JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

SEISMIC ANALYSIS OF HIGH RISE BUILDING WITH TRANSFER FLOOR

[1]Gaurva Rarokar, [2]Sanjay Denge,

[1]PG Student, [2]Professor,
[1]Civil Engineering Department,
[1]V.M. Institute of Engineering & Technology, Nagpur, India

Abstract : As the population grows, so does the demand for land and all of the facilities that go with it. Additionally, architectural requirements necessitate variations in the vertical elements of the structure between the stories of the structure, as well as the introduction of transfer floor structures that provide all of the facilities in one location, while also supporting the vertical and lateral load systems and transfers. The current study indicates that three 12 storey models were constructed on ETABS software with transfer slabs at the 1st, 3rd, and 5th floors, and the response spectrum analysis was studied and the results were compared to reach a conclusion.

***IndexTerms* - Transfer floor, Seismic load, Lateral & Vertical load, response spectrum analysis.**

I. Introduction

In developing countries such as India, China, Turkey, and Qatar, population is increasing every day, as is the demand for land with multiple uses and facilities in one location, i.e. commercial and residential. Similarly, inventive architecture designs necessitate a change in the position of the vertical elements of the structure between floors. In a commercial, function room, malls, parking areas, etc. below the transfer floors system and above the building structure can be used both for residential and offices purposes, while the structure with transfer floor can be used for commercial and residential purposes, with an economical layout. The columns are arranged in a longer span, however the top structure contains a close spacing for a shorter span. For this purpose, the podium or mall structure is spacious. The utilisation of transfer floors has become known among different building components. Today, numerous structures have been designed with vertical irregularities and can be columns or shear walls. The floor transfer system is the palace between the two columns. The two different floor systems of the transmission dome and the transfer dome are used in accord with the load distribution on the structure. The figures on the first floor transfer slab are shown and in figure 1.1 and in figure 1.2 shear wall above the transfer slab the irregular column arrangement is shown.

Figure 1:- Transfer slab With Shear wall

Figure 2:- Transfer slab With Column

II. METHODOLOGY & BUILDING DETAILS

This study illustrates the spectrum of response & wind analysis for the analysis using the E-Tabs programme of a specified model. References to the Indian IS 1893 & IS 875 code are analysed (PART3). The floor plan is 28m X 48m and a model with 12 floors is chosen. The model was picked with the transmission sheet at different building levels. The biaxial symmetric construction plan was chosen to exclude the effect of torsion. There were three separate models, 3.5 m below and 3.0 m above the transfer plate, and the model was analysed in the 1st, 3rd and 5th floors on the transfer plate.

A. Loadings

Live load Above and at the transfer slab level = 2 kn/m2

Below the transfer slab = 3.5 kn/m2

Dead load

Wall load

Above the transfer slab = (4.14 + 2.07) kN/m2

Below the transfer slab = (3.312 + 1.656) kN/m2

Floor finish

Above and at the transfer slab = 1 kN/m2

Below the transfer slab = 1.5 kN/m2

Response reduction factor = 3

B. Dimensions of the Building

Storey =12 storey

Column dimensions

Above the transfer slab = 0.3 x 0.6 m

Below the transfer slab = 0.5 X 1 m

Slab thickness- Transfer slab = 1m

Above & below transfer slab = 0.15m

III. ANALYSIS

Analysis of the response spectrum is a linear statistical dynamic. Analytical approach representing the highest possible earthquake. Reaction of the inherent elastic structure Vibration. The dynamics of response spectrum analysis Speed or measuring behaviour by spectral speed. Displacement according to a certain building era Time and weather history. The scaling factor for the response range function is assigned.

S.F = I x G / R

Where, I = Importance factor

R= Response reduction factor

G=Gravity force

Re-scaling = (I x G / R) x (Static base shear / Response spectrum base shear)

IV. STRUCTURAL MODELLING

For the analysis, a transmission sheet in the structure with columns below and above a transmission sheet was chosen, as shown in Fig. 6.1 & Fig. 6.2. Model was examined for vertical positioning on E-tabs software. The analysis was performed using E-tabs, following three models with a transmission plate at the 1st, the 3rd and 5th floors.

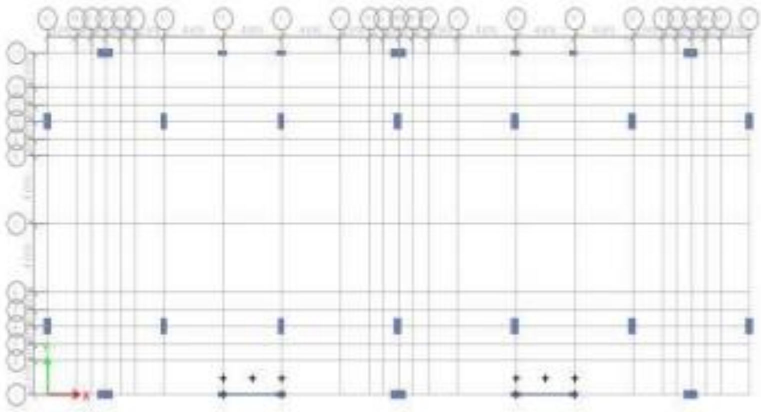


Figure 5.1

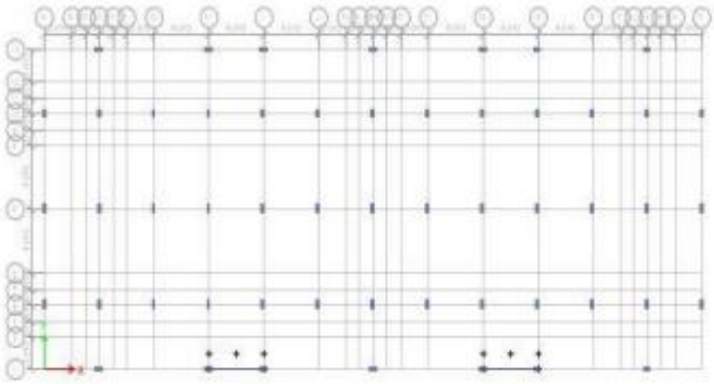


Figure 5.2

Figure 5.3, 5.4 & 5.5 shows the position of the transfer slab in the building,

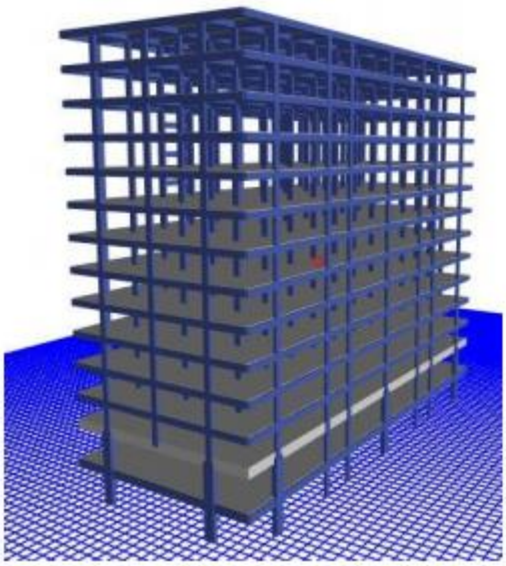


Figure 5.3

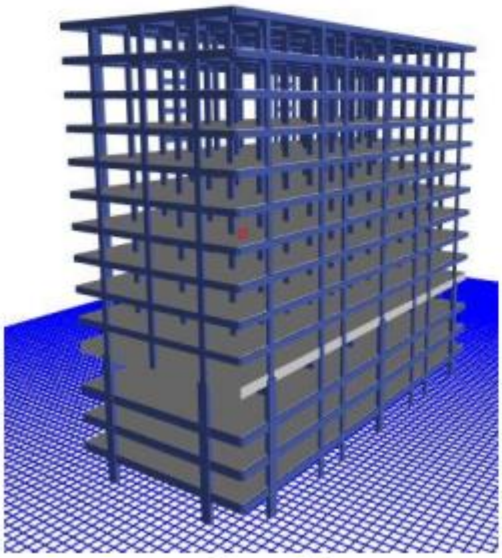


Figure 5.4

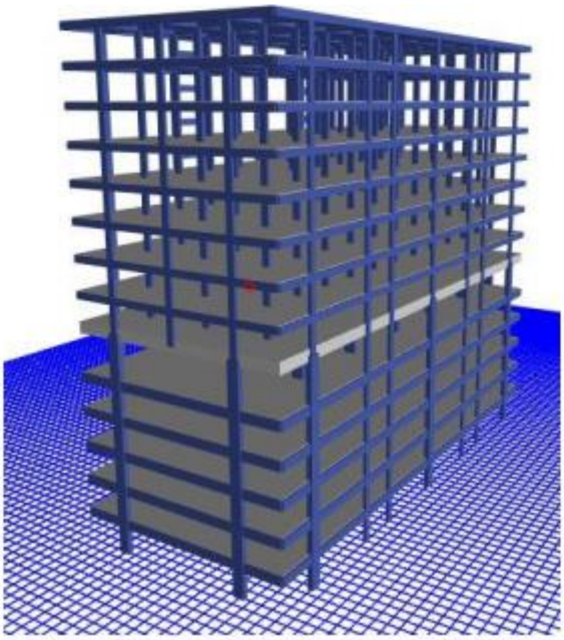


Figure 5.5

V. RESULT AND DISCUSSION.

In order to assess the structure's behaviours, the vertical position of the transfer sheet in the structural software was analysed in the E-tabs. Three different 12 stories were examined and analysed. 12 floor models were studied using 1st floor transfer slabs, 3rd floor & 5th floor Shear and drift results given in the form of diagrams from the analytical displacement. The section shows all models in the following way about the position of the transmission slab results.

A. Storey shear

B. Lateral displacement

C. Storey drift 1) Model 1: (Transfer slab at 1st floor level)

a) Storey Shear: The following graph shows maximum floor shear for each storey, fig. 6.1 for the first model with a 1-st floor transfer plate. Linearly, shelf shearing in x-direction decreases on the top floor levels, with a maximum floor shear of 1398,507 KN dropped to a maximum level of 241,97. Fig. 6.2 shows the shelf shear in Y-direction at the lower and the lower level of the models.

Figure 6.1 Maximum storey shear in direction of X

Figure 6.2 Maximum storey shear in direction of Y

b) Displacement: the X-direction & Y-direction joint displacement depicted in Fig 6.3 & 6.4. On the top floor, with a value of 24.374 mm & 21.906 mm correspondingly, maximum displacement in the 1st model with transducing plate is seen.

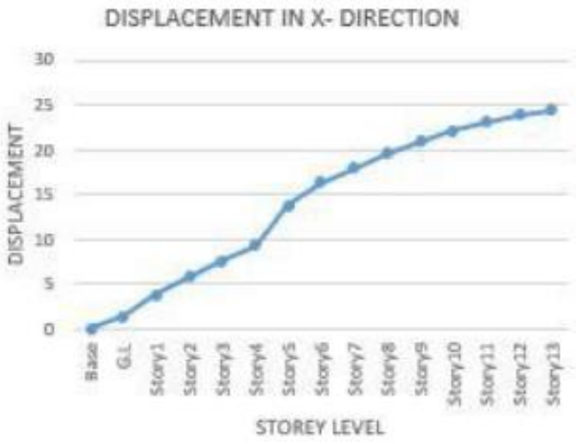


Figure 6.3 Joint displacement in direction of X

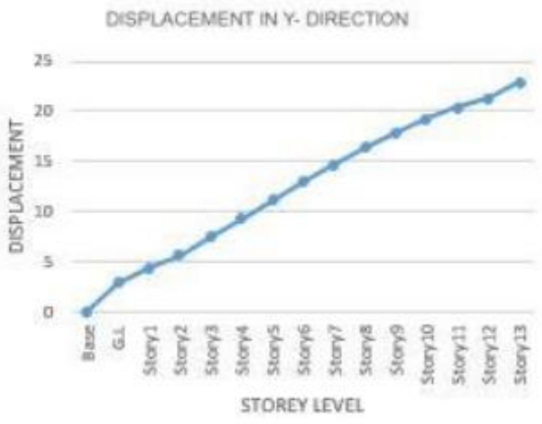


Figure 6.4 Joint displacement in direction of Y

c) Storey drift: The largest value of storey drift is at first level and thereafter declines to the top level in Figure 6.5.

Figure 6.5 Joint Drift

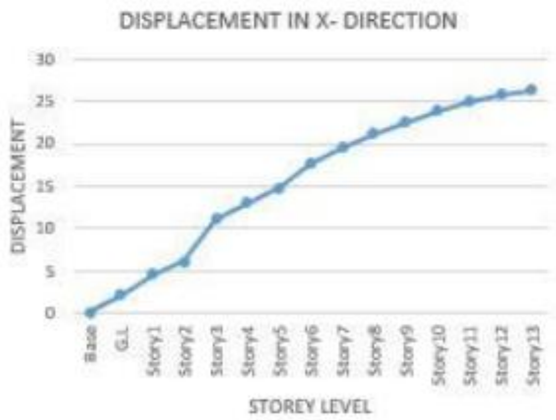
2) Model 2: (Transfer slab at 3rd floor level)

a) Storey Shear: Fig. 6.6 & 6.7 displays the graph of shear values at each level shown by the Transfer Slab model on the ground level of 1447.224 & 1963. 261 KN are the maximum value of shear on the lower level of the structure in this model.

Figure 6.6 Maximum storey shear in direction of X

Figure 6.7 Maximum storey shear in direction of Y

b) Displacement: The transfer plate of this model is located at the 3rd floor. This model gives the magnitude of the lateral shift in the x-direction & y-direction, as illustrated in Fig 6.8 & 6.9, respective 26.281 mm and 32.413 mm respectively.



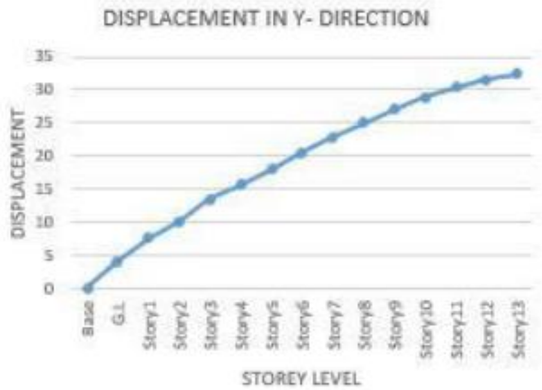


Figure 6.8 Joint displacement in direction of X Figure 6.9 Joint displacement in direction of Y

c) Storey Drift: Figure 6.10 depicts the floor drift of the model-2, where the transfer layer is on the 3rd floor level. The next figure The graph demonstrates that the drift value continues to grow up to the transfer plate level, which then decreases to the third level.

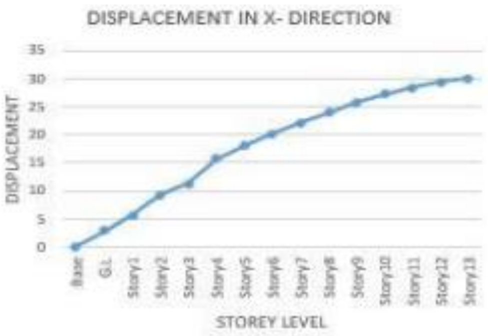
Figure 6.10 Storey Drift

3) Model 3: (Transfer slab at 5th floor level)

a) Storey Shear: This model depicts the transmission plate on the fifth floor. Fig. 6.11 & Fig. 6.12 show the shear values. In the x-and-y-direction, the greatest value observed of the shear values are 1610.67 KN& 1983.24 KN.

Figure 6.11 Maximum storey shear in direction of X Figure 6.12 Maximum storey shear in direction of Y

b) Displacement: The displacement graphs Fig. 6.13 & Fig. 6.14 highlight the movement from the ground floor to the top floor in the lateral X & Y-Director graphics. On the top floor of a structure with the values of 29,932 mm & 33,413mm are the greatest values of joint displacement noted.



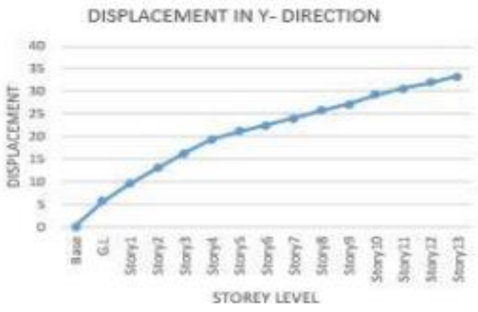


Figure 6.13 Joint displacement in direction of X Figure 6.14 Joint displacement in direction of Y

c) Storey Drift: The following graph Figure 6.15 demonstrates how the floor drift of model-2 is located on the 3rd floor of the transfer sheet. The graph demonstrates that the drift value continues to grow up to the transfer plate level, which then decreases to the third level.

Figure 6.15 Storey Drift

V. COMPARISION RESULT

All the models are compared in order to understand the behaviour of all structures with respect to the position of the transmission plate. The result shaving, joint shift and maximum shielding drift given in this section are compared.

A. Storey Shear

Figure 7.1 and 7.2 below illustrates the shop shears for the 12-story models with transfer slabs at different positions in the building in Both X & Y direction. When observing the figures, it shows that the level of shear is reduced in x and y direction, as the location of the transfer plate is in the lowest position compared to the entire building height, the shear is decreased gradually. When the position of the transfer shear is higher and lower, the storey shear value is more.

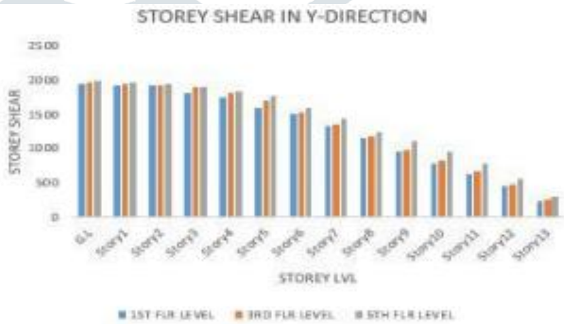


Figure 7.1 Maximum storey shear in direction of X Figure 7.2 Maximum storey shear in direction of Y

A. Displacement

Below figures 8.3 & 8.4 show the results of analyses in the building from which joint displacement in X & Y directions observation was explored, for the 12-story model with a transfer plate in different locations. By looking at the figure, it shows that the position of the transferring lab increases more and the displacement increases as the height of the structure increases, i.e. the displacement over the transferring label increases and the displacement under the transfer layer decreases.

Figure 8.3 Joint displacement in direction of X

Figure 8.4 Joint displacement in direction of Y

C. Storey Drift

The drift of structure from several transfer plate sites is illustrated in figure 8.5, below, and the drift across the transfer plate is seen to reduce and rapid increase at the transfer plate level. Figure 8.5 below

Figure 8.5 Storey Drift

VI. CONCLUSION

To avoid serious structural damage, imperfections in the structure should be considered when constructing a building with a transfer floor, and columns with separate footings have better lateral stiffness than floating columns on a transfer floor. Minor earthquakes do not cause cracks to form, and the structure stays pliable.

- To observe the transfer slab vertical position in the structure a study was supervised, with the different locations of the transfer slab in the structure with respective to the height of structure. Following are the some conclusion obtained by study.
- There is increase in storey shear as the transfer floor system location is in the lowest position in the building as compared to the total height of building.
- Story shear goes on decreasing above transfer slab position in every case because of unusual mass devaluation.
- Decrease in the displacement as the location of transfer slab at lowest level and increase when it is at upper level in X & Y directions.
- Drift value goes on increasing up to the transfer slab level and then sudden goes on decreasing.
- Maximum base shear value goes on increasing when the position of the transfer slab is at higher level & lesser when the location of transfer slab is at the lower level.

REFERENCES

[1] Mohammed Abdul Sameer, M. A. Azeem "A Study on Seismic Performance of Tall Buildings with Transfer Plate" International Journal of Applied Engineering Research ISSN 0973-4562 Volume 14, Number 8 (2019) pp.1849-1859.

[2] Kong Wei-yi, Fu Chuan-guo, and Song Ya-min, " Internal Force Analysis of Reinforced Concrete Structure with Bearing Column Girder Transfer Floor in Fire" International Journal of Structural and Civil Engineering Research Vol. 7, No. 3, August 2018

[3] Neelkanth D. Joshi, Dr. M. M. Murudi "EFFECT OF TRANSFER GIRDER ON SOFT STOREY CONDITION OF FRAME FLOATING FROM IT" International Journal of Technical Innovation in Modern Engineering & Science (IJTIMES) Impact Factor: 5.22 (SJIF-2017), eISSN: 2455-2585 Volume 4, Issue 09, September-2018.

[4] Mehair Yacoubian, Nelson Lam, Elisa Lumantarna and John L. Wilson "Simplified design checks of buildings with a transfer structure in regions of lower seismicity" The 2017 World Congress on Advances in structural engineering and mechanics(ASEM17), 28 August-1-September 2017, llsan (Seoul), Korea.

[5] Y.M. Abdlebasset, E.Y. Sayed-Ahmed, S. A. Mourad, "High-Rise Buildings with Transfer Floors: Linear Versus Nonlinear Seismic Analysis", Electronic Journal of Structural Engineering 16(1) 2016.

[6] Yasser M. Abdlebasset, Ezzeldin Y. SayedAhmed, Sherif A. Mourad, "HIGH-RISE BUILDINGS WITH TRANSFER FLOORS: CONSTRUCTION STAGES ANALYSIS" Journal of Al Azhar University Engineering Sector, Vol. 11, No. 40, July, 2016, 927-942.

[7] 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.

[8] Tamrazyan A., Seyed Mehdi Zahrai, Hassan Negahdar "Study of Monolithic High-rise Buildings with Transfer Floors under Progressive Destruction in the Nonlinear Formulation. 15WCEE LISBOA 2012

[9] Zhua, R.K.L. Sub, "Influence of Local Deformations of Transfer Structures on Seismic Design" The 14th World Conference on Earthquake Engineering, October 12-17, 2008, Beijing, China.

[10] R.K.L. Su, "Seismic Behaviour of Buildings with Transfer Structures in Low-to-Moderate Seismicity Regions" Earthquake Engineering in the low and moderate seismic regions of Southeast Asia and Australia (2008).

[11] Jack Zunz, Chris Wise , Structural Systems Transfer Structures.

[12] Khan, P. I., and Dhamge, N.R., (2016). "Seismic analysis of multistoried rcc building due to mass irregularity." IJEDR 4(3).