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A REVIEW ON "RESPONSE SPECTRUM ANALYSIS OF G+7 MULTI STOREY BUILDING USING E-TAB"

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ABSTRACT: ETABS stands for Extended Three-Dimensional Analysis of Building Systems. The main purpose of this software is to design multi-story building in a systematic process. This paper presents Response spectrum analysis of G+7 building by using ETABS. Response spectra are curves plotted between maximum response of single degree of freedom system specified earthquake ground motion and its time period. The use of the response spectrum to reveal significant characteristics of ground motion is discussed and the role of the response spectrum in establishing seismic coefficient for structure behavior. Various research studies have been conducted on response spectrum analysis of G+7 building using E-tab software.

Keywords: E-tab, Response Spectrum Analysis, Equivalent static method

INTRODUCTION

Response spectra are curves plotted between maximum response of SDOF system subjected to specified earthquake ground motion and its time period (or frequency). Response spectrum can be interpreted as the locus of maximum response of a SDOF system relation for given damping ratio. Response spectra thus helps in obtaining the peak structural responses under linear range. Usually response of a SDOF system is determined by time domain or frequency domain analysis, and for a given time period of system, maximum response is picked. This process is continued for all range of possible time periods of SDOF system.

Various research studies have been conducted on response spectrum analysis of G+7 building using E-tab software. The code provisions as per IS:1893 (Part 1)-2002 code for response spectrum analysis of multi-story building is also summarized.

LITERATURE REVIEW

Mr. Ashish A. Mohite - The wind-induced response of a structure with a damper system and to estimate the suppressing effects of dampers under earthquake loadings. Analysis of symmetrical moment resistance frame (MRF) 10th,12th,14th,16th,18th, and 21th story three – dimensional model with tuned mass damper and without tuned mass damper by using software ETABS Parameters/Model/Software: Tuned Mass Damper, TABS.

The following parameters to be used in the following discussion. The optimum natural frequency of the damper and the optimum damping ratio of damper are given by equation (1) and (2) respective. This study is aimed as tuned mass dampers in reducing structural (story drift, story displacement and base shear) of seismically excited 10th, 12th, 14th, 16th,18th, and 21th story building. It has been found that the TMDs can be successfully used to control vibration of the structure.

A. Ravi Kumar- Designed and analyzed a G+9 floor earthquake resisting building with shear wall with the help of modeling ETABS software. In this study, the earthquake load was calculated and applied to a multi-storied building of plan 26mx26m and 10 no. of (G+9) floors with 40 meters height.

He concluded that shear walls are one of the most effective building elements in resisting lateral forces during earthquake and also provides larger stiffness to the buildings there by reducing the damage to structure and its contents.

Mr. Khemraj S. Deore - Time History Analysis and Response Spectrum Analysis is a vital technique for structural seismic analysis particularly once the structural is high rise. This thesis study of the damper effect in the frame (MRF) is an important factor for the analysis. A tuned mass damper (TMD) is placed on top floor of building and Response spectrum analysis has performed.

For Analysis purpose practical (G+16) story building modeled with and without tuned mass damper by using software ETABS.

Thakur V.M - In this paper TMD is used as soft story which is considered to be made up of RCC, constructed at the top of the building. A six storied building with rectangular shape is considered for analysis. Analysis is done by FE software SAP 2000 by using direct integration approach. TMDs with percentage masses 2% & 3% are considered. Three different recorded time histories of past EQ. are used for the analysis. Comparison is done between the buildings with TMD and without TMD.

Govardhan Bhatt et al (2017) made analysis for different models with Shear walls curtailed at different heights and compared those using ETABS, to understand the effect of curtailment of shear walls on the response of the structure.

They found that Storey Drifts increases tremendously at the level of curtailment for all the models. Also, the storey forces vary hugely in all the six models. Maximum forces were observed in SW10 while SW
5 displayed the minimum forces because of the higher stiffness of SW10 model, enabling it to withstand higher lateral forces as compared to the others.

Jaimin Dodiya - Analyzed the multi-storey building with response spectrum using ETABS modeling software. Equivalent static method, Response spectrum method and time history methods were adopted. The area of building was 376m2 and height was 60m. Total number of floors was 20 and slab thickness was 150mm. Column size was 900x600mm.

He concluded that providing shear wall at opposite direction, performing better and more efficient than all other cases. Also, the provision of shear wall position in an appropriate location is advantageous and the structure performs better for an existing or a new structure.

Mr. K. Lova Raju- He studied the effective location of shear wall on performance of building frame subjected to earthquake load. In this paper, four types of structures with G+7 are considered in which one of the frame without shear wall and three frames with shear wall in various positions. The Non Linear Static analysis is done using ETABS v9.7.2 software

Syed Mohammad Umar- Investigated the effects of openings in shear wall on seismic response of structures. For parametric study 15 storied 4mx5m bays apartment buildings with typical floor plan of 25mx12m and floor height of 3m with different openings size and location in shear walls were modeled in ETABS-2015.

However the response of the building was better when the openings are provided in the center of the wall as compared to their eccentric positions.

MODELLING

Building Discription

The model of multi-storied G+7 storey RCC structure considered for the analysis. The building is symmetrical in plane. The building has bay width of 7m in X and 16m in Y direction with 3.0m storey height. Base floor height is 3.5m. Tuned mass damper is installed at the top of building. Analysis is carried out in ETABS software by Response Spectrum Analysis and Equivalent static analysis. A G+7 story multi-storied building is situated in Zone IV on medium grade soil is analyzed and the displacement and acceleration with and without TMD of the structure due to different load combination are obtained. Seismic analysis is performed using response spectrum method given in IS1893:2002. For the modeling of the G+7 story structure.

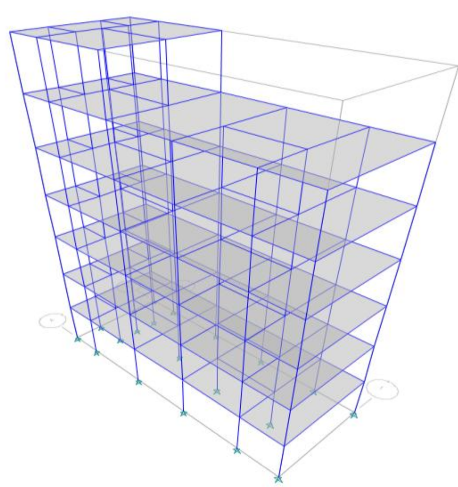

Fig 1.11: E-tab model Frame structure of the building

Structure Data

This chapter provides model geometry information, including items such as story levels, point coordinates, and element connectivity.

Name	Height mm	Elevation mm	Master Story	Similar To	Splice Story
Story7	3000	21000	No	None	No
Story6	3000	18000	No	None	No
Story5	3000	15000	No	None	No
Story4	3000	12000	No	None	No
Story3	3000	9000	No	None	No
Story2	3000	6000	No	None	No
Story1	3000	3000	No	None	No
Base	0	0	No	None	No

Frame Sections-

Name	Material	Shape
beam	M30	Concrete Rectangular
colum	M30	Concrete Rectangular

Shell Sections

Name	Design Type	Element Type	Material	Total Thickness Mm
Slab	Slab	Shell-Thin	M30	170

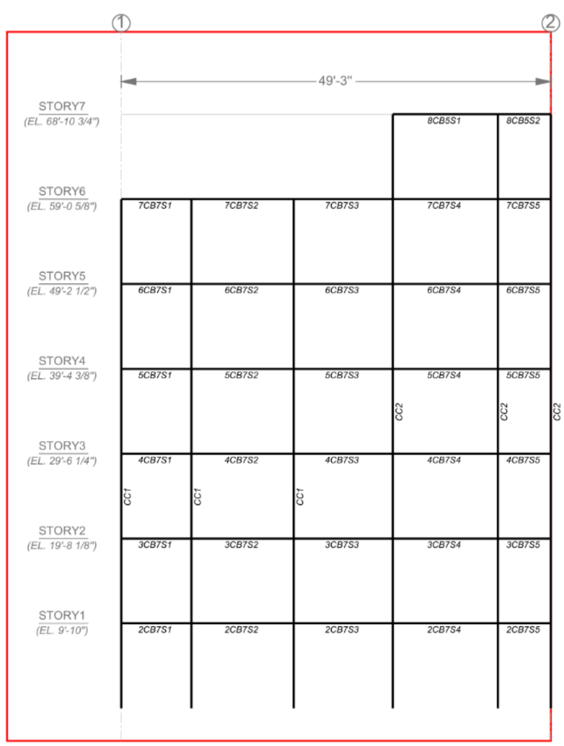

Fig 2: E-tab model Elevation of the building

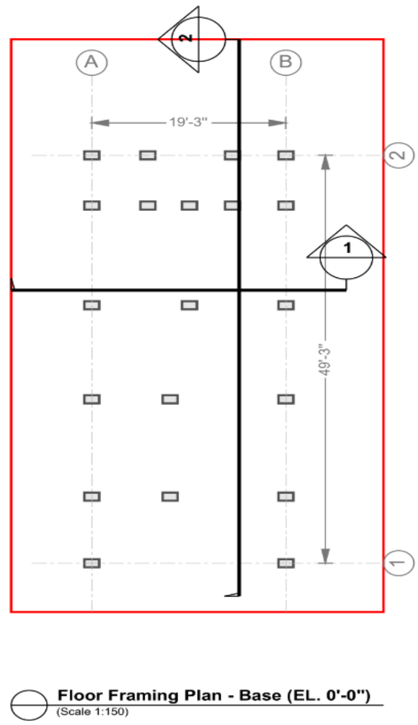

Fig 3: E-tab model floor of the building

Dead load-

Dead loads are permanent or stationary loads which are transferred to structure throughout the life span. Dead load is primarily due to self-weight of structural members, permanent partition walls, fixed permanent equipment and weight of different materials. It majorly consists of the weight of roofs, beams, walls and column etc. The calculation of dead loads of each structure are calculated by the volume of each section and multiplied with the unit weight.

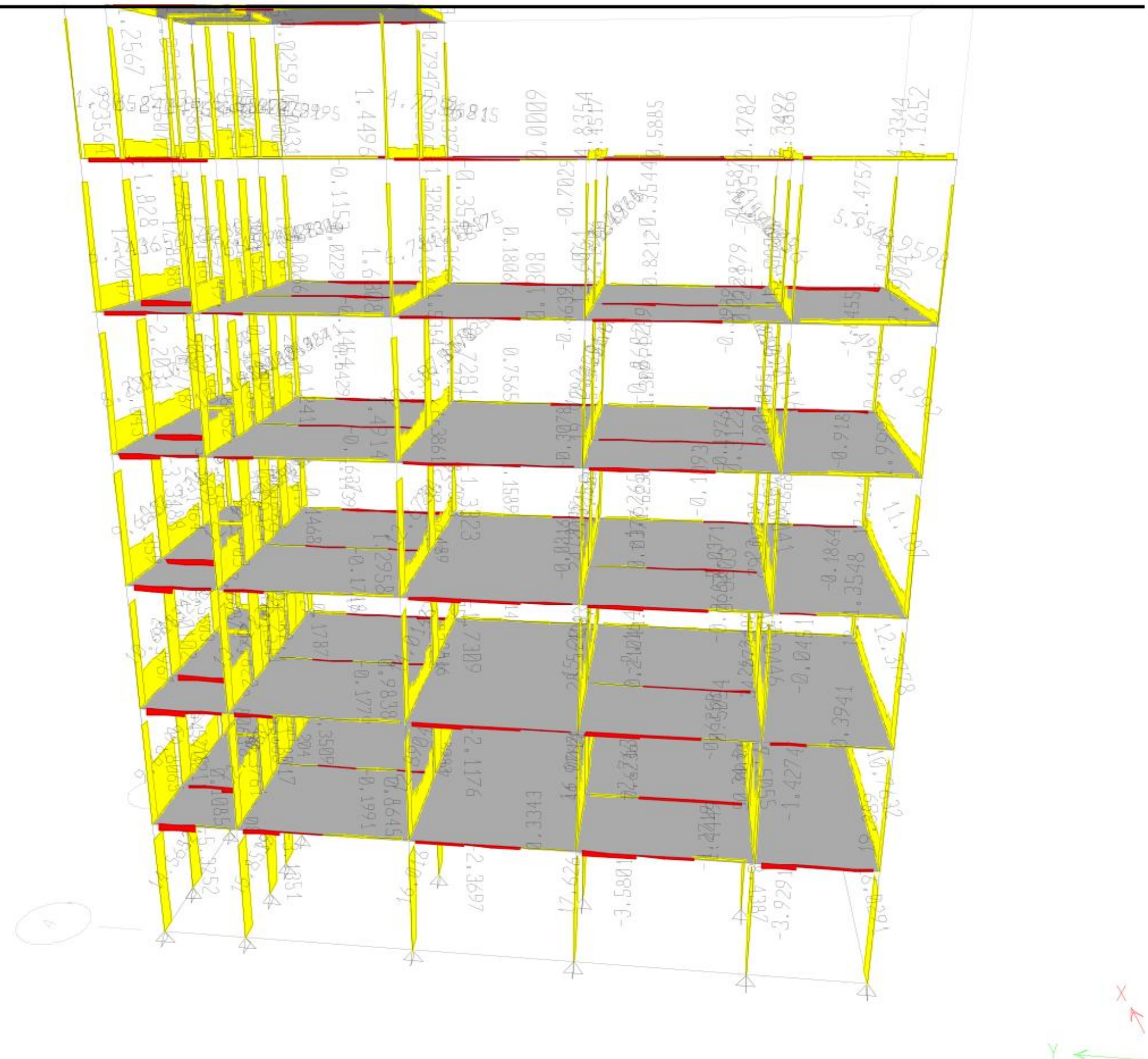

Fig 1.11: E-tab model self-weight of the building

Wind Loads

Wind load is primarily horizontal load caused by the movement of air relative to earth. Wind load is required to be considered in structural design especially when the heath of the building exceeds two times the dimensions transverse to the exposed wind surface. For low rise building say up to four to five stories, the wind load is not critical because the moment of resistance provided by the continuity of floor system to column connection and walls provided between columns are sufficient to accommodate the effect of these forces.

Earthquake loads

Earthquake forces constitute to both vertical and horizontal forces on the building. The total vibration caused by earthquake may be resolved into three mutually perpendicular directions, usually taken as vertical and two horizontal directions. The movement in vertical direction does not cause forces in superstructure to any significant extent.

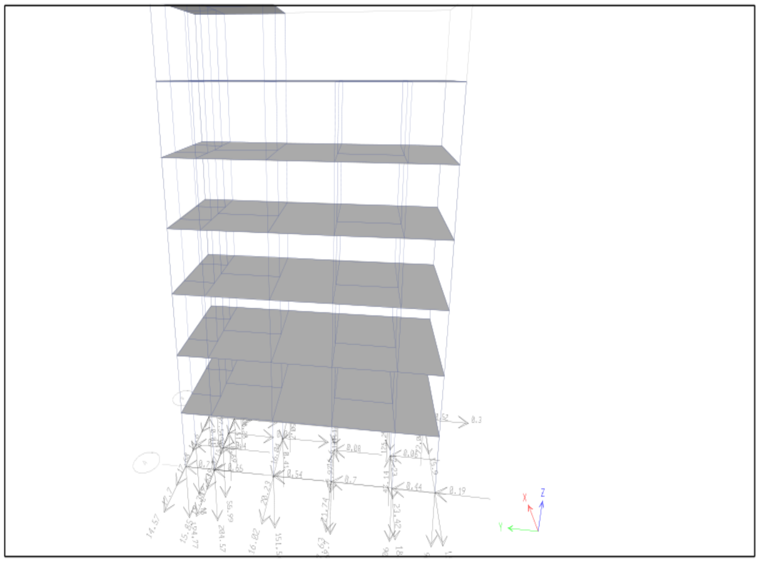

Fig 1.11: E-tab model seismic load of the building

CONCLUSION

From the study of literature presented in this paper, conclusions are drawn out for analysis of RCC framed structure:
1. Analysis can be done by using software ETAB in detail.
2. Finding displacement by response spectrum method.
3. Analysis is to be done with different zones.
4. By constructing shear walls damages due to effect of lateral forces due to earthquake and high winds can be optimized.
5. The base shears, maximum story displacement, story drift, axial, shear, bending moment with their diagrams are known for the different load combinations.

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