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Performance analysis of stilt floor building with composite column in seismic event

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Abstract - *An abstract summarizes, the buildings now a day are constructed as stilt floor building because they fulfill the parking need also the free space available at soft storey is free from FSI. Stilt floor building causes lots harm to mankind because such building fall under substantial ground shaking. Because of stilt floor building large over turning moment occur, opening of 90 degree bent up tie, bulging effect in longitudinal reinforcement and plastic hinges. Model analyze here in this study by time history method and pushover analysis. In this composite column is use only at stilt storey and checked the performance of the building by using commercial software sap2000 the result shows building with composite column performs well.*

Key Words: Composite column, Pushover, Stilt floor.

1. INTRODUCTION

This stilt floor building getting more popular now a day because it provide extra space for parking and it is free from FSI. Such type of building also called as soft storey building or open ground storey. From past earthquake studies such type of building found to be more vulnerable. Stiffness discontinuity in the building is of the major reason of building collapse. All around the world study is going on to find solution regarding to this problem. Some of the solution is found out such as use of moment resisting RC frame, use of shear wall, provision of extra reinforcement near beam column joint, design of heavy section using of multiplication factor etc. The motivation behind this study is to improve the performance of building. Lots of software available in market but for this particular for study SAP2000 is use because it facilitate analysis of composite column, pushover analysis etc.

Fig -1: Photograph of stilt floor building.

1.1 Stilt floor or soft storey building

According to various codes such as ASCE, Eurocode or IS code a stilt or soft storey building is one that has a discontinuity in the stiffness of the building where one storey is more flexible than the adjacent storeys. According to IS1893:2002, a soft storey has lateral stiffness less than 70% of that of the storey immediately above, or less than 80% of average stiffness of the three storeys above. Such building behaves like an inverted pendulum in earthquake excitation and moves single degree freedom system.

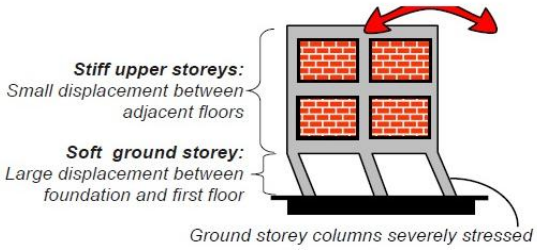

Fig -2: Behaviour of soft storey.

1.2 Composite Column

Researcher studies that composite column has great axial load resistivity than normal reinforced concrete column and such section perform well in seismic excitation. Two types of composite columns, those with steel section encased in concrete and those with steel section in-filled with concrete are commonly used in buildings. In this study concrete encased steel composite column is used.

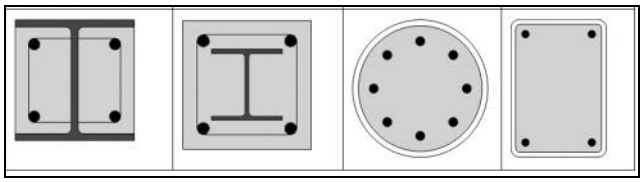

Fig -3: Types of composite column.

2. SYSTEM DEVELOPMENT

For this study G+20 building model as soft storey building as it contain infill wall in upper storey and slab model as plate member. The building is analysis for time history and

pushover analysis method. The geometry of building is unsymmetrical and as shown in the figure 3. The concrete enchased steel composite column is used at stilt storey only.

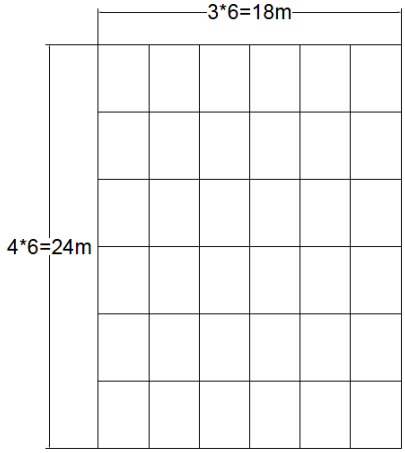

Fig -4: plan of G+20 Unsymmetrical building.

The data required for analysis of building is in table 1.

Table -1: Building configuration data

Live load	**3kN/m²**
Floor finish	1kN/m²
Wall thickness	0.23 m
Beam size	0.4m*0.23m
RC column size	0.6m*0.6m
Composite column size	0.6m*0.6m
I-sec in composite column	ISHB 450
Rebar	16 No's of 25 dia
Grade of concrete	M30
Grade of reinforcement	Fe 500
Storey height	3m

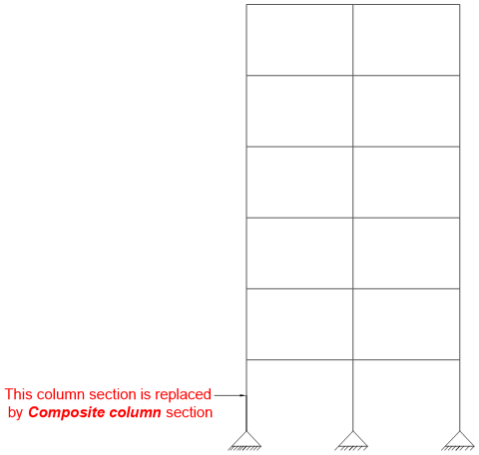

Fig -4: Position of Composite Column

3. PERFORMANCE ANALYSIS

Performance analysis is carried out by two methods that is time history and pushover analysis method.

3.1 Time History Method

Time history method is which in recorded ground motion data from past earthquake record. Buildings are subjected to dynamic response of the structure at each increment of time, when its base is subjected to specific ground motion time history.

3.1 Pushover Analysis

The pushover analysis is non linear static analysis in which displacement is applied under the vertical load. The performance point is consider as per fema-440 linearization equalization method. In this method capacity curve crosses demand curve. This performance point gives when the building shows collapse level.

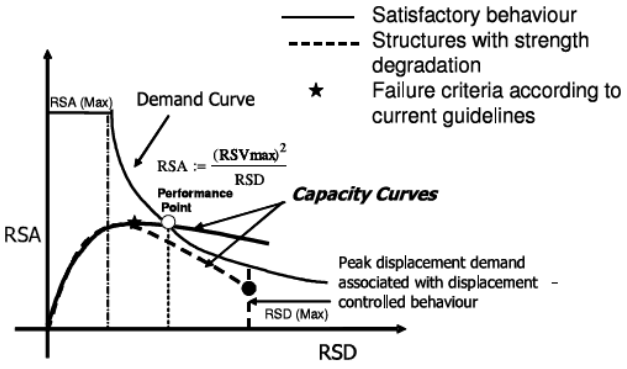

Fig -5: Performance point as per FEMA – 440.

4. RESULTS

4.1 Time history method

The base shear resistivity of building as per time history method is as in figure 6.

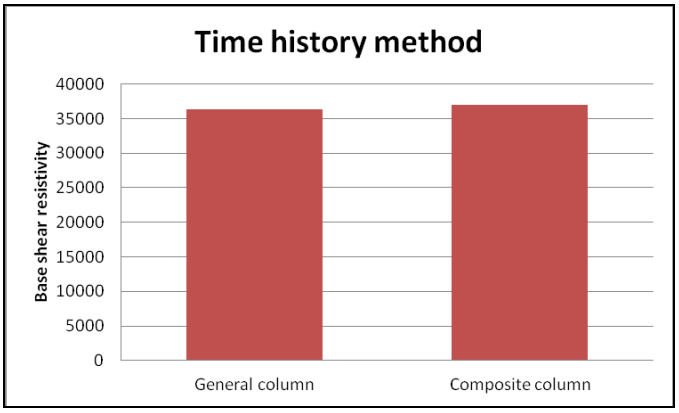

Fig -6: Graph of Base Shear Resistivity.

4.2 Performance point from pushover analysis

This performance point shows building collapse under dead load and substantial increment displacement in pushover analysis method.

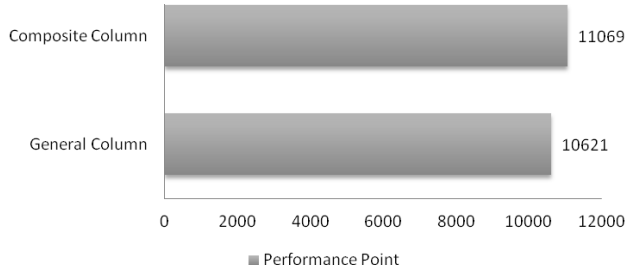

Fig -6: Performance Point of G+20 Building.

4.3 Discussion

From the result it has been clear that building with composite column shows higher value of base shear resistivity in time history method and higher value of performance point.

5. CONCLUSIONS

It is observed from result that building with composite column shows better performance in seismic event or ground motion or in earthquake excitation.

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