ANALYSIS of MULTI-STOREY BUILDING (G+7) due to SIESMIC LOADING USING ETABS

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Abstract- E-Tabs is the present day leading design software in the market. Many design companies use this software for their project design purposes. So, this project mainly deals with the comparative analysis of the results obtained from the design of a regular and a plan irregular (as per IS 1893) multi storey building structure when designed using E-Tabs software. The principle objective of this project is the comparative study on design and analysis of multi-storeyed building (G+7) by E-Tabs software. E-Tabs is one of the leading software for the design of structures. E-tabs are mostly used to analyze concrete& steel structure, low& high rise buildings, skyscrapers& portal frames structure. In this project we had studied structural behavior of multi-story building (G+7) on E-tabs.

Keywords- Regular, Irregular, Multi-story Building, Steel structure and E-Tabs.

1. INTRODUCTION

ETABS is the Acronym of EXTENDED 3D ANALYSIS OF BUILDING SYSTEMS, is software developed by Computers and Structures, Inc. (CSI); a Berkeley, California based engineering software company founded in 1975. ETABS is an engineering software product that can be used to analyze and design multi-story buildings using grid-like geometry, various methods of analysis and solution techniques, considering various load combinations.

E-TABS issue for analysis and design for building systems. ETABS features are contain powerful graphical interface coupled with unmatched modeling, analytical, and design procedures, all integrated using a common database. It is quick and very easy for simple structures. It can handle the largest and most complex building models.

ETABS can also handle the largest and most complex building models, including a wide range of nonlinear behaviors, making it the tool of choice for structural engineers in the building industry. ETABS can be effectively used in the analysis and design of building structures which might consists of structural members like beams, columns, slabs, shear walls etc, With ETABS you can easily apply various construction materials to your structural members like concrete, structural steel, Reinforced Concrete etc. ETABS automatically generates the Self weights and the resultant gravity and lateral loads.

ETABS provides an unequaled suite of tools for structural engineers designing buildings, whether they are working on one-story industrial structures or the tallest commercial high-rises. Immensely capable, yet easy-to-use has been the hallmark of ETABS since its introduction decades ago, and this latest release continues that tradition by providing engineers with the technologically-advanced, yet intuitive, software they require to be their most productive.

2. METHODOLOGY

A research presents the main features and organization of ETABS, a computer programs that has been developed for the static and seismic stability evaluations of different civil engineering structures and concrete gravity dams. Our project involves analysis and design of multistoried building using a very popular designing software ETABs against all possible loading conditions. In this paper a multistory building has been modeled and analyze with considering all loads like Dead load, Live load, Wind load, Seismic loads as per as IS standard

- Calculation of loads as per Indian Standards.
- Step by Step process of Methodology.
- Analysis using E-TABS on multi-storied framed structure.
- Design using E-TABS on multi-storied framed structure.

PRELIMINARY DATA:

Type of frame: RC frame building.

Seismic zone:	III
Number of storeys:	8
Floor height:	3 m

Plinth height: 1.5 m
Spacing between frames: 3m along both Directions
Live load on floor level: 3 KN/m2
Live load on roof level: 1.5 KN/m2
Floor finish: 1.0 KN/m2
Terrace water proofing: 1.5 KN/m2
Thickness of infill wall: (Exterior walls) 230mm
Thickness of infill wall: (Interior walls) 150mm
Density of concrete: 25 KN/m2
Density of infill: 20 KN/m2
Type of soil: Medium Soil
Response spectra: As per IS 1893(Part1):2002
Damping of structure: 5 %

Live load on floor level and roof level are taken from IS-875 (Part-) considered RC framed buildings as residential usage.

a. MEMBER AND MATERIAL PROPERTIES:

We are using material for concrete with M-25 grade concrete and FE-415 grade reinforcing steel for construction. Basic properties of material are as follows.

Modulus of elasticity of steel, Es =205000Mpa
Modulus of elasticity of concrete, Ec =21718Mpa
Characteristic strength of concrete, fck =25Mpa
Yield stress for steel fy = 415 Mpa

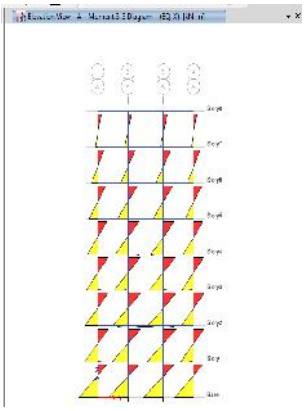
Table No. I: Detail of Materials

MAT	NAME	MODULUS OF ELASTICITY	POISSION RATIO	Density (kg/m3)	~ (/°C)
1	STEEL	205.000	0.300	7.83 E +3	12 E -6
2	STAINLESS STEEL	197.930	0.300	7.83 E +3	18 E -6
3	ALUMINUM	68.948	0.330	2.71 E +3	23 E -6
4	CONCRETE	21.718	0.170	2.55 E +3	10 E -6

Table No. II: Section Properties

Prop	Section	Area(cm^2)	Iyy (cm^4)	Izz (cm^4)	J (cm^4)	Material
1	Rect 0.25*0.23	575.000	25.3E+3	29.9E+3	46.1E+3	Concrete
2	Rect 0.26*0.25	650.000	33.6E+3	36.6E+3	59.2E+3	Concrete

Graphs and Tables from ETABs



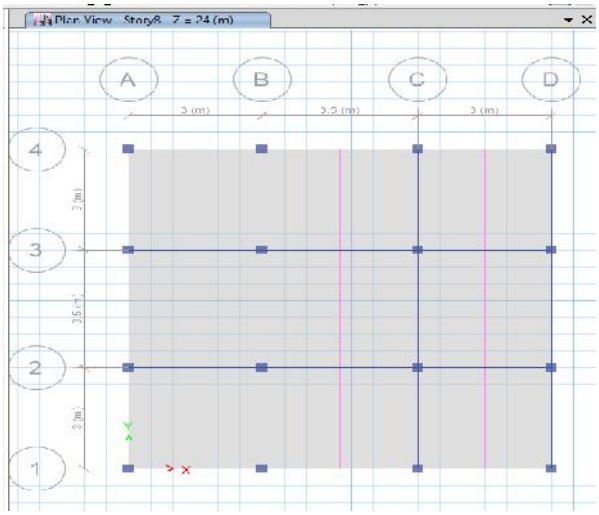


Fig 1: PLAN OF G+7 STRUCTURES

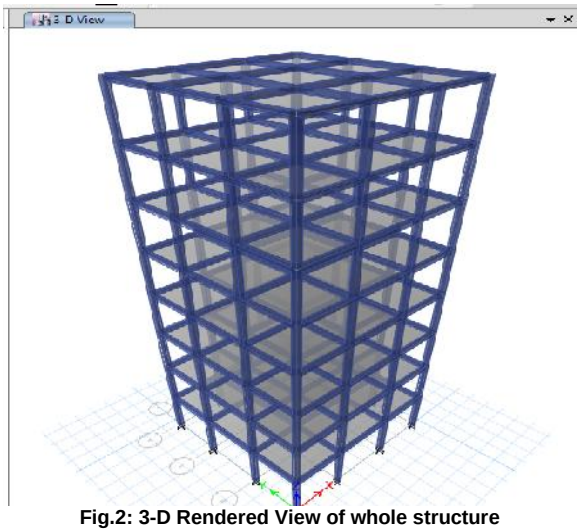


Fig.2: 3-D Rendered View of whole structure

Table No. III: Maximum Bending moment value on each floor

Floor Name	Maximum value in EQ-X (K-Nm)	Maximum value in EQ-Y (K-Nm)
1	7.7767	4.1882
2	8.0226	4.2845
3	6.8425	4.0843
4	6.5478	4.3993
5	6.8464	3.818
6	5.8304	2.5350
7	4.36	2.1188
Top Floor	2.4803	0.1181

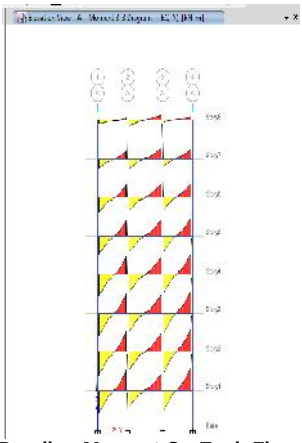
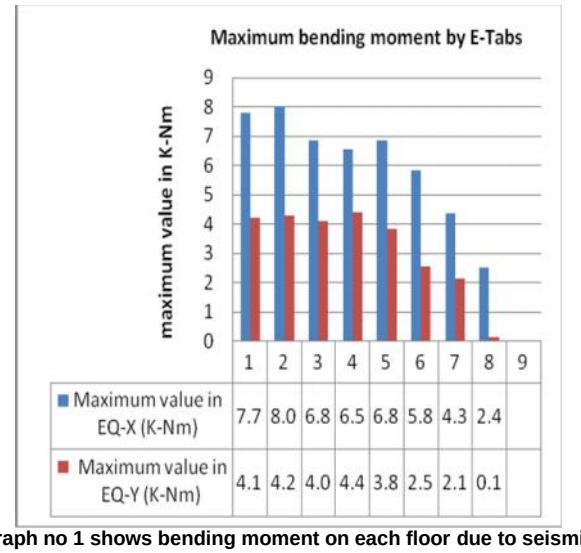


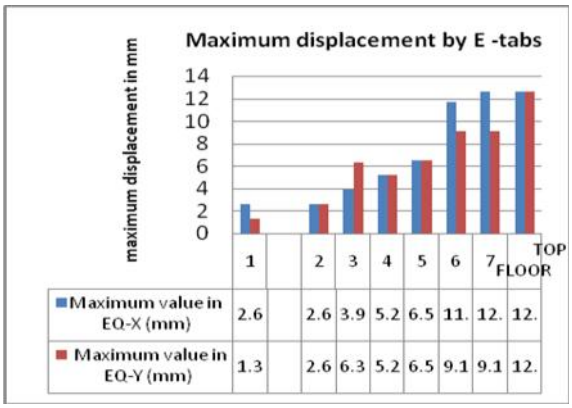
Figure3: Shows Bending Moment On Each Floor In Both X And Y direction



Graph no 1 shows bending moment on each floor due to seismic load

Table No. IV: Maximum Displacement with Maximum Values on each Floor

Floor Name	Maximum value in EQ-X (mm)	Maximum value in EQ-Y (mm)
1	2.60	1.30
2	2.60	2.60
3	3.90	6.3
4	5.20	5.20
5	6.50	6.50
6	11.7	9.10
7	12.6	9.10
TOP FLOOR	12.6	12.6



Graph no 2 shows maximum displacement values n each floor due to seismic load

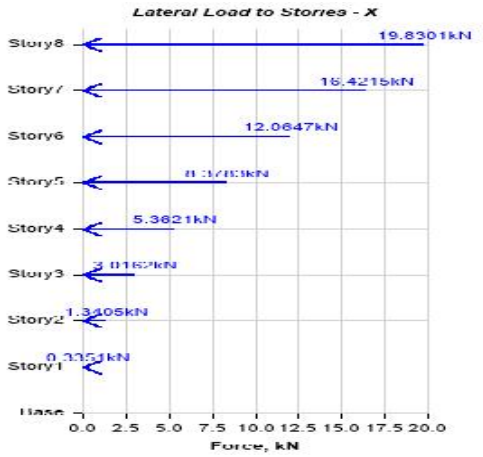


Figure 4: Showing Lateral Load on Stories

5. RESULTS AND CONCLUSION

After Discussion of results and observation some of results are summarized. Based on the behaviour of RC building on STAAD-PRO some important conclusions are drawn:-

1. Results of max bending moment due to seismic loading at top floor in X-direction are 8.0226 KN-m and 4rth floor in Y-direction is 4.3993 KN-m.
2. Results of minimum bending moment due to seismic loading at top floor in X-direction are 2.4803 KN-m and top floor in Y-direction is 0.1181 KN-m.
3. Results of max displacement due to seismic loading at 7th and top floor in X-direction are 12.6 mm and top floor in Y-direction is 12.6 mm.
4. Results of minimum displacement due to seismic loading at 1nd floor in X-direction are 2.60 mm and 1th floor in Y-direction is 1.30 mm.

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