Comparison of Effects of Wind Load and Earthquake Load Applying on Tall Building using ETABS 2015 15.1 Software

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Abstract - ***Tall Building, a buiding where lateral loads such as wind load and earthquake load play an important role in structural analysis and designing. ETABS-2015 15.1 is used for analysis of the building for wind load and earthquake load analysis. Earlier, it has been used in the analysis and designing of Burj Khalifa, Dubai. Large number of structural consultants are using this software for the analysis and designing of multistoried buildings. Here, the research work includes the comparison of effects of wind load and earthquake load applying on the tall structure, has been analysed using ETABS-2015 15.1. All analysis is done by considering IS-800,1987 and IS-1893, 2002 . Later on , a comparative statement has been made.***

Keywords: Structural Modelling & Analysis , Wind Loaad, Earthquake Load and ETABS-2015 15.1 .

I. INTRODUCTION

The lateral loading due to wind or earthquake will govern the design the tall structures.Generally, for low height structures , wind load does not play any crucial role in comparision to the load due to earthquake.However, for high rise structures , wind load plays lead role as compared to the earthquake load. Moreover, wind load is applied on the building every day whereas earthquake load occurred once in a while.

Wind load analysis can be done through methodologies such as exposure from the diaphragm (for regular structure) , exposure from the shell objects (for irregular structure), gust factor calculations (if frequency of building is less than 1 Hz) and wind tunnel analysis (for high rise buildings having more than 35 stories).

Earthquake load analysis is completed by either static analysis or dynamic analysis. Static earthquake analysis includes the gradual action of force while Dynamic earthquake analysis imbibes instantaneous action of force.

Structure Softwares are used for abovesaid purposes. Here, we are taking the help of ETABS 2015 15.1 for the analysis of structure for wind and earthquake loads. ETABS 2015 15.1 is one of best tool for the structural analysis and designing. At the end, comparison of the effects of wind load and earthquake load for the 8 storied building has been made.

The project deals with the difference of effects of story shears through both wind load analysis as well as earthquake load analysis. A 25mx25m 8 storey building is modelled by ETABS software. Each storey is having 3mts height and that makes height of the building 24m. Thereafter , analysis and d of the structure is done and then the respective results will be compared. Additionally, future aspect for this research will be discussed.

II. SYSTEM MODEL

A 25 mt x 25 mt 8 storey regular structure is considered for the study. The modelling and analysis of the structure is done on ETABS 2015 15.1 software. The building plan considered is shown in Figure 1.

III. PREVIOUS WORK

Earlier, Khaled M. Heiza , Magdy A. Tayelsome presented a paper on “Comparative Study of The Effects of Wind

and Earthquake Loads on High-rise Buildings”. The paper includes the effects of lateral loads i.e. wind load and earthquake load in the design of the building. A computer program has been developed to analyse the rcc building for wind load as well as earthquake load by considering Egyptian code for building. Five different parameters are used for the comparision between the effects through wind and earthquake loads. A 12 storied building containing columns and shear walls is taken for the analysis purpose. Later on, comparative statement has been made to show the effects of building for wind loads and earthquake load.

IV. PROPOSED METHODOLOGY

The regular 8 story building is having 5 bays of width 5m.

The structure is made up of Reinforced Cement Concerte. The important structural parameters are given in Table-1.

TABLE 1. PRELIMINARY DATA

Length x Width	25m x 25m
No. of storeys	8
Storey height	3m
Beam	400 mm x 400mm
Column 1-5 storeys	500mm x 500mm
Slab thickness	130mm
Support conditions	Fixed
Beam Releases	Axial force

The loads acting on the structure are Dead Load , Live Load ,Wind Load and Earthquake Load.
Dead Load (DL) includes self - weight of the building , Floor Finishes and Wall Loads.
Wall Thickness – 115 mm
Live Load - 2 kN/m^2
Floor Finish - 1 kN/m^2
Wall Load – 5.98 kN/m^2 (As per the calculation)
Soil Type – II
Plastering is not considered
Grade of Concrete – M30
Grade of Steel - Fe500

Wind Load Analysis Parameters
Basic wind speed = 47 m/s (Agra)
k1 = 1
Terrain category = 4
Class = B
k3 = 1
h= 24 – 3 =21 m
w = 25 +1 = 26 m
l = 25 + 1 = 26 m

Earthquake Load Analysis Parameters
T = 0.432 sec
R = 3
Z = 0.16
I = 1

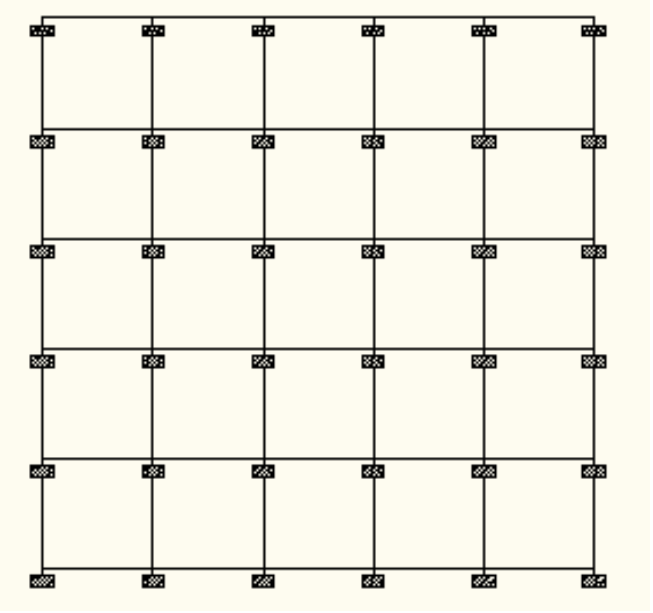

Fig.1 Plan of the regular structure considered

V. SIMULATION/EXPERIMENTAL RESULTS

Results of base reactions of a structure for different loads have been given in Table-2.

TABLE 2. BASE REACTIONS

Loading	Force/Moment	Magnitude
DL	Fx	0
	Fy	0
	Fz	49164.91
	Mx	614561.31
	My	-614561.31
	Mz	0
LL	Fx	0
	Fy	0
	Fz	8750
	Mx	109375
	My	- 109375
	Mz	0

Loading	Force/Moment	Magnitude
ELx	Fx	3400.87
	Fy	0
	Fz	0
	Mx	0
	My	55310.41
	Mz	42510.89
ELy	Fx	3400.87
	Fy	0
	Fz	0
	Mx	0
	My	55310.41
	Mz	42510.89

Loading	Force/Moment	Magnitude
WX1	Fx	- 354.95
	Fy	0
	Fz	0
	Mx	0
	My	- 5082.4
	Mz	4436.93
WX2	Fx	0
	Fy	- 354.95
	Fz	0
	Mx	5082.4
	My	0
	Mz	- 4436.93

Loading	Force/Moment	Magnitude
WY1	Fx	- 448.36
	Fy	0
	Fz	0
	Mx	0
	My	- 6419.88
	Mz	5604.55
WY2	Fx	0
	Fy	- 448.36
	Fz	0
	Mx	6419.88
	My	0
	Mz	5604.55

VI. CONCLUSION

Through analysis results, we can come to conclude that the earthquake load analysis gives higher lateral forces as compared to the wind load analysis for the given structures.

Moreover, according to the Indian codes , we can choose only one load among the both wind load and earthquake load. Therefore, higher magnitude of lateral forces (i.e. story shears) due to earthquake load analysis will be preferred for the above said structure.

VII. FUTURE SCOPES

This research will be helpful in selection between wind load analysis and earthquake load analysis. So that, we can choose right analysis methodology for the structure. This research will help in enhancement of strength of the structure , as per the available condition.

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