International Journal of Engineering, Management, Humanities and Social Sciences Paradigms (IJEMHS)
Volume 30, Issue 04, Quarter 04 (Oct-Nov-Dec 2018)
An Indexed and Referred Journal with Impact Factor: 2.75
ISSN (Online): 2347-601X
www.ijemhs.com

A Review on ETABS to Prevent Seismic Effect on Multi Storey Building

Mukul Saini[1] and Jaswant Singh[2]

[1]M. Tech. Scholar, Department of Civil Engineering, CBS Group of Institutions, Jhajjar, Haryana (India)
[2]Assistant Professor, Department of Civil Engineering, CBS Group of Institutions, Jhajjar, Haryana (India)

Publishing Date: December 21, 2018

Abstract

The input, output and numerical solution techniques of ETABS are specifically designed to take advantage of the unique physical and numerical characteristics associated with building type structures. As a result, this analysis and design tool expedites data preparation, output interpretation and execution throughput. The need for special purpose programmes has never been more evident as Structural Engineers put non-linear dynamic analysis into practice and use the greater computer power available today to create larger analytical models. Over the past two decades, ETABS has numerous mega-projects to its credit and has established itself as the standard of the industry. ETABS software is clearly recognised as the most practical and efficient tool for the static and dynamic analysis of multi-storey frame and shear wall buildings. Seismic protection of buildings is a need-based concept aimed to improve the performance of any structure under future earthquakes. Earthquakes of vary in magnitude have occurred in the recent past in India, causing extensive damage to life and property. Some recently developed materials and techniques can play vital role in structural repairs, seismic strengthening and retrofitting of existing buildings, whether damaged or undamaged.

Keywords: *ETABS, Seismic Effect, Multi Storey Building.*

Introduction

Earthquake is the most disastrous and unpredictable phenomenon of the nature. When a structure is subjected to seismic forces it does not cause loss to human lives directly but due to the damage cause to the structures that leads to the collapse of the building and hence loss to the occupants and to the property.

Buildings in recent earthquakes lead to the need of investigation especially in a developing country like India. Earthquakes occurred in recent past have indicated that if the structures are not properly designed and constructed with required quality, may cause great destruction of structures. This fact has results to ensure safety against earthquake forces of structures hence, there is need to determine seismic responses of such building for designing earthquake resistant structures by carrying static and dynamic analysis of the structure according to IS1893:2002.

To perform good in an earthquake, a building should possess four main attributes, simple and regular configuration, adequate lateral strength, stiffness and ductility. When earthquake forces are considered on a structure, dead load, imposed load and earthquake load are taken respectively.

In the present work analysis of G+10 multi-storeyed RCC building is considered by dynamic analysis with the help of ETABS software for seismic zone IV in India. In dynamic analysis response spectrum method is used. Structural analysis means determination of general shape and all particular structure so that it will perform the function for which it is created and will safely withstand the influences which will act on it throughout its life.

ETABS stands for Extended Three Dimensional Analysis of Building System. The new version of ETABS is the ultimate software package for the structural analysis and design of buildings.

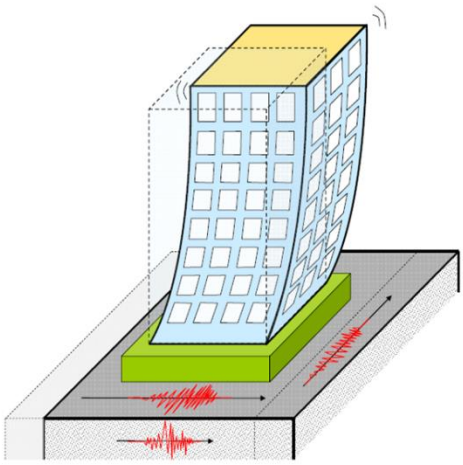

Figure 1: Seismic effect on a building

Results and Discussions

Table 1: Support Reaction in Dynamic Analysis

Story	Point	Load	FX	FY	FZ
BASE	1	UDCON1	5924.95	-22505.2	1607130
BASE	1	UDCON2 MAX	18492.5	-11347.3	1388630
BASE	1	UDCON2 MIN	-8995.29	-24817.5	1108090
BASE	1	UDCON3 MAX	18492.5	-11347.3	1388630
BASE	1	UDCON3 MIN	-8995.29	-24817.5	1108090
BASE	1	UDCON4 MAX	6643.06	-9582.16	1302321
BASE	1	UDCON4 MIN	2854.16	-26582.6	1194399
BASE	1	UDCON5 MAX	6643.06	-9582.16	1302321
BASE	1	UDCON5 MIN	2854.16	-26582.6	1194399

BASE	1	UDCON6 MAX	20754.29	-5260.28	1055592
BASE	1	UDCON6 MIN	-13605.4	-22098	704915.9
BASE	1	UDCON7 MAX	20754.29	-5260.28	1055592
BASE	1	UDCON7 MIN	-13605.4	-22098	704915.9
BASE	1	UDCON8 MAX	5942.49	-3053.88	947705.1
BASE	1	UDCON8 MIN	1206.36	-24304.4	812802.8
BASE	1	UDCON9 MAX	5942.49	-3053.88	947705.1
BASE	1	UDCON9 MIN	1206.36	-24304.4	812802.8
BASE	1	UDCON10 MAX	23137.25	-14379.7	1642428
BASE	1	UDCON10 MIN	-11222.5	-31217.4	1291752
BASE	1	UDCON11 MAX	23137.25	-14379.7	1642428
BASE	1	UDCON11 MIN	-11222.5	-31217.4	1291752
BASE	1	UDCON12 MAX	8325.44	-12173.3	1534541
BASE	1	UDCON12 MIN	3589.32	-33423.8	1399639
BASE	1	UDCON13 MAX	8325.44	-12173.3	1534541
BASE	1	UDCON13 MIN	3589.32	-33423.8	1399639
BASE	1	COMB1	3921.14	-14742.6	1195900

As shown in table the value for different loadings is given in X, Y & Z direction respectively. Two values comes one is maximum and the second one is minimum. The value in z direction is maximum as compare to x & y direction.

Displacement Table in mm

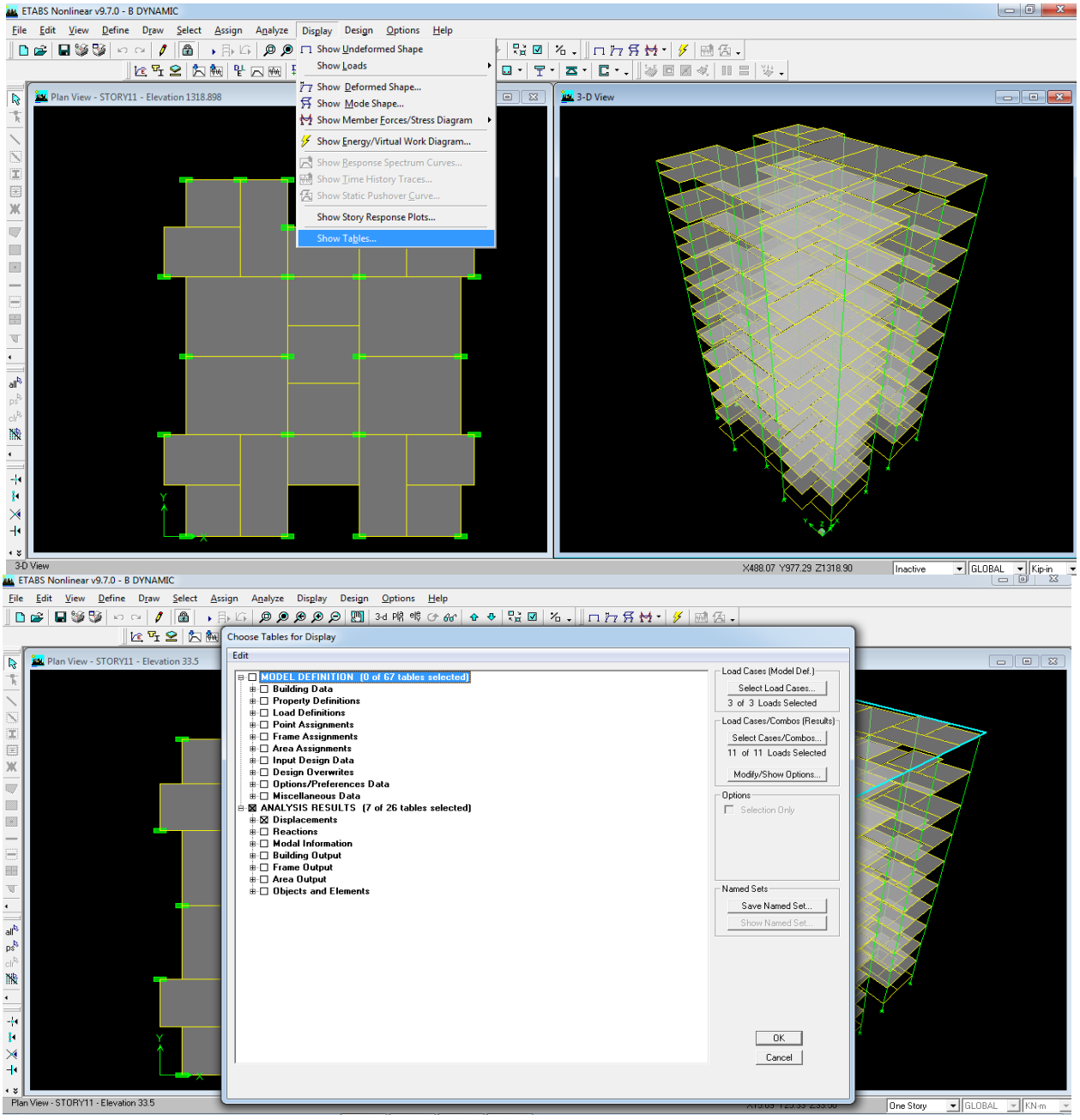

Figure 2: Showing displacement table

After analyzing the building by going into the run analysis click run than go to the show table option, a table of various things comes out choose displacement table in that.

Maximum Displacement Table of Dynamic Analysis

Table 2: Displacement in mm

STOREY	X	Y	Z
11	101.9869	86.3545	7.5054
10	97.2901	75.3445	7.426
9	92.2976	73.1927	7.2113
8	85.7871	71.1297	6.8616
7	77.9638	63.8387	5.8921
6	68.8226	55.6251	5.3254
5	58.4234	46.6073	4.633
4	46.8629	35.001	4.1136
3	34.2605	26.6059	2.8697
2	20.7799	15.856	1.5443
1	6.7154	5.1001	0.601

Unit of Displacement is in mm. Maximum value is at top storey which is 101.9869 mm in X direction & minimum is in bottom storey in Y direction which is 0.601mm in Z direction.

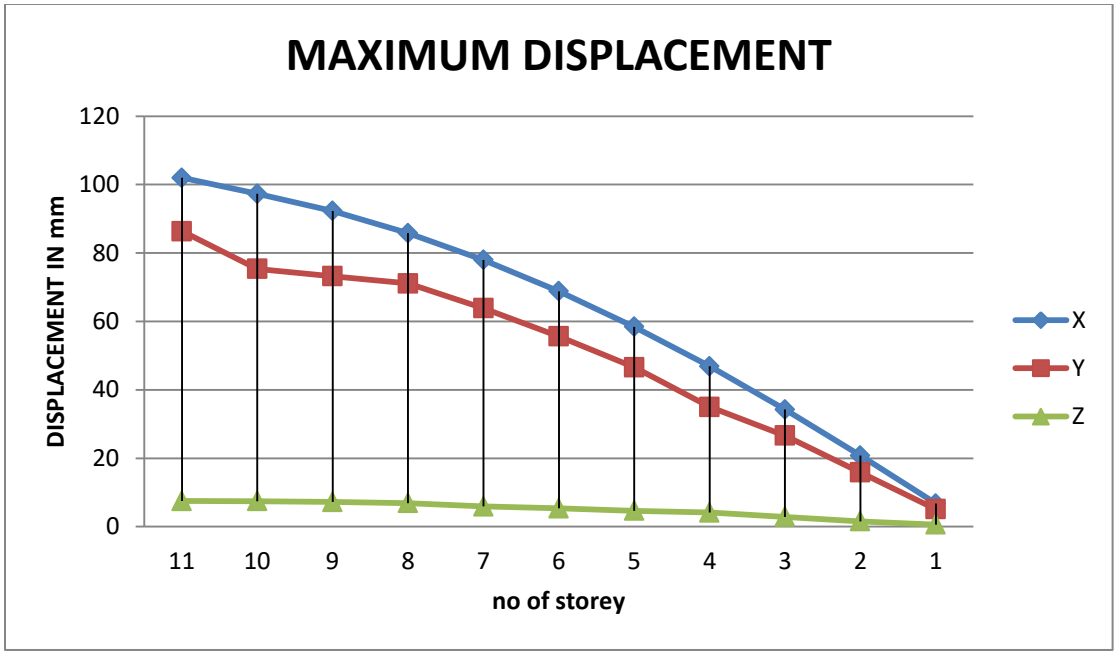

Figure 3: Response Spectrum Acceleration

Table 3: Response spectrum acceleration time period

Mode	Period	Damp Ratio
1	4.448458	0.05
2	4.128951	0.05
3	3.177048	0.05
4	1.313869	0.05
5	1.225495	0.05
6	0.917935	0.05
7	0.723833	0.05
8	0.568765	0.05
9	0.468537	0.05
10	0.442971	0.05
11	0.328564	0.05
12	0.318986	0.05

The value of time period varies for different modes .it gives maximum value at mode 1 and minimum value at mode 11. For which the mode shapes comes out and show deformation in building**.**

Table 4: Storey drift

STOREY	DRIFT X	DRIFT Y
11	0.001628	0.001284
10	0.001946	0.001962
9	0.002302	0.002327
8	0.002666	0.002465
7	0.00303	0.002576
6	0.003377	0.003066
5	0.003693	0.003234
4	0.003976	0.003368
3	0.004222	0.003466
2	0.004409	0.003515
1	0.004477	0.00353

Storey drift comes maximum in x direction for first storey and minimum in y direction for eleventh storey. As the storey increases the value of storey drift reduces.

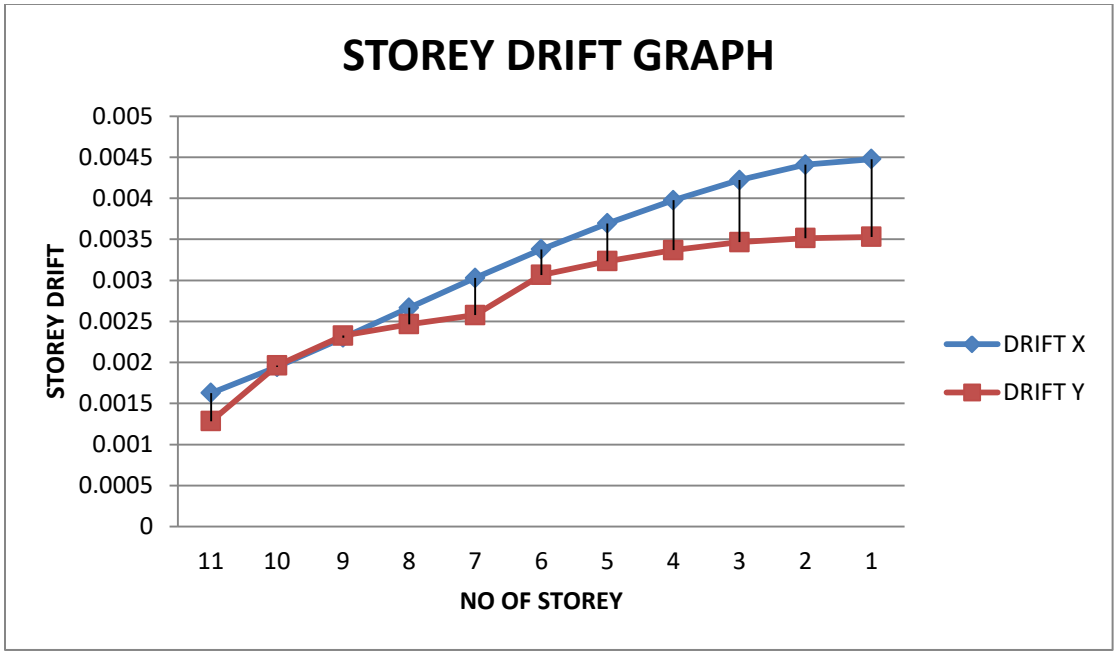

Figure 4: Storey drift graph

Conclusion

A lot of research has been carried out on the dynamic effect on the building. The present work is on dynamic analysis of earthquake forces on a 11 storey building by response spectrum method in zone IV. The analysis mainly deals with the study of rectangular shaped plan using ETABS. The height of each storey is taken as 3.2 m and the total height of structure is 33.5 m. loads that are considered, taken from the IS-1893(2002). An RCC framed structure is basically consist of slabs, beams, columns, and foundation connected to each other as a unit.

- The value of displacement is maximum in eleventh storey that is 101.9869 mm in x direction, 86.3545 mm in y direction & 7.5054 mm in z direction respectively and minimum in first storey that is 6.7154 mm in x direction, 5.1001 mm in y direction & 0.6010 mm in z direction.
- The value of column force is minimum in eleventh storey that is 104.6266 KN and maximum in first storey that is 1607.129 KN.
- The value of storey drift is minimum in eleventh storey that is 0.001628 in x direction & 0.001284 in y direction and maximum in first storey 0.004477 in x direction & 0.003530 in y direction.

References

[1] A. Rahman, A. A. Masrur Ahmed and M. R. Mamun (2012), "Drift Analysis Due To Earthquake Load on Tall Structures", Journal of Civil Engineering and Construction Technology Vol. 4(5), pp. 154-158, May 2012.

[2] BahadorBagheri, EhsanSalimiFiroozabad, and MohammadrezaYahyaei (2012), "Comparative Study of the Static and Dynamic Analysis of Multi-Storey Irregular Building", International Journal of Civil, Environmental, Structural, Construction and Architectural Engineering ,Vol:6, No:11, 2012.

[3] Baldev D. Prajapati1 & D. R. Panchal , " Study of seismic and wind effect on multi storeyr.c.c., steel and composite building"International Journal of Advances in Engineering & Technology,ISSN: 22311963,Sept. 2013.

[4] Mohammed yousuf1, P.M. shimpale, "Dynamic Analysis of Reinforced Concrete Building with Plan Irregularities", International Journal of Emerging Technology and Advanced

Engineering", (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 3, Issue 9, September 2013)

[5] Sanjay Kumar Sadh 1, Dr. UmeshPendharkar, "Influence of Aspect Ratio & Plan Configurations on Seismic Performance of Multistoreyed Regular R.C.C. Buildings: An Evaluation by Response Spectrum Analysis", International Research Journal of Engineering and Technology (IRJET), e-ISSN: 2395 -0056 p-ISSN: 2395-0072,Volume: 03 Issue: 01 | Jan-2016.

[6] Ankit Jain1, R. S. Talikoti, "Survey Paper on Study the Performance of High Rise Structure with Dampers at different Location", International Research Journal of Engineering and Technology (IRJET), e-ISSN: 2395 -0056 p-ISSN: 2395-0072, Volume: 03 Issue: 04 | Apr-2016.

[7] Pralobh S. Gaikwad†* and Kanhaiya K. Tolani, "Review Paper on Dynamic Analysis of Building",International Journal of Current Engineering and Technology,E-ISSN 2277 – 4106, P-ISSN 2347 – 5161,2015INPRESSCO**.**

[8] Mahesh Suresh Kumawat, L.G.Kalurkar, "STATIC &DYNAMIC ANALYSIS OF MULTISTORY BUILDING USING COMPOSITE STRUCTURE",International Journal of Research in Engineering and Technology, ISSN: 2319-1163 pISSN: 2321-7308.

[9] VinayakKulkarni, SwapnilCholekar, HemantSonawadekar, "Effect of openings of shear wall in high rise buildings", International Journal of Applied Sciences and Engineering Research, ISSN 2277 – 9442, Vol. 3, Issue 4, 2014 © 2014 by the authors–Licensee IJASER-Under Creative Commons License 3.0 editorial@ijaser.com Research article.

[10] Ashish Mohan Shivhare, K.K. Pathak, S.K. Dubey, "Parametric Seismic Analysis of Tall Buildings with Different Geometry and Constant Plan Area", DOI: 10.15415/jotitt.2014.22006.

[11] Pralobh S. Gaikwad1, Prof. Kanhaiya K. Tolani, "Study of Dynamic Effect On Unsymmetrical Building (Rcc& Steel)", IJREAT International Journal of Research in Engineering & Advanced Technology, Volume 3, Issue 3, ISSN: 2320 – 8791 (Impact Factor: 2.317), June-July, 2015.

[12] Dr. S.K. Dubey, Prakash Sangamnerkar and Ankit Agrawal, "Dynamics Analysis of Structures Subjected to Earthquake Load", International Journal of Advance Engineering and Research Development Scientific.