irregularity; where limitations for each of the type of these irregularities are specified in codes of practice to prevent the phenomena of soft story mechanism. Transfer system deformation is still ignored and assumption of rigid diaphragm is adopted in design. Transfer slab can redistribute the loads from superstructure above transfer plate to widely spaced columns and core walls below transfer slab. They easily facilitate incorporation of architectural layout to provide a column free open space area at lower stories Super structure having regular columns and load bearing shear walls usually sit on transfer floor to make provisions for facilities such as swimming pool, shopping mall, car parking, mass transit infrastructure, etc. Transfer slab system involves a podium structure that houses spaces functional areas such as a shopping mall, a large lift lobby, parking, commercial markets, multi-purpose halls, etc. For the upper part of structure, it is often used as office and residential units using more economical and shorter span design using transfer slab system between these two parts of the building has become common solution.

Figure 1 Transfer girder

The above figure 1 shows the high rise building with transfer girder provided at first storey. Here, transfer girder system is used to provide the open free spaces for parking, large lift lobbies, shopping mall at the lower storey while the upper part often used as office or residential units using shorter span design.

II. LITERATURE REVIEW

1. **Li C. S. (2008)** quantified the seismic performance of transfer plate in high rise building pseudo dynamic test. The 18 storey building with transfer plate tested in this study with no seismic provisions. They carried out pseudo dynamic test with history records. And concluded that shear wall remains elastic throughout loading history, whereas transfer plate is severely damaged when subjected to dynamic loading. Main damage occurred at transfer plate. So, transfer plate may have sufficient strength to resist possible earthquake actions. High-rise buildings with transfer floors generally suffer minor cracks 8 (conventional elastic behavior) when subject to frequent (minor) earthquake. However, severe cracking in the vicinity of the transfer floor is encountered when these buildings are subjected to rare (medium to major) earthquakes. Currently, reduced stiffness for cracked columns and walls is normally adopted for strength design of these buildings while full stiffness adopted for serviceability and drift design.

2. **Su R.K.L (2008)** Presented a shaking table test and numerical analyses, general seismic behavior of transfer structures is identified. The mechanisms for the formation of soft story below the transfer floors, the abrupt change in inter-story drift in the vicinity of transfer story and shear concentration due to local deformation of transfer structures are summarized. And conclude that, a stiffer transfer structure with higher flexural and shear stiffness can help in decreasing the abrupt change in the shear forces in the exterior vertical elements

3. **Yong L, Tassios T.P Zhang G.F and Vintzileou E (2009)** worked on "Seismic Response of Reinforced Concrete Frames with Strength and Stiffness Irregularities" recommended that if this irregularity is not taken into consideration during design stages, the structural irregularity may become a major source of building damage during strong earthquakes. Due to that vertical irregularity damage will occurs at floor between two different load resisting system in building during rare earthquake also.

4. **Zhang M. Ling and Abdelbasset (2011)** major drawback of any transfer floor is the abrupt change in the building's lateral stiffness in the vicinity of its level; a direct consequence of such irregularity is that the deformation of a soft-storey mechanism under moderate to severe earthquakes or lateral wind loads imposes high ductility demands on the elements in the vicinity of the transfer floors. Therefore, if this irregularity is not taken into consideration during the design stages, it becomes a major source of damage during strong earthquakes.

5. **El-Awady (2014)** pointed out to the severity of the drift in the vicinity of the transfer floor on the level of damage occurring to these buildings. This investigation showed the significant effect of the lateral flexure and shear stiffness of the vertical elements above/below the transfer level on the drift values.

III. PROBLEM STATEMENT

A ten storey building model has been selected and to be analyzed in the course of this study. The building has a plan area of 13.5m x 13.5m. A 10 storey building model with transfer girder provided at different floor levels. And also for transfer girder at different floors along a building height, a 10 storey building has been analyzed.
Building size = 13.5m x 13.5 m Floor
Height above and below transfer floor = 3.5 m
Transfer girder = 0.3m X 0.6m Slab thickness = 125mm
The table 1 shows dimensions of building models for 10 storey building. The building has floor plan of 13.5m X 13.5m with total building height 40.5m.

Table 1 Description of building models and dimensions

Number of stories	Outer wall dimension (m)	Inner wall dimension (m)	Slab thickness transfer floor(m)	Building height (m)
10	0.230	0.150	0.125	40.5

Seismic Zone = 2,
Response reduction factor = 5
Live load seismic mass reduction factor = 0.5
Super imposed dead load = 1 KN / m2
Live load : 2 KN / m2

IV. TRANSFER GIRDER

Structural analysis program ETABS 2018 software was used for performance analysis of high rise building with transfer girder. For the study, different building models are analyzed using response spectrum analysis. A five different models of 10 storey building with transfer girder provided at different floor levels such as 1st floor, 4 th floor, 7 th floor and 10th floor levels are analyzed. The seismic response plots such as storey shear, storey moment, Storey disp and Storey drift are described here. A complete analysis and results for the buildings models are given below

1. NUMERICAL ANALYSIS

To scrutinize the level of transfer girder in high rise building, the linear dynamic response spectrum analysis was conducted on models by using ETABS 2018 software.

2. RESPONSE SPECTRUM FUNCTION

Response spectrum analysis is linear dynamic statistical analysis method which indicate the maximum seismic response of an elastic structure from natural mode of vibration.

For the Response spectrum function the scale factor is given by,

$$\text{Scale Factor} = \frac{I.G}{2R}$$

Where,

I= Importance factor

G= gravity force

R= response modification factor

To investigate the transfer floor level along a building height, a four different models has been analyzed with transfer girder. Now in this case, transfer girders are provided at 1 st floor, 4 th floor, 7 th floor and 10 th floor levels and analyzed using response spectrum analysis. The below figure shows the five different models of building providing transfer girder at 1 st floor, 4 th floor, 7 th floor and 10 th floor levels

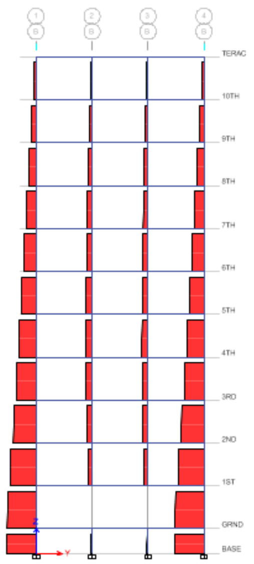

Fig -2.1: Transfer girder at 1st floor

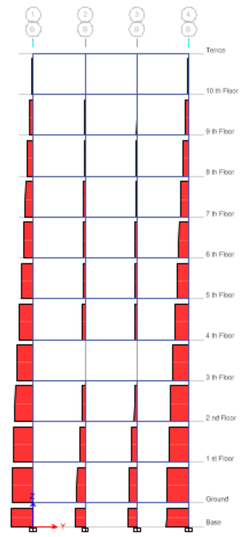

Fig -2.2:Transfer girder at 4th floor

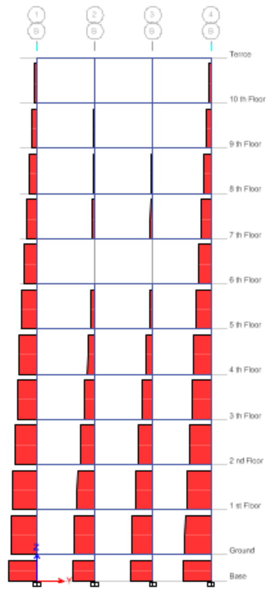

Fig -2.3: Transfer girder at 7th floor

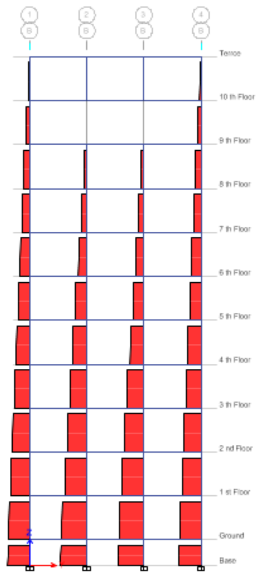

Fig -2.4:Transfer girder at 10th floor

Fig -2:Models with transfer girder at different floors

V. RESULTS

A structural analysis program ETABS 2018 software was used for performance analysis of high rise building with transfer floor system. For this different building models were analyzed using response spectrum analysis. A five different models of 10 storey building with transfer floor provided at different floor levels such as 1st floor, 2nd floor, 3rd floor and 4th floor levels were analyzed. And vertical position of transfer girder with respect to building height was investigated. For this seismic response graphs of the building such as storey displacement and storey drift were numerically evaluated.

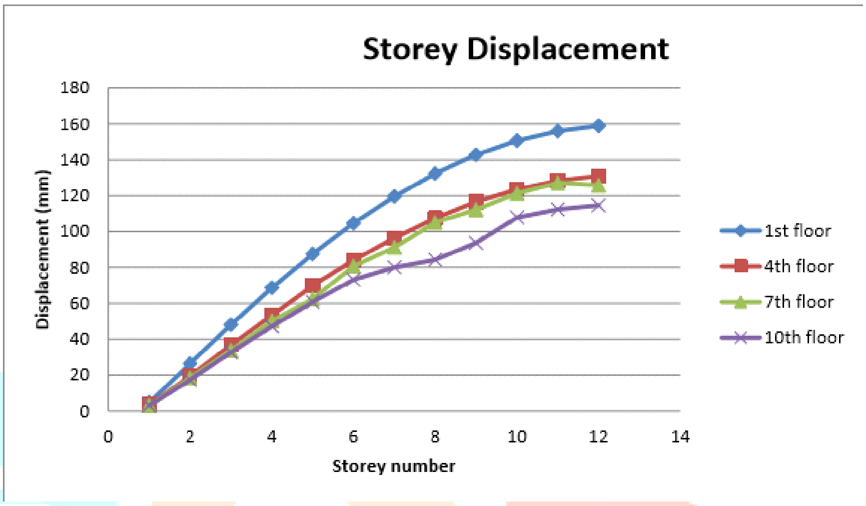

Figure Storey displacement (x dir)

Figure Storey displacement (y dir)

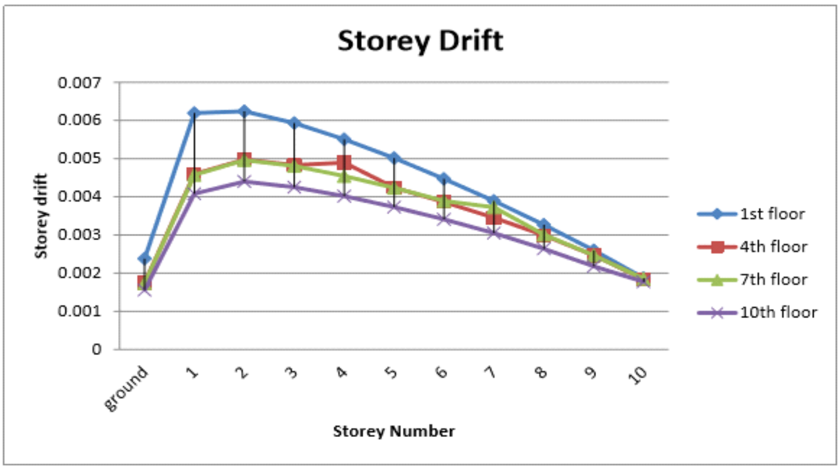

Figure 4.2.13 storey Drift (x dir)

Figure 4.2.13 storey Drift (y dir)

VI. CONCLUSIONS

Location of the transfer floor within the building height also controls the maximum drift location. this is th issue which will enable designers to take the suitable precutions to have a safe design from serviceability point of view. Roof drift for building with lower level transfer floor is higher than that of building with transfer floor located at higher level. Storey drift is decrease the height of structure in each model. This study also represent the end forces decrease if transfer beam are started from 5th floor level than 2nd floor. Vertical location of transfer floors with respect to total height of the building has a significant effect on high rise building; introduction of the transfer floor in the lower part of the structure (20-30% of the total height of the structure from its foundation) is better than having it in a higher location. If transfer beam are used in framed structure it will reduce dead load of structures. As such, conclusion drawn here to higher level transfer floor is safe as compaired to buildings with lower transfer floor.

REFERENCES

[1] Yoshimura M., "Nonlinear Analysis of a Reinforced Concrete Building with a Soft First Storey Collapsed by the 1995 Hyogoken-Nanbu Earthquake", Cement and Concrete Composites, Vol. 19, No. 3, 1997, pp. 213-221

[2] Li C.S., Lam S. S. E., Zhang M. Z., and Wong Y. L., "Shaking Table Test of a 1:20 Scale High-Rise Building with a Transfer Plate System", ASCE Journal of Structural Engineering, Vol. 132, No. 11, 2006, pp. 1732–1744.

[3] Su R.K.L., "Seismic Behaviour of Buildings with Transfer Structures in Low-toModerate Seismicity Regions", eJSE international Special Issue: Earthquake Engineering in the low and moderate seismic regions of Southeast Asia and Australia. 2008, pp. 99-109.

[4] Paulay T., and Priestley M. J. N., "Seismic Design of Reinforced Concrete and Masonry Buildings", John Wiley & Sons, New York, USA. 1992.

[5] Yong L., Tassios T.P., Zhang G.F., and Vintzileou E., "Seismic Response of Reinforced Concrete Frames with Strength and Stiffness Irregularities", ACI Structural Journal, Vol. 96, No. 2, 1999, Title no. 96-S24.

[6] Zhang, M., & Ling, Z., "Dynamic analysis of elastoplastic performance of tall building with arch transfer floor subjected to severe earthquake [J]". Journal of Beijing Jiaotong University, 2011, 6, 008.

[7] El-Awady, A.K., Okail, H.O., Abdlerahman, A.A., SayedAhmed E.Y., "Seismic Behaviour of High-Rise Buildings with Transfer Floors", Electronic Journal of Structural Engineering eJSE, 2014, 14(2), pp. 57-70.

[8] Yasser Abdelbasset, Sherif mourad, Ahmad, " Seismic Behaviour of High-Rise Buildings with Transfer Floors;state of art of review", Electronic Journal of Structural Engineering eJSE, 2016