International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 6 June 2022, pp: 120-122 www.ijaem.net ISSN: 2395-5252

Design and analysis of Multi-Storey building with a single column using E-tabs

Dhruv Dave[1], Aakash Suthar[2]
[1]*MTech student L.J University, Ahmedabad, India.*
[2]*Aakash Suthar, Assistance Professor, civil engineering department ,L.J University , Ahmedabad, India.*

Submitted: 25-05-2022 Revised: 01-06-2022 Accepted: 05-06-2022

ABSTRACT - – Nowadays, The rapid increase in populations tends to develop verticality in buildings and tends to lead an innovative ideas for vertical development. The parking and aesthetic views are one of them. Therefore, it is better to have multistory building resting on a single column which requires less space at ground then other normal building. In this paper proper analysis is done in E-tabs. In this paper the there are 3 types of model has been done for the different zones and different soil condition. The story displacement , story drift,story stiffness, mode shape factor has been also checked and result is satisfactory.

Key Words: Aesthetic view, Single column, E-tabs, Story drift, Story displacement, Mode shape

I. INTRODUCTION

The structural optimization plays a vital role in today's highly competitive industry, where there is continuous increase in customer demand for superior quality, better safety and affordable cost. The rapid increase in population and scarcity of land tends to the development of construction technology and high-rise commercial structures. For aesthetic appearance, the building supported by a single column & floor response of the structure under linear & dynamic loading, results are studied for deflection, bending moment, shear force, structural planning. Accommodation of parking or reception lobbies is the primary use of this open ground story in the multi storey buildings constructed. But Conventional Civil Engineering structures are designed on the basis of strength and stiffness criteria.

The structural optimization plays a vital role in today's highly competitive industry, where there is continuous increase in customer demand for superior quality, better safety and affordable cost. The rapid increase in population and scarcity of land tends to the development of construction technology and high-rise commercial structures.

For aesthetic appearance, the building supported by a single column & floor response of the structure under linear & dynamic loading, results are studied for deflection, bending moment, shear force, structural planning. Accommodation of parking or reception lobbies is the primary use of this open ground story in the multi storey buildings constructed. But Conventional Civil Engineering structures are designed on the basis of strength and stiffness criteria.

1.1 OBJECTIVE

- To describe the philosophy of fundamental structure behaviour.
- To identify and analyze various structural and material behaviour.
- To prepare a mono column structural system.
- To analyze the building having mono column with seismic forces
- To get identify the seismic behaviour on building resting on single column structure.

II. METHODOLOGY

There are three major types of geometry has been possible for single columned structure.
M1:Single column having floating column at every level and cross beams at only first level
M2: Single column having floating columns and cross beams at each level
M3:Single column having no floating columns and ross beams at each level

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 6 June 2022, pp: 120-122 www.ijaem.net ISSN: 2395-5252

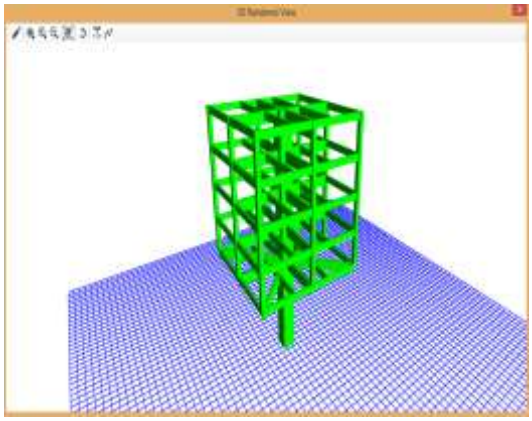

Fig -1: M1 type model

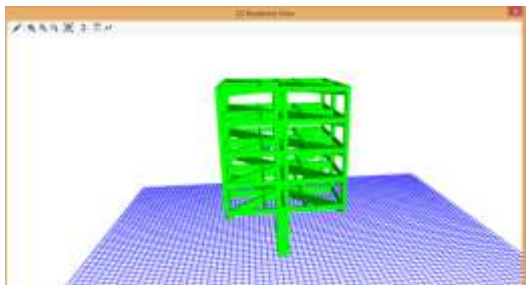

Fig -2: M2 type model

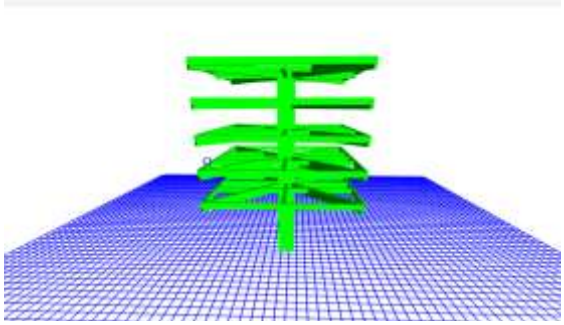

Fig -3: M3 type model

2.1 Input data

Table. 5.1 Data input in Etabs

Defination	Data
Depth of foundation	3.5m
Supports	Fixed
Type	F+4
Height of floor	4m
C/S of beam	350x1200mm
C/S of column	2mx2m
Thickness of wall	230mm
Density of brick	20kN/m3
Density of concrete	25kN/m3
Slab thickness	0.15m
Floor finish load	1.25kN/m2
Live load	2kN/m2
Importance factor	1.2
Grade of concrete in column	M30
Grade of concrete in slab and beam	M25
Grade of steel	Fe500

III. OBSERVATIONS

There are 3 major type of model is analyzed with different seismic zones and soil conditions.

3.1 Story drift: Story drift should be within limit upto 0.004 times the height of the building in mm

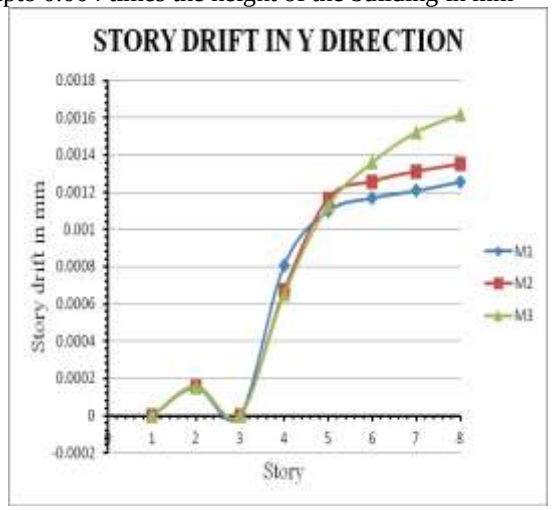

Chart 1: Story drift for three models

3.2 Story displacement: It is a relative displacement to the base.

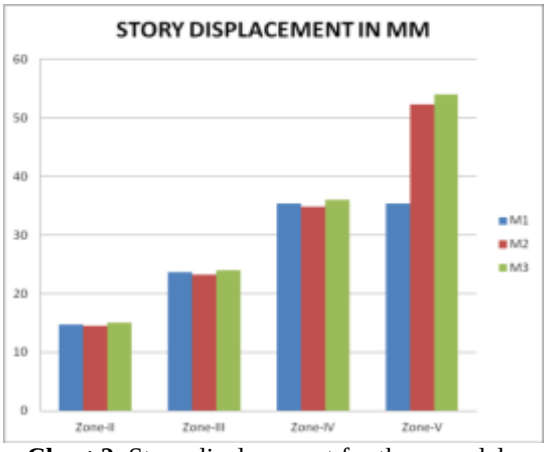

Chart 2: Story displacement for three models

3.2 Mode shape: Mode shape should be in transational in first two modal case and should have rotational in third modal case.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 6 June 2022, pp: 120-122 www.ijaem.net ISSN: 2395-5252

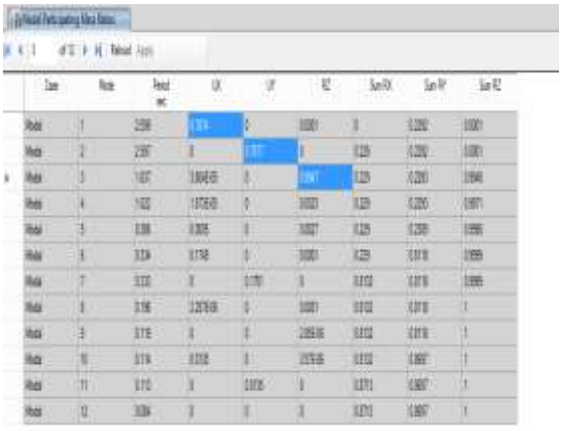

Fig -4: Mode shape values for M1 model

IV. CONCLUSIONS

Column Reinforcement

	SOIL TYPE 1				SOIL TYPE 2				SOIL TYPE 3			
	II	III	IV	V	II	III	IV	V	II	III	IV	V
Single column having floating column and cross beam at one storey	1.74 %	1.74 %	1.74 %	1.74 %	1.74 %	1.74 %	1.74 %	1.74 %	1.74 %	1.74 %	1.74 %	1.74 %
Single column having floating column and cross beam at each storey	1.44 %	1.88 %	1.88 %	1.88 %	1.44 %	1.88 %	1.88 %	1.88 %	1.44 %	1.88 %	1.88 %	1.88 %
Single column having no floating columns and only cross beams	1.74 %	1.74 %	1.74 %	1.74 %	1.74 %	1.74 %	1.74 %	1.74 %	1.74 %	1.74 %	1.74 %	1.74 %

Fig -5: Column Reinforcement comparision

1. It is possible to model a single column building.
2. It is observed that requirement of shear reinforcement would be more in all cases.
3. Deflection of beam is within limit.
4. Percentage of reinforcement required in column is within 2.5%.
5. Story displacement and story drift is within limit as per IS 1893(Part-1)-2016
6. The behavior of lateral load application is as expected and within fundamental rules.
7. The mode shape gives the satisfactory results in all cases.
8. Story drift and displacement is higher in model M3 as compare to other models in all cases.
9. Model M1 gives all satisfactory results in all analysis results but requires sp. Reinforcement details in beams at the location of floating column
10. It is conclude that soil type is the major role at the time of earthquake.

REFERENCES

[1]. [1] Badikala Sravanthi, Dr. K. Rajasekhar, Design of a Structure Supported On Single Column, Pp In ISSN-2349-8439, 2016.
[2]. A. Venu Babu et al, Design of a structure supported on single column office building, International Journal of Research Sciences and Advanced Engineering [IJRSAE] Vol. 2, Issue 15, pp 112-123, 2016.
[3]. Madireddy Satyanarayana, Design of Multi Storey Building Resting on Single Column, [IJRET] Vol. 5, Issue 3, ISSN: 2319-1163, 2016.
[4]. M.S. Matsumot, et al, Structural Design of an Ultra High-rise Building Using Concrete Filled Tubular Column with Ultra High Strength Materials, pp. 15, WCEE, 2012.
[5]. E. K. Mohanraj, S. Nisar Ahmad, A. Gowri Sankar, Kongu Engineering College, Analysis and Desgn of an Office Building with Mono Column, pp. 27th Conference on Our World in Concrete & Structures, 2002.
[6]. IS 456-2000
[7]. IS1893(Part-1)-2016
[8]. T. Subramani, S. Priyanka, E. Sahul Hameeth, P. Shanmuga Subramani, K.R. Shuresh, Design and analysis of mono column building by using STAAD Pro, [IJAIEM], Vol. 8, Issue 3, ISSN 2319 – 4847, 2019.
[9]. Ankur Pandey, Vaibhav Singh, Gaurav Awasthi, A review on mono column multi-storey structural system using composite material, [IJAIEM] Vol. 8, Issue III, ISSN NO: 2249-7455, 2018.
[10]. S. Sudheer, Dr. K.V. Subba Reddy Institute Of Technology, Analysis & Design Of G+5 Residential Building Using Staad-Pro, [GJRA] Vol. 6, Issue 5, ISSN No 2277 – 8160, 2017.