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ANALYSIS OF MUILTYSTOREY BUILDING BY USING TRANSFER FLOOR

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Abstract - *A transfer floor is the floor system which supports a vertical as well as lateral load resisting system. A transfer its loading to different underneath system. Transfer floor distribute the load from closely spaced columns to the columns with long span. This study presented, a seismic analysis of muiltystorey building with transfer floor. A different type models of high rise building were analyzed using linear response spectrum analysis. The models were analyzed using structural software for building analysis ETABS 2018 software. The analyzed models has transfer girder system at different floor levels in high rise building. In this paper, four different models of 10 storey building had studied by providing a transfer girder at different floor levels such as first floor, second floor, third floor and fourth floor of the building. And the vertical position of transfer girder with respect to building height was investigated. The seismic response of high rise building such as storey shear, storey moment, storey displacement, inter-storey were numerically evaluated.*

Key Words: *Transfer girder, Response spectrum analysis, Storey shear, Storey moment, ETABS 2018.*

1. INTRODUCTION

In large and populated cities, the need to have buildings with various operational demands has been increased. To accommodate the multiple architectural requirements, the location, orientation, and dimensions of the vertical and lateral load resisting elements vary every certain number of stories. In such cases, a transfer floor is commonly used to solve this persistent structural-architectural conflict. A transfer floor is the floor system which supports a system of vertical and lateral load resisting elements and transfers its straining action to a different underneath system. Transfer systems are generally used in multifunction structures, in which the lower stories of the building usually are used as open public areas, while floors above that transfer system could accommodate typical residential or office spaces. Several structural system could be used for such buildings as the lateral resisting system below/above the transfer floor may be moment-resisting frames, core walls and structural walls. The transfer structures may be in form of transfer girders or transfer slabs. Many buildings are constructed with these vertical irregularities (column and shear wall). In Transfer floor is provided between these two different column arrangements. A transfer girder is the floor system which supports vertical as well as lateral load resisting system. A transfer floor had different floor systems such as transfer slab and transfer girder. Depending upon the distribution of loads above the transfer structure, the type of transfer floor system is chosen

Fig -1. Transfer girder

Yong et al. [1] concluded that if this irregularity is not taken into account during analysis, then this irregularity may become major source of building damage during strong earthquake.

Yoshimura [2] also concluded that, if soft storey mechanism occure, the collapse should be unavoidable even for building with base shear of 60% of total weight.

Y.M. Abdlebasset[3] Presented a state-of-the art review on seismic behavior of high rise buildings with transfer floors. The review discusses the effect of the sudden change in the building stiffness on the building and story drifts distribution along the building height. And concluded that irregularity in upper stories would have a little effect on the floor displacements, while, irregularity in lower stories would have a significant effect on floor displacement along a building height.

Li et al.**[4]** Quantified the performance of transfer slab in high rise building using pseudo dynamic test. The 18 storey building with transfer plate tested in this study 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. then transfer plate may have sufficient strength to resist possible earthquake actions.

Yoshimura and Li et al. [5] recommended that the sudden change in lateral stiffness at transfer floor from stiff shear wall structure to relative column system may create a weak storey mechanism and violates the design concept of strong column weak beam.

2. BUILDING DETAILS

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 / m^2
Live load : 2 KN / m^2

3. 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.

3.1 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,

Scale Factor =

$$\frac{I.G}{2R}$$

Where,

I= Importance factor

G= gravity force

R= response modification factor

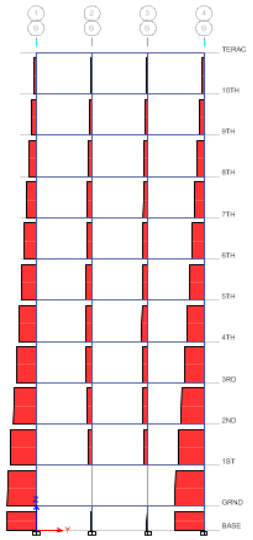

Fig -2.1: Transfer girder at 1st floor

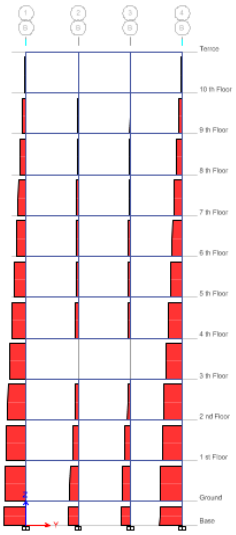

Fig -2.2: Transfer girder at 4th floor

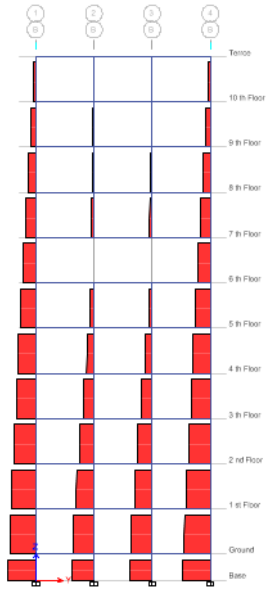

Fig -2.3: Transfer girder at 7th floor

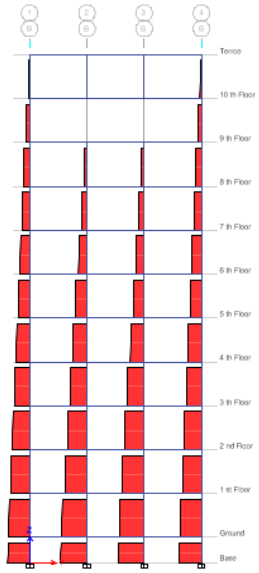

Fig -2.4: Transfer girder at 10th floor

Fig -2: Models with transfer girder at different floors

4. 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 shear, storey moment, displacement and inter-storey drift were numerically evaluated.

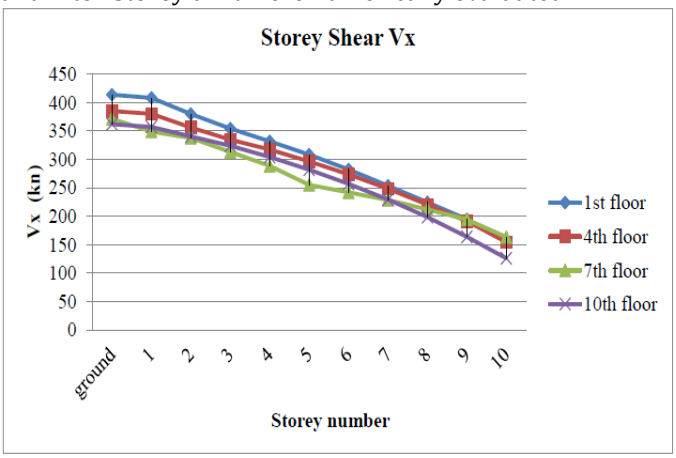

Chart -1 Storey shear distribution for building models resulting from linear spectral analysis.

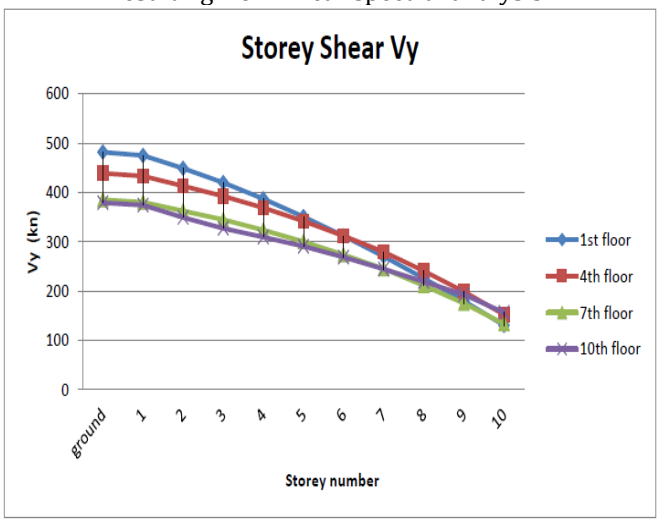

Chart -2 Storey shear distribution for buildings models resulting from linear spectral analysis

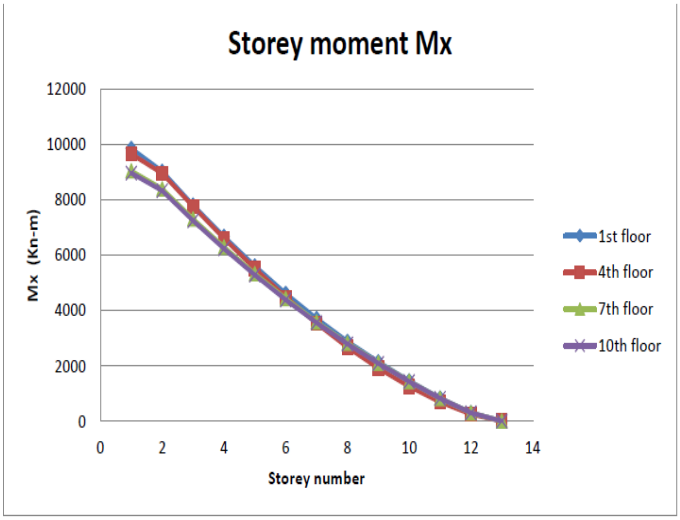

Chart -3 Storey moment distribution for buildings models resulting from linear spectral analysis.

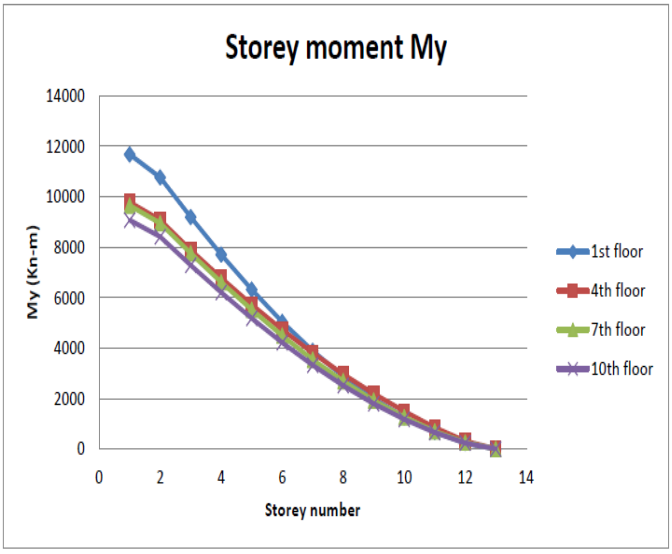

Chart -4 Storey moment distribution for buildings models resulting from linear spectral analysis.

5. CONCLUSIONS

An analytical study was conducted to investigate vertical position of transfer girder in high rise building. A number of building models were analyzed by using elastic response spectrum. The transfer girder system was considered and different level for transfer floor with respect height to building height was scrutinized. The total base shear moment is increases as transfer floor lies at higher level. .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. This study also represent the end forces decrease if transfer beam are started from 5th floor level than 2nd floor.

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