COMPARATIVE STUDY OF EQUIVALENT STATIC METHOD AND RESPONSE SPECTRUM METHOD ON EFFECT OF BRACING SYSTEM ON FLOATING COLUMN STRUCTURE UNDER EARTHQUAKE EXCITATION - A REVIEW

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Abstract

Civil engineering structure with the floating column is becoming a standard amenity for modern multi-story buildings in India. But this floating column lessens the proficiency of the construction to resist seismic forces up to huge amount that is why these are the tremendously detrimental unit in the seismic disposed area, and the building with the bracing system has more adjacent immovability as paralleled to normal moment-resisting mounted constructions behavior floating column structure with the bracing system is premeditated. In this study G+15 regular column structure, G+15 floating column structure without bracing systems and G+15 floating column structure with bracing systems built in seismic zone 4 of India are considered for the analysis This study highlight the importance of bracing system for lateral stability in floating column structure. The comparison of result of maximum story displacement, maximum base reaction, and maximum story drift is done by Equivalent static method and Response spectrum method by using ETABS software (v 16.2.1) considering the earthquake Indian code IS 1893:2002.

Keywords— *: Floating column, Bracing, Equivalent static method, Response spectrum, IS 1893:2002, ETABS*

I. INTRODUCTION

Nowadays the vast majority of the multi-storied structures in India having a Floating column, which gives a lot of open spaces as an unavoidable component. This is mainly being adopted to facilitate anteroom or for parking of the vehicle.

Buildings oscillate during earthquake shaking. The oscillation causes inertia force to be induced in the building. The strength and period of oscillation, and the extent of inertia force encouraged in a structure depend on topographies of constructions, termed their dynamic individualities, in accumulation to the characteristics of the tremor shuddering itself. The significant vibrant characteristics of structures are methods of oscillation and damping. A type of oscillation of a structure is demarcated by associated Natural Period and Deformed Shape in which it fluctuates.

A vertical member whose slenderness ratio is more than 3 carrying compressive loads is called as a column. The main function of the column is to carry the load of the beam and transfer it to the foundation or footing of the structure. It is subjected to two equal and opposite compressive forces applied at its ends. They are the vertical members who support floors or girders in a building.

Regular column increases both stiffness and mass of buildings. Which provide lateral strength against earthquake loading.

Columns convey Axial Loads and thus are planned for firmness. Other loads from snow, wind or other flat forces can cause pliable in the columns. Thus, the Columns are needed for Axial Loading and Bending.

Fig 1.1 : showing column damage during earthquake excitation

II. OVERVIEW OF WORK

Civil engineering structure with the floating column is becoming a standard amenity for modern multi-story buildings in India. But this floating column lessens the proficiency of the construction to resist seismic forces up to huge amount that is why these are the tremendously detrimental unit in the seismic disposed area, and the building with the bracing system has more adjacent immovability as paralleled to normal moment-resisting mounted constructions behavior floating column structure with the bracing system is premeditated. In this study G+15 regular column structure, G+15 floating column structure without bracing systems and G+15 floating column structure with bracing systems built in seismic zone 4 of India are considered for the analysis This study highlight the importance of bracing system for lateral stability in floating column structure. The comparison of result of maximum story displacement, maximum base reaction, and maximum story drift is done by Equivalent static method and Response spectrum method by using ETABS software (v 16.2.1) considering the earthquake

Indian code IS 1893:2002.

Fig. 1.2: Structure showing Floating Columns

Floating column structure has low stiffness as compared to normal moment resisting framed structure due to this all other loading effects, e.g., wind loads, wave loads (excluding tsunami loads), blast loads, snow loads, imposed (live) loads and dead loads, earthquake excitation is

The most severe in floating column structure, because it imposes displacement under the building, which is time varying. This, in turn, demands lateral deformation in the building between its base and upper elevations. Greater is the seismic zone, loftier is the relentlessness of this levied relative distortion. Therefore, the main contest is to meet the duple request – the construction ought to be able to endure this levied distortion with loss under minor intensity trembling, and with no downfall under greater intensity trembling. The structure needs to have large unyielding distortion capacity and needs to have the power in all its adherents to withstand the forces and moments induced in them.
The introduction of the floating column in the structure makes the building more susceptible to collapse, to avoid this phenomenon due to lateral loading various lateral load resisting system such as a shear wall, bracing, core and outrigger and tabular may introduce to avoid the failure of the structure due to the earthquake excitation.
The Bracing systems rely on both compression and tension braces for stability, and so the stiffness and strength of the compression braces must be explicitly accounted for. The same upper bound limits on slenderness 6 apply, but there is no lower bound limit in Eurocode 8 because the concern about neglecting the compression brace force does not apply. In V-braced systems (Fig 3.4 and Fig 3.5) the plane brace is exposed to an out-of-balance strength when the density brace starts to clasp, and in Euro code 8 this must be deliberated for. Also, the horizontal brace must be designed to carry any gravity loads without support from the diagonal braces.

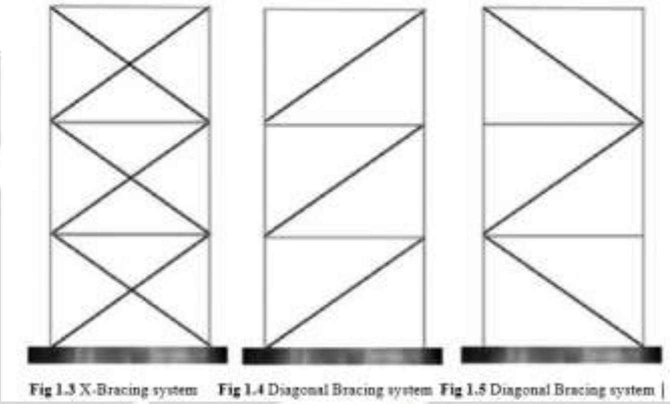

Fig 1.3 fig showing various arrangement bracing system

III. LITERATURE REVIEW

On reviewing various research paper following points are concluded .

- Base shear is lesser in the building with a floating column.
- The floating column structure shows many disadvantages such as high story displacement, large story drift.
- Floating column structure shows low lateral stability.
- Various software's are used such as STAAD PRO, SAP 2000, etc are used for seismic analysis of structures with floating column and without floating column.
- The X bracing system was found to be the most efficient and stable section amongst all the bracing systems.

Ms. Waykule S.B. (2017), conducted static analysis for a multi-story building with and without floating columns. Diverse cases of the structures are considered by varying the locality of detached columns level wise. The operational reaction of the building mockups with respect to, Base shear, and Storey disarticulations are inspected. The essayist examined the fundamental response of the structure with admiration to this. The investigation is supported out using software sap 2000. It was observed that the displacement of each story of floating column building is more as compared to without floating column building.
Akshay Sonawane et. al. (2016), focuses on the effect of bracing system on the story that is critical in the structure. They premeditated on bracing systems like cantankerous bracing, oblique bracing, reversed V bracing and V bracing systems and outcomes on mechanisms like story drift and bending moment in pillars and story transposition were premeditated.
K. K. Pathak et. al. (2016), considered and examined G+9 steel mounts with a diverse variety of bracing configuration and altered combination of soft-story by means of software STAAD Pro. Result of these altered bracings on the soft story is planned for unlike constraints like column shift, determined deflection, story drift, maximum bending moment, maximum axial force and maximum shear force.
Nitin Bhojkar and Mahesh Bagade (2015), considered the seismic appraisal of elevated- rise construction by means of steel bracing system. For the seismically insufficient reinforced concrete mounts, the use of steel

bracing systems is prepared for solidification. In this investigation, diverse varieties of bracing structures are used and seismic examination is completed for seismic region III as per IS1893:2002. Adjacent movement, story drift, axial force, and base shear are the key constraints which are considered. It was perceived that the mechanical toughness was supplementary by the X type of steel bracing and extreme inter-story drift of the casings also grows condensed. The bracing system gives best outcomes in lateral rigorousness, power aptitude as well as in movement capacity. They determine that a decline in lateral movement of the assembly happens up to 65% by the use of X kind of bracing arrangement. Story drift becomes less in X type of bracing system. There was an upsurge in axial force for X bracing system up to 22%.

Hiten L. Kheni and Anuj K. Chandiwala (2014), worked on seismic retort of RC construction with soft floors. The durable column and scrawny beam assembly are done for the wellbeing of the house during a quake. For this notion, beams yield afore columns failure. In this research, different models are analyzed with a soft story for proper assessment of the stiffness of the story. They concluded that displacement would be more at upper stories and less at lower stories.

Snehal Ashok Bhayar (2017) had done a comparative study of the behavior of building with and without floating column for the regular and irregular plan, subjected to seismic loading for equivalent static analysis by using ETABS Software. The areas of study were Base Shear, Lateral story Displacement and Storey Drift in seismic zone

IV. He found that the probability of failure of building with a floating column is more.

Kapil Dev Mishra (2018), worked a multi-storied Court structure of varying heights (G+2+3, G+2+4, G+2+5) devising different location of floating pillars (4 columns of mid ordinate axis or 4 columns of diagonal axis) at altered stature of construction (at the floors above second level) at two separate zones (Zone III and Zone IV) are deliberated for examination and STAAD PRO. Software is utilized for the investigation. The plan space of construction up to the second floor is 30m×30m and above this floor area is changed to 20m×20m. The comparisons were done on the basis of results from the software and are based on following parameters such as Maximum displacement at joint, Support reaction at the base, Maximum moment at the joint and Base shear..

IV. NEED FOR THE PROPOSED WORK

There are many disadvantages of using floating column in multi-storey building these disadvantages can be overcome by using bracing .

i. Not suitable in the high seismic zone since the abrupt change in stiffness was observed.

ii. The mandatory huge size of girder beam to sustenance of floating column.

iii. Floating columns tips to toughness anomalies in the structure.

iv. The load from operational adherents shall be shifted to the footing by the shortest thinkable path. The course of weight path rises by providing floating columns, initiating in poor presentation of the construction.

v. It results in more displacement, story drift than structure without floating column.

V. OBJECTIVE OF THE WORK

The key objective of the existing study are as follows:

1) To calculate the Maximum Reactions, Maximum Story Displacement, maximum base shear and Maximum Story Drift of R.C.C framed structure.

2) To compare the above results with the floating column structure (without bracing) and floating column structure with the bracing system.

3) To study various cases of multi-story buildings having different locations of floating columns.

4) To compare the results by using Equivalent static method and Response spectrum method.

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