EFFECT OF OBLIQUE COLUMN AND VISCOUS DAMPER ON PODIUM STRUCTURE USING ETABS

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Abstract: Nowadays the space requirement was the major problem which results into the congestion of structures and also they are very unsafe whenever lateral forces i.e. earthquakes forces are experienced by the structures. Podium is the structure which was used as a multi-usage platform for making the regular or irregular structures. Podium may consist of commercial to certain height, residential and also for many other purposes. The stiffness variation can also be seen throughout the height of the structure, which results in large oscillation of the building. Hence in order to fulfil the space requirement and also for the safety purpose the podium structure and its analysis is been made. In the present study the static analysis and the dynamic analysis is been done. Also the dynamic analysis was been carried out by the response spectrum method. The whole analysis is been carried out in the ETABS software and also the time histories of builings with or without large slab below the foundation which forms the podium structure , different types of column like normal and oblique and also with and without damper is compared by applying time history of different Indian earthquakes and response of the building is studied.

Keywords—Static analysis, response spectrum analysis, Time history method, Podium structure.

1.INTRODUCTION

Nowadays population was a major problem and is increasing day by day thus resulting in construction of more vertical housing due to shortage of land. Earthquake was a common disastrous phenomenon that each and every structure on earth may suffer to certain damage. The seismic waves affect the building more violently that leads to building collapse. The aim of the structural engineer was to know the reason of building collapse due to earthquake and find out appropriate solution for that may be designing a structure to withhold the lateral forces etc. Among the different structures available Podium structure is one among them which can solve the above mentioned problem.

1.1PODIUM STRUCTURE

Podium was the multi-tasking structures in which large variation in plan and elevation was seen. Structure has the stiffness variation while observing the elevation of the podium structure. This stiffness variation creates a large drift to the podium that results in the disturbance of the structure. Thus in order to make the structure more stable and to withstand desirable seismic forces engineer has to design the structure by using proper techniques and many design software. By using proper design techniques and software, stability of the building can also be achieved if each and every member of the structure are properly analyzed and designed for the worst condition of seismic forces. The member such as beam, column, slab etc., which are the main part of structure, must withstand large lateral forces even in the high magnitude of earthquake.

1.2OBLIQUE COLUMN

Oblique columns are stiffer as RC frames, and therefore, the initial stiffness of the RC frames largely depends upon the stiffness of oblique column. Stiffness of RC frames significantly depends on the distribution of oblique column in the frame. Generally, the RC frames with regular distribution of masonry oblique columns in plan as well as along height are stiffer than the RC frames. The factor of 2.5 was specified for all the buildings with soft stories irrespective of the extent of irregularities and the method is quite empirical. The other option was to provide symmetric RC Columns, designed for 1.5 times the design storey shear force in both directions of the building as far away from the centre of the building as feasible. In this case, the columns can be designed for the calculated storey shears and moments with considering the effects of oblique columns.

Fig:1: Typical Figure of Podium structure

Fig:2 Typical Figure of Oblique Column

2. OBJECTIVES

- To investigate the seismic performance of a multistory podium structural building with normal and oblique column by Response Spectrum analysis and Time history analysis
- To compare podium structure with ordinary structure
- To study the effect of damper in a structure

3. DESCRIPTION OF MODEL

In this study two models of vertical and three oblique column model were prepared using ETABS software and analysed . The properties of the considered building configurations in this study are given below.

Table 1: Details and dimension of the building models

Type of building:	Ordinary moment resisting frame
Number of stories	G + 7
Seismic zone	IV
Floor height	3m
Grade of Concrete	25Mpa
Grade of steel	Fe 500
Beam dimension	300mm × 500mm
Column dimension	230mm ×450mm
Slab depth	150mm
Podium dimension	4000mm×2000mm
Damping coefficient Cd	810 kN-s/m
Velocity exponent	0.3

Table 2: Dead load and live load data

Dead load	1.5 kN/m²
Live load :	2 kN/m²
Importance factor(IF):	1
Response reduction factor:	3

4. MODELS CONSIDERED FOR ANALYSIS

Total five models were considered, vertical column building with and without podium, oblique column building with and without podium and final with damper. Response Spectrum Method is used for the analysis of the models

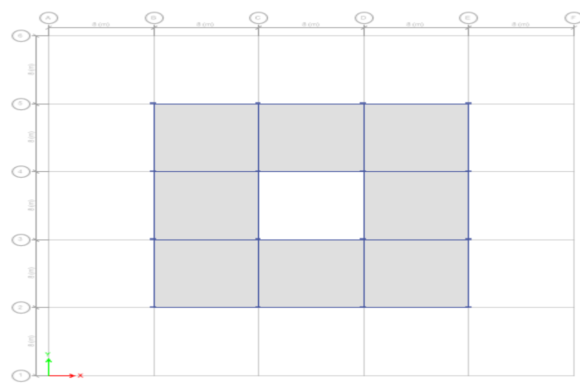

Fig.3: Plan of building with podium

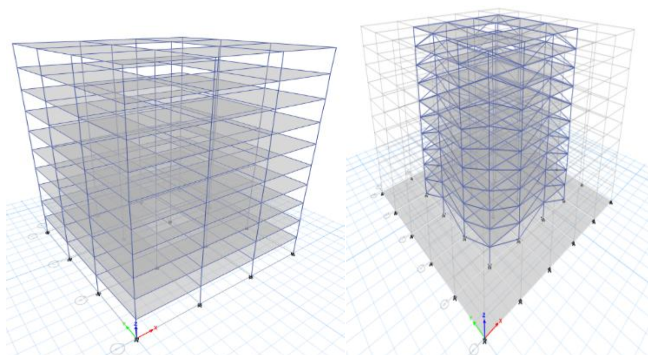

Fig 4: 3-D view of vertical column building without and 3-D view of oblique column with podium

5. RESULT AND DISCUSSION

The modelling and seismic analysis for all models were carried out using the software ETABS. The results obtained are tabulated below. The parameters which are to be studied are maximum storey displacement, maximum storey drift, storey stiffness and overturning moments

Table 3: Values Obtained For Different Models in X Heading

	Vertical column without podium	Oblique column without podium	Vertical column with podium	Oblique column with podium	oblique column with podium and damper
Maximum storey displacement (mm)	65.716661	21.430232	56.234166	21.430126	21.208236
Maximum storey drift	0.002668	0.000827	0.002408	0.00082	0.00081
Maximum storey stiffness (kN/m)	171966	1670774	171559	1660774	1680999
Overturning moments (kNm)	3.186E-07	1.009E-07	3.258E-07	8.495E-07	1.06E-07

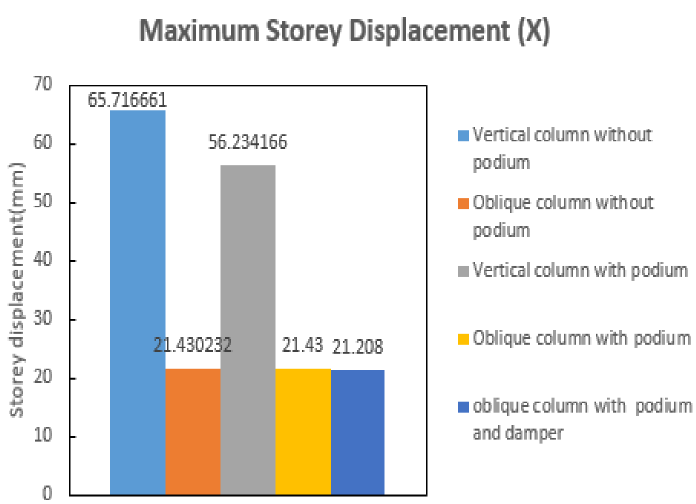

Fig.5: Storey displacement(mm)

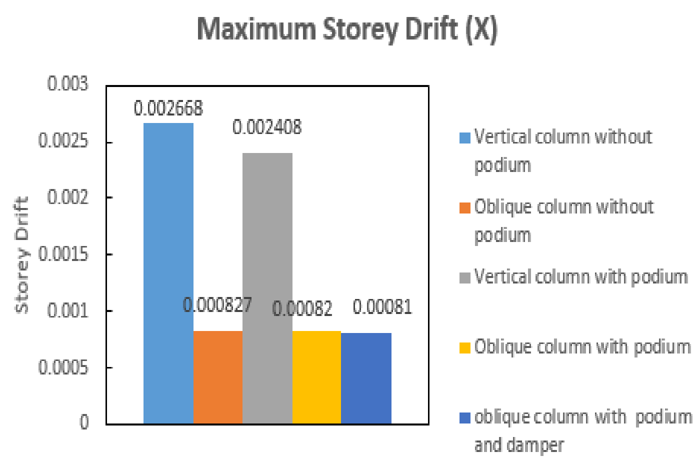

Fig.6:Storey drift

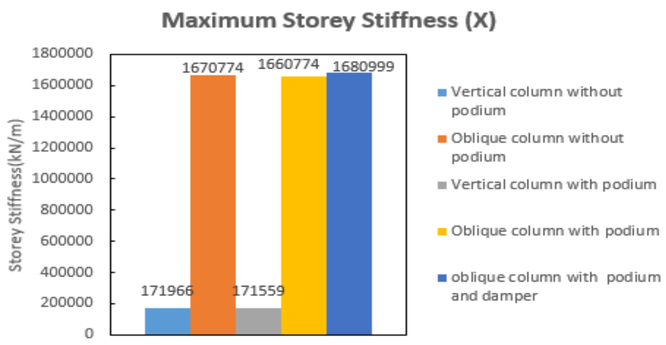

Fig.7:Storey stiffness (kN/m)

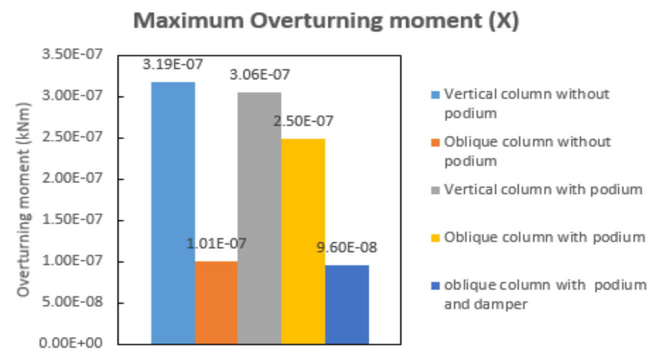

Fig.8: Overturning moment(kNm)

Table 4: Values Obtained For Different Models in Y Heading

	Vertical column without podium	Oblique column without podium	Vertical column with podium	Oblique column with podium	oblique column with podium and damper
Maximum storey displacement (mm)	92.323591	21.284144	91.314709	21.084058	20.134773
Maximum storey drift	0.004085	0.00082	0.003889	0.00082	0.000808
Maximum storey stiffness (kN/m)	65519	1557410	65384	1557411	1559495
Overturning moments (kNm)	14576	68179	14332	68179	67780

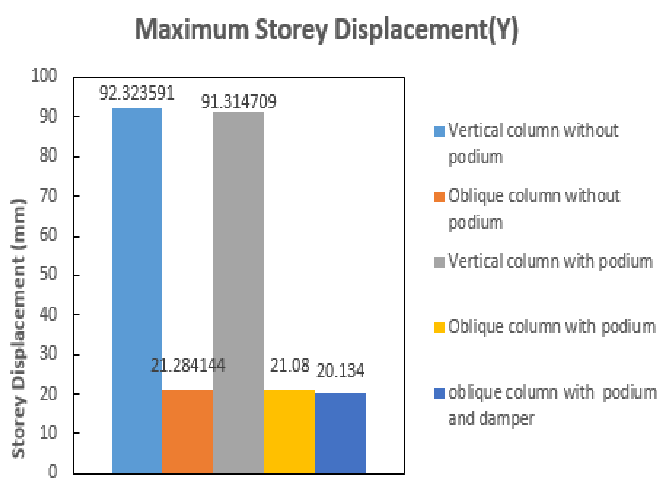

Fig.9: Storey displacement (mm)

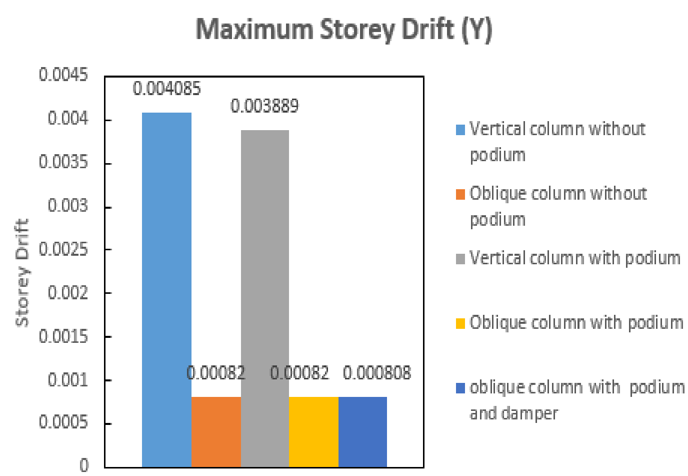

Fig.10: Storey drift

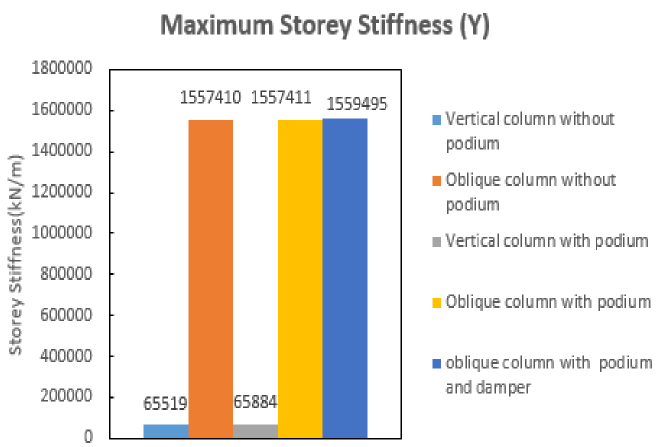

Fig.11: Storey stiffness(kN/m)

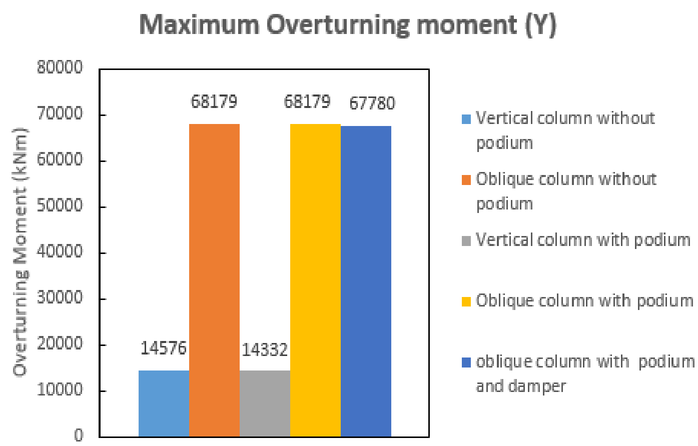

Fig.12: Overturning moment(kNm)

6. CONCLUSION

All five models of vertical, oblique and oblique with and without podium modelled The selected models where analysed using the response spectrum method in ETABS and the conclusions obtained from the analysis are:

- Structure provides more resistance in the oblique column building which makes the structural system more effective
- Introduction of viscous damper provides more stability to the structure in seismic loading.
- Oblique column more effective seismic loading.
- The podium structure provides better stability to the building.
- Building with oblique column and viscous damper, with podium will provides more stability during seismic loading.

7.REFERENCES

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