International Journal of Advance Research in Science and Engineering
Volume No. 12, Issue No. 12, December 2023
www.ijarse.com
IJARSE
ISSN 2319 - 8354

Study of Seismic waves and analysis of floating column for buildings by using E-Tabs software

Kunal S Chavan[1], Harshada P. Kale[2] Rohini P.Chaudhari[3]

[1, 2, 3] *Assistant Professor, Department of Civil Engineering, North Maharashtra Knowledge City College of Engineering, Jalgaon*

ABSTRACT

In the present day, constructions of buildings in urban areas in India, the common problem are in the accommodation of parking areas, reception lobbies etc. To overcome this problem floating columns came into existence and now it has become an unavoidable feature in most of the multi-storied buildings from foundation level and transferring the load to the ground. The term floating column is also a vertical element that (due to architectural design/site situation) at its lower level (termination level) rests on a beam that is a horizontal member. The beams transfer the load to the other columns below it. The floating column act as a point load on the beam and this beam transfers the load to the columns below it as far as analysis is concerned, the column is often assumed pinned at the base and is therefore taken as a point load on the transfer beam. Buildings with floating columns that hang or float on beams at an intermediate storey and do not go all the way to the foundation have discontinuities in the load transfer path. The floating column is used for the purpose of architectural view and site situations. It can be analysed by using E-TABs.

Keywords: *E-Tabs, Floating columns, Horizontal member, Intermediate storey, Termination level*

1. INTRODUCTION

Nowadays, every multi-story building (residential, commercial, industrial, etc.) requires an open ground story for parking space, lobbies, conference halls, banquet halls, etc.So the ground floor needs to keep free without construction except for columns. Conventional columns which are closely spaced are not preferable on ground floors. To avoid this, discontinuity in columns is required, and here floating column comes into existence. Floating column is a type of column that is constructed over beams or slabs of any intermediate floors of a structure. These columns are not attached to any footings or pedestals. Floating columns are also known as hanging columns. In structures such as residential buildings, complexes, banquet halls, and all other commercial buildings where parking space is necessary for the free flow and convenience of people, floating columns are introduced to obtain a clear space, and this provides liberty to alter the structure of the above floor plans. The design of a floating column is like a regular common whereas the beam on which the floating column rests is so designed to carry the

load as a single point load these beams are called grinder beams. While constructing a floating column the design of the grinder beam is very crucial as it is subjected to torsion.

1.1. Types of Floating Columns.

1.1.1 Structural floating column: The floating column that loads in form of tension or compression from any beam is called a structural floating column.

1.1.2 Stiffener columns: These columns are designed for some purpose for example to avoid cracks in the wall. These columns are also constructed to fix any ill element in the structure.

1.2. Floating column and earthquake

Floating columns are discouraged in earthquake-prone zones as floating columns are good against vertical pressures but when it comes to lateral forces they don't perform very well.However, still, commercial buildings glorify the idea of floating columns as giving them the flexibility to alter above-floor planning and give them a good clear space at the bottom.

1.3 Seismic Waves

Seismic waves are caused by the sudden movement of materials within the Earth, such as slip along a fault during an earthquake. Volcanic eruptions, explosions, landslides, avalanches, and even rushing rivers can also cause seismic waves. A seismic wave is a mechanical wave of acoustic energy that travels through the Earth or another planetary body.

1.4 Transfer Beam

A transfer beam is defined as a beam which transfers the loads of the column to the nearby columns. In framed structure when column is not allowed to continue downward due to certain restrictions, problem is resolved by using transfer beam. A transfer beam carries the load of an especially heavy load, normally a column. Utmost importance should be given to transfer beams as

2. LITERATURE SURVEY

Detailed comparison between normal columns and floating columns has been done. The comparison is based upon shear force and bending moment for both normal columns and floating columns. Various design parameters required for normal columns has been given in IS 456:2000 [1].

The use of ETABS for different plan configurations has been given by Abhay Guleria by computing shear forces, bending moments and maximum storey displacement. The researcher analysed the structure which reflected that the displacement increased with storey height [2].

Different cases of the building are studied by Ms. Waykule.S.B, Dr.C.P.Pise, Mr. C.M.Deshmukh, Mr. Y.P.Pawar, Mr. S.S.Kadam, Mr. D.D.Mohite, and Ms. S.V.Lale. They varied the location of floating columns floor wise. The structural response of the building models with respect to base shear, and storey displacement was investigated [3].

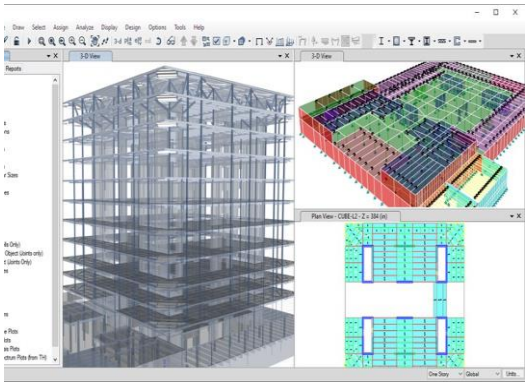
Comparative study of behavior of building with and without floating column for regular and irregular building plan was studied by Snehal Ashok Bhoyar. The study was carried out on three crucial parameters i.e. lateral distance, Storey shear, Storey drift which concluded that failure of building with floating column was found to be more than building without floating column [4].

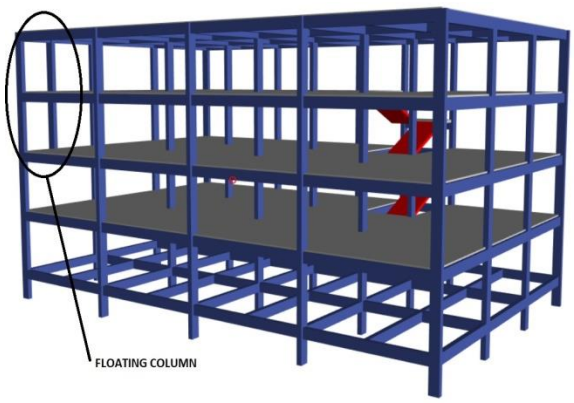
Study of G+3,G+5,G+10 having normal column and floating columns by Shiwli Roy, Gargi Gagan De showed that the bending moment and shear force increased with increase in storey height which means that the bending moment and shear force is proportional to storey height [5].

Jayashri Sarode and Mr. Amol.S.Pote compared three models classified as normal structure, floating column structure with RCC beam girder and floating column structure with composite beam girder using ETABS as their software.The study showed that the maximum displacement was observed in floating column structure with composite beam girder [6].

K.V.Sudheer,Dr.E.Arunakanthi studied the comparison and seismic analysis of the multistory buildings with and without floating columns.They analysed the high rise building based on storey drifts,storey displacement and base shear.The researchers finally concluded that preference to floating columns should not be given unless there is a specific need or functional purpose[7].

3. TYPICAL METHODOLOGY FOR STRUCTURAL ANALYSIS





Seismic analysis is an important tool in earthquake engineering which is used to investigate the response of buildings in a simpler manner due to seismic forces. It is a part of structural design where earthquake is prevalent. Response Spectrum Analysis (RSM) permits a multiple modes of response of a building to be taken into account. Computer analysis can be done to determine these modes of structure. For each mode, a response is obtained from the design spectrum, corresponding to modal frequency and modal mass, and they are combined to estimate the total response of the structure. In this, the magnitude of forces in all directions is calculated and then effects on the building are observed

4. OUTCOMES AND CONLUSIONS

By referring research papers the researchers have concluded that:

1. The maximum moment obtained is more in case of structure having floating column as compared to normal column.
2. The floating column is subjected to maximum shear force as compared to the structure having normal column.
3. In order to curb the failure of floating column the stirrups should be spaced closely in the position where the floating column is placed.
4. The dimensions of transfer beams should be greater than normal beams
5. Floating column experiences more lateral displacement than normal column.
6. Floating column is more susceptible to seismic load which was observed by the researchers.
7. It was also observed that there is no provision of specific design code for floating column which is generally provided to normal column.
8. Preference should not be given to floating column unless there is a need or purpose.
9. Proper care should be taken for the construction of floating column.
10. Most important conclusion is that normal columns are safer than floating columns.

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