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NON LINEAR DYNAMIC ANALYSIS OF G+10 CONCRETE BUILDING'' WITH SOFT STOREY AT DIFFERENT LEVEL

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Abstract: Many Urban multistoried building in India today have open storey as an unavoidable features. This is primarily being adopted to accommodate parking or lobbies in open storey, such features are highly undesirable in building built in seismically active areas, and this has been verified in numerous experience of strong shaking during past earthquake. Though multistoried building with open (soft) ground floor is inherently vulnerable to collapse due to earthquake load, their construction is still widespread developing nation like India. Social and functional need to provide parking space at the ground floor level and for office. Open storey at different levels of the structure for out-weighs the warning against such building from engineering community. In this paper we are concentrating on finding the best place for soft stories which is use for parking space and offices in high rise building.

Keywords- Non Linear, Soft Storey

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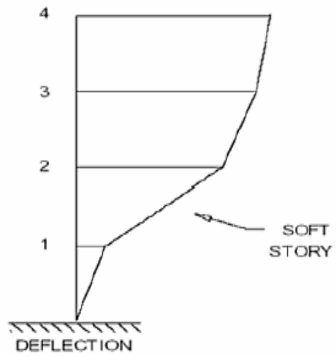
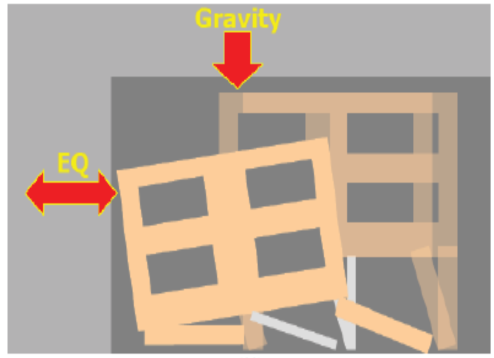
INTRODUCTION

Due to increasing population since the past few years so that car parking for residential apartment in the populated cities is the matter of major problem. So that the construction of multistoried building with open storey (first) is common practice in all world. The upper stories have brick infilled walls panels. The draft Indian seismic code classifies a soft storey as one in which the lateral stiffness is less than 70% of that in the storey above or less than 80% of average. The building with the first soft storey, where seismic base shear as experienced by the building during an earthquake is dependent on its natural period , the seismic distribution of stiffness and the mass along the height . In the building with soft storey, the upper storey s being stiff undergoes smaller inter-storey drift. However the inter storey drift in the first storey is large. The strength demand on the column in the first storey is also large , as the upper storey force in the column maximum , for the upper storey force in the column are effectively reduced due to the presence of infill, infill increase the stiffness of the column . And this is the main reason, ground (first) soft storey has no infill, only column is there, there is infill masonry in between column only column is there . This has adverse effect on performance of the building during ground shaking, such buildings are required to be analyzed by dynamic analysis and designed carefully. [1]

Infill plays an important role in building to increase the stiffness of storey. The most commonly used technique to model infill panel is that of single equivalent diagonal strut. The observation of response of the of the building structure, engineered are not considered infill in designing the structure. Infills were usually classified as nonstructural element and their influence was neglected during the modeling phase of the structure leading to substantial inaccuracy in predicting the actual seismic response of framed structure. Masonry infill has several advantage good sound and heat insulation property. These helps to increase the strength and stiffness of R. C. C. frame and hence increase the lateral drift, higher energy dissipation capacity due to cracking of infill. [2]



(i)



(ii)

Fig (i) Lateral displacement diagram of building with soft storey under lateral loading (ii) collapse mechanism of a building structure having soft storey

SOFT STOREY FAILURE

During the earthquake, the upper storey move almost together as a single block and most of the horizontal displacement of the building occurs in the soft ground storey itself. In other words this type of building sways back and forth like inverted pendulum.

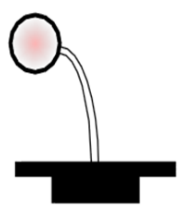


Fig (iii) Behavior of OGS buildings like as inverted pendulum

Producing high stresses in column and if column are incapable of taking these stresses or do not possess enough ductility, they get severely damage and which can also lead to collapse of the building. Soft storey is subjected to large lateral load during earthquake and under lateral loading. This lateral force cannot be well distributed along the height of the structure. This situation causes the lateral force to concentrate the storey having large displacement. The lateral force distribution along the height of the building is directly related to mass and stiffness of each storey. The collapse mechanism of structure with the soft storey under both earthquake and gravity load. Therefore dynamic analysis procedure is accurate distribution of the earthquake and lateral force along the building height determining modal effect and local ductility damage efficiency. [3]

NONLINEAR DYNAMIC ANALYSIS (TIME HISTORY ANALYSIS**)**

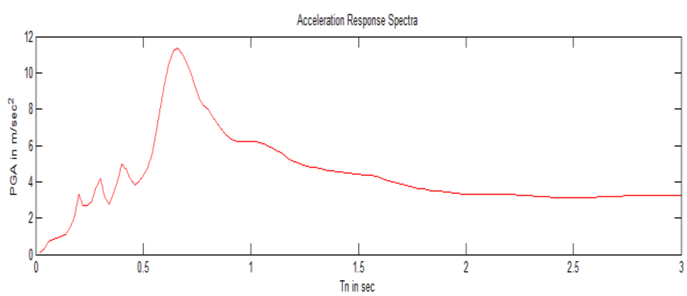
Nonlinear dynamic analysis or inelastic analysis known as Time history analysis. This is the only method to distribute the actual behavior of the structure during earthquake. This method is based on direct numerical integration of the motion differential equation by considering the elasto-plastic deformation of the structure element. This method capture the effect of amplification due to resonance , the variation of displacement at diverse level of a frame , an increase of motion duration and tendency of regularization of movement result as far as the level increase from bottom to top.

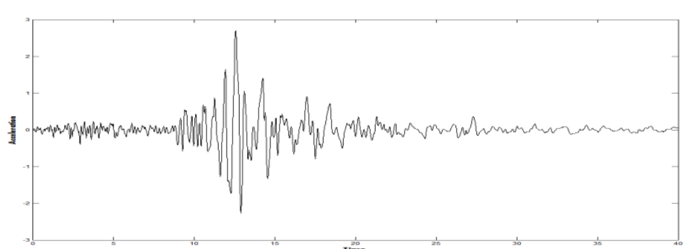
The time history analysis determines the response of a structure due to forces, displacements, velocities or accelerations that vary with time. There are two versions of this method, first is direct integration and the second, modal superposition [Ehsan, 2011]. Modal superposition is only suitable for linear analysis, whereas direct integration can be used also for nonlinear analysis. The direct integration utilizes a step-by-step solution of Equation of motion, which is generally described as:

$$M\ddot{U} + C\dot{U} + KU = F(t)$$

Where, *M, C, K* are the mass, the damping, and the stiffness matrices, respectively

For this purpose ground acceleration records, Loma Prieta October 17, 1989 is used as the disturbing ground motion. The acceleration time history and response spectrums of the model input earthquake are shown in Fig (iv) & (v). [4]





DISCRIPTION OF BUILDING

In the present study 3-Dimension G+10th storey R. C. C. frame building are considered. The plan and elevation of the building model is a shown in fig.

1)	Building	=	(G+10) Storey
2)	Slab thickness	=	150mm
3)	Live Load	=	2.5kN/m^2 (No live load at terrace)
4)	Live load at Terrace	=	1.25 KN/m^2
5)	Floor finish	=	1kN/m^2
6)	Wall Thickness (EXTERNAL)	=	230mm
7)	Wall Thickness (Internal)	=	115mm
8)	Grade of concrete	=	M25
9)	Grade of steel	=	Fe415
10)	Software used	=	SAP2000
11)	Method of analysis	=	Nonlinear time history analysis.
12)	Earthquake use	=	Loma prieta earthquake – Oct 17, 19894

13) Preparing model in SAP 2000 with applying section properties of beam and column

COLUMN C1- 400 x 400, C2- 450 x 450 mm, BEAM B1-300X300mm

PROPERTY OF INFILL

Applying masonry infill having width = 0.87m, Thickness = 0.230m, modulus of elasticity = 700mpa

And passions Ratio=0.3

Model-1 Building has soft storey at ground floor. Building has no infill at ground storey as model as bare frame and infill are consider for all floors.

Model-2 Building has soft storey at first floor. Building has no infill at first floor storey as model as bare frame and infill are consider for all floors.

Model-3 Building has soft storey at second floor. Building has no infill at second floor storey as model as bare frame and infill are consider for all floors.

Model-4 Building has soft storey at fifth floor. Building has no infill at fifth floor storey as model as bare frame and infill are consider for all floors.

Model-5 Building has soft storey at seventh floor. Building has no infill at seventh floor storey as model as bare frame and infill are consider for all floors.

Model-6 Building has soft storey at tenth floor. Building has no infill at tenth floor storey as model as bare frame and infill are consider for all floors.

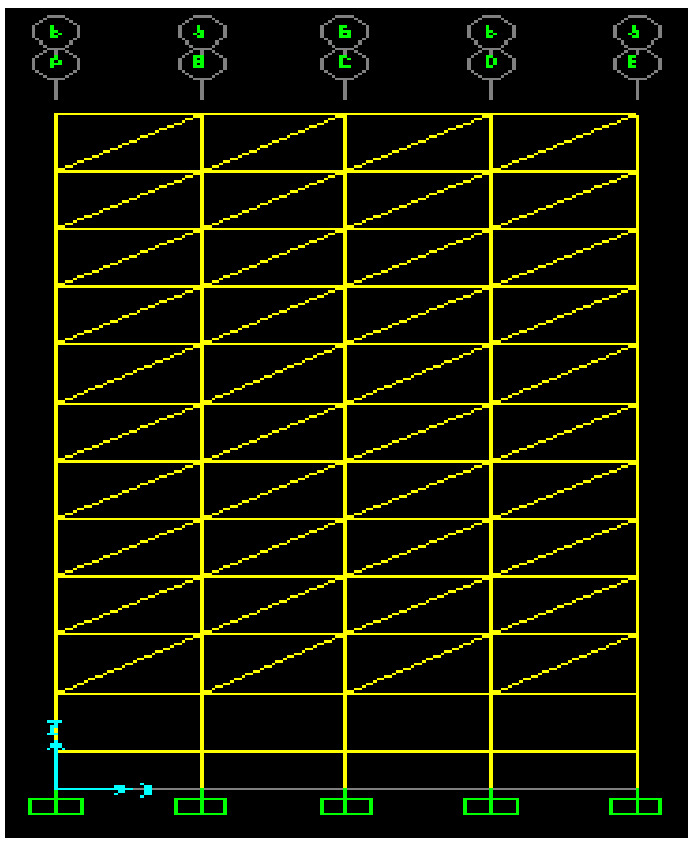


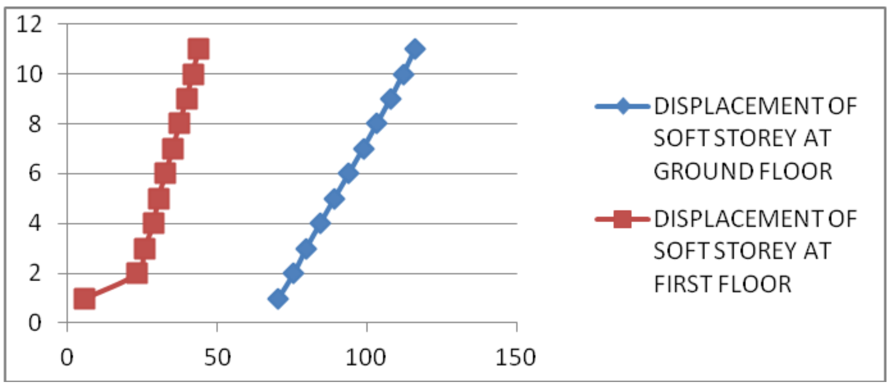
Fig (vi) Elevation Of Building

OBJECTIVE OF THIS PAPER

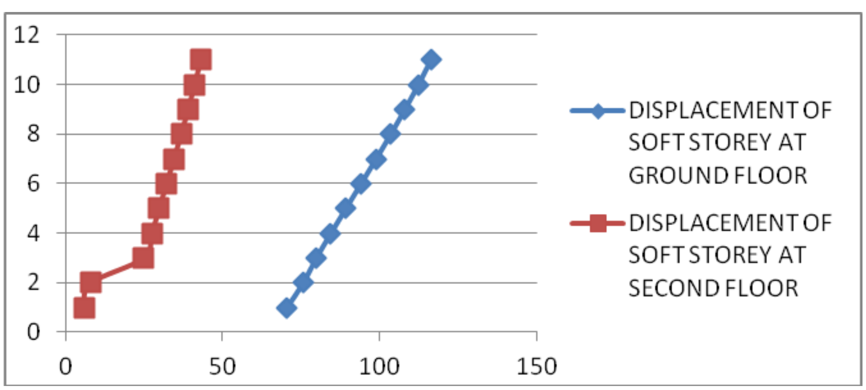
R. C. C. frame building which are known to perform poorly during strong earthquake shaking. The presence of infill wall influences the overall behavior of the structure when subjected to lateral force. When masonry infills are considered to interact with their surrounding frame the lateral stiffness and lateral load carrying capacity of structure largely increases. In this paper the seismic vulnerability of building is shown with an example of G+10. Earthquake analysis would be comes out of R. C. Frame of tall building without infill at soft storey with the help of SAP-200

RESULT AND DISSCUSSION

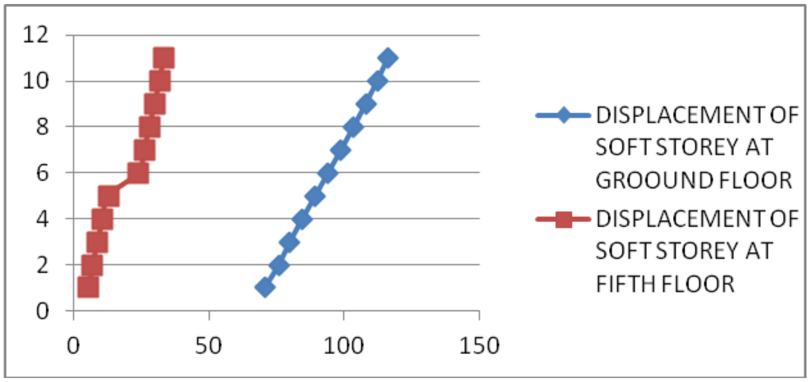
1) **Building with soft storey at ground floor without infill compare Building with soft storey at first floor**



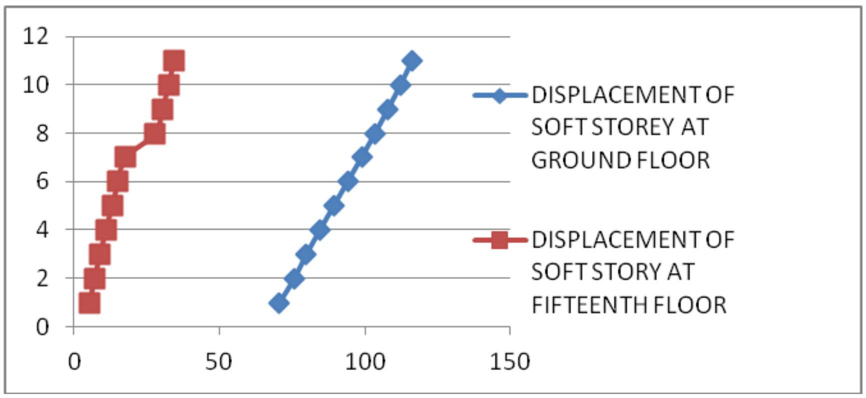
2) **Building with soft storey at ground floor without infill compare Building with soft storey at second floor**

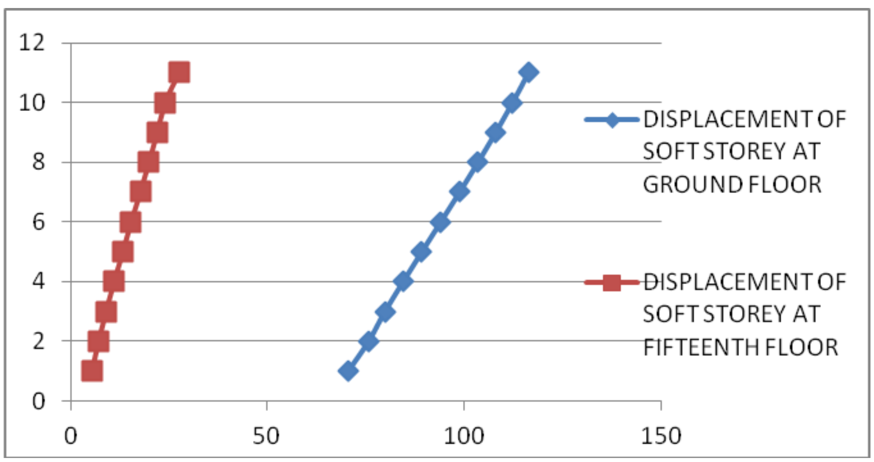


3) Building with soft storey at ground floor without infill compare Building with soft storey at Fifth floor

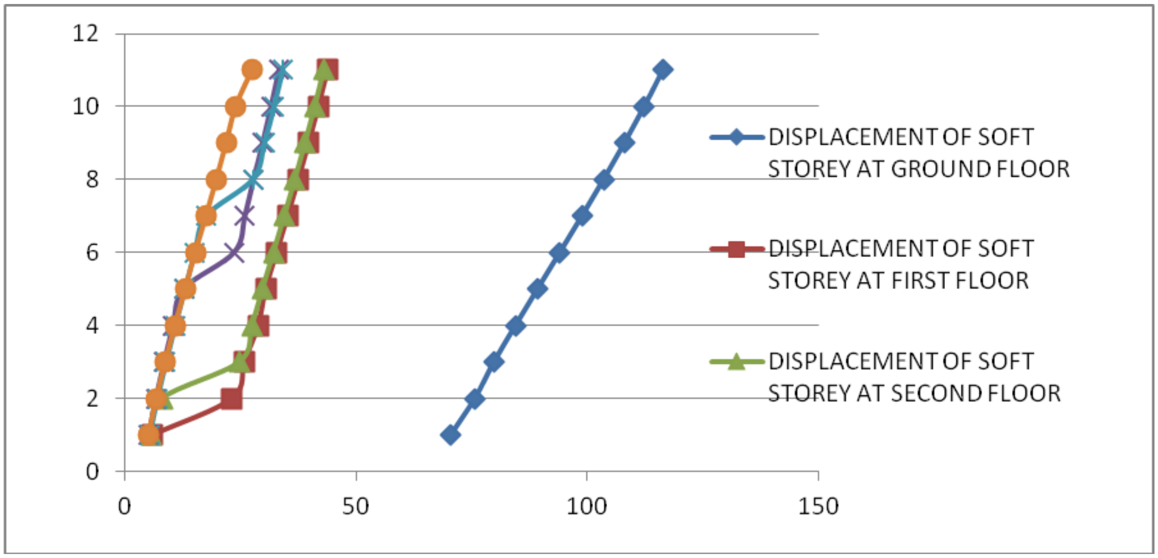


4) Building with soft storey at ground floor without infill compare Building with soft storey at Seventh floor

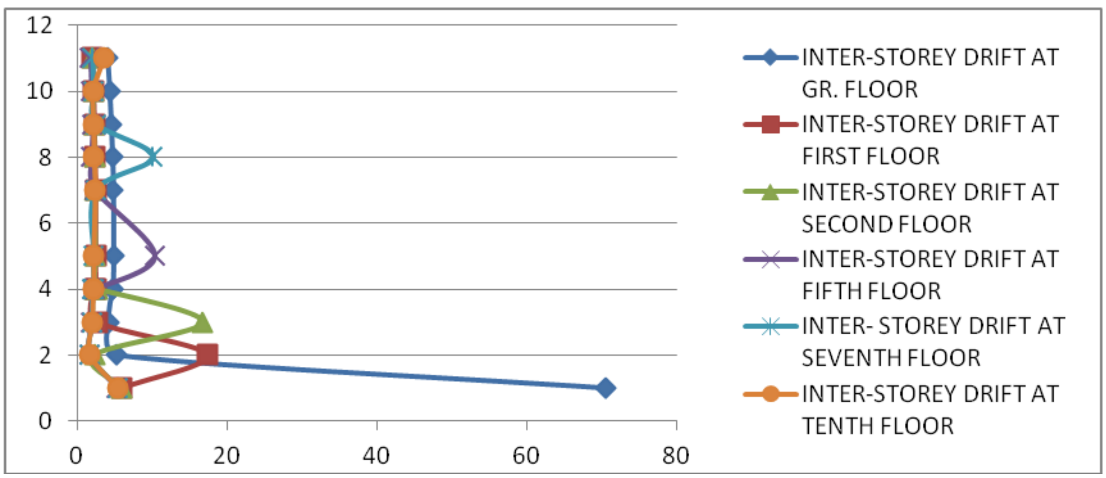




5) Building with soft storey at ground floor without infill compare Building with soft storey at Tenth floor



6) Building with soft storey at ground floor without infill compare Building with soft storey at drift level



Inter-Storey Drift At Different Levels

CONCLUSION

1) The seismic performance of structure is very sensitive to stiffness ratio. The lower the stiffness ratio of soft storey, more vulnerable the structure will be to the seismic forces.

2) Soft storey at lower floor is more vulnerable to seismic force because it attracts more force due to high seismic weight.

3) It is conclude that stiffness of structure should be maintained throughout the structure.

4) It is observed that location of soft storey at higher level displacement of structure goes on increasing order.

5) It is also observed that inter- storey drift goes reducing as the location of soft storey.

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