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ELASTIC BEHAVIOUR OF BUILDING SUBJECTED TO EARTHQUAKE LOAD

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ABSTRACT

Height of building ,column orientation ,mansonry infill wall are three parameters to evaluate the dynamic response of a structural system under vibration. Multi-storeyed buildings are behaved differently depending upon the various parameters like mass-stiffness distribution. In multi-storey building as height increases there is an increase in stiffness and reduction in time period This paper attempted to find out effect of height and effect of unreinforced mansonry infill wall in RC frames and study the soft storey .

***Keywords*: Multi-Storied RC Frame, Time Period, Masonary Wall, Building Height, Mass Of Building**

I INTRODUCTION

Earthquake causes shaking of the ground. So a building resting on it will experience motion at its base when the ground moves, even the building is thrown backwards, and the roof experiences a force, called inertia force. The inertia force depends upon mass and acceleration of the building. The duration of the oscillation provide the acceleration part of the inertia force. As the duration of the oscillation is less, more will be the acceleration part of the inertia force and vice- versa. Thus the oscillation period of the building provides a rational sense of the inertia force expected to come on the building under design seismic load. This characteristics (i.e. oscillation time) of building is peculiar under dynamic load only so it is under the head of dynamic characteristics of building. Dynamic characteristics of buildings are influenced by many factors such as stiffness.

Now we don’t have the special height of building upto which increasing the size of structural member enhances the stiffness. In general increasing the size of column, stiffness and mass of building structure also increases. But starting from bottom upto particular height of building structure, the increase in stiffness is linear after that particular height of structure, the stiffness reduces. Whereas in case of mass, it increases from bottom to top of building linearly. Presently there is no ready tool to find out the specific height of structure, upto which increase in column size, will give maximum stiffness.

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The objective of present paper is to find out the effect of height on natural period, find out effect of mansonry infill wall on natural period

II METHODOLOGY

Natural period, T_n of a building is the time taken by it to undergo one complete cycle of oscillation. It is an inherent property of a building controlled by its mass (m) and stiffness (k). These three quantities are related k

$$T_n = 2\pi\sqrt{\frac{m}{k}}$$

in units are seconds(s).as we increase height of building then increasing the time period and when mansonry wall added in bare frame the stiffness is increasing and time period will be reduce. when masonry wall is not provide at ground floor so it is called soft storey. The time period of with infill wall and soft storey at 25 storey is near about same and at 10 th storey time period is vary. We have to prepared 5 model and analysis in SAP 2000.Beam and column sizes are same and apply the properties of masonry

III CASE STUDY

In this paper, 6 different combinations of stories viz. i.e G+1, G+2, , G+4, G+9, G+24 with same column size are analysed. In each model stiffness and time period is find out. All model has been prepared in SAP-2000 and In each set of building, the model is analysed by increasing the are floor height and adding masonry wall and find out the effect on natural periods and study the soft storey

In present work all beam sizes were considered as 230x450 mm, larger column size of 230x700 mm were considered and strut in mansonry model is 1.04X0.23. A live load of 10 kN/m^2 is considered with default earthquake loading from SAP and load combinations from IS 1893.

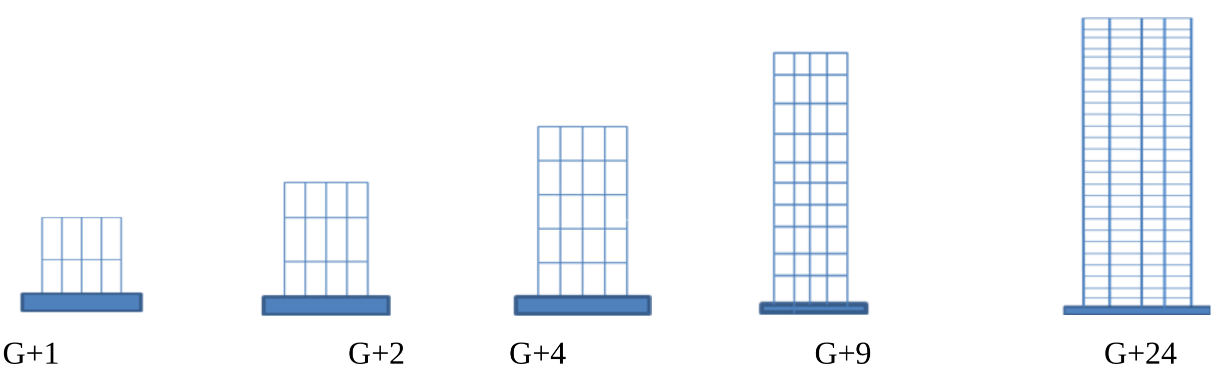

Fig. 1 Combinations of Building Stories

IV DIFFERENT MODELS ANALYSED

In this work various building models were analysed by varying building height and adding the mansornry wall at different storey levels. Following are the various building configurations analysed in this regard

4.1 Effect of Building Height

The taller a building, the longer its natural period tends to be. But the height of a building is also related to another important structural characteristic: the building flexibility. Taller buildings tend to be more flexible than short buildings. As the height of building increases, its mass increases but its overall stiffness decreases. Hence, the natural period of a building increases with increase in height. Buildings Model 1,2,3,4 and 5 have same plan size with same column and beam sizes, but are of different heights. Taller buildings have larger fundamental natural period than shorter ones. Result of effect of building height in table no.1

Table 1 output for effect of building height

SR.NO	MODEL	NO OF FLOORS	HEIGHT OF MODEL	TIME PERIOD
1	MODEL 1	G+1	6m	0.300
2	MODEL 2	G+2	9m	0.402
3	MODEL 3	G+4	15m	0.883
4	MODEL 4	G+9	30m	3.35
5	MODEL 5	G+24	75m	20.420

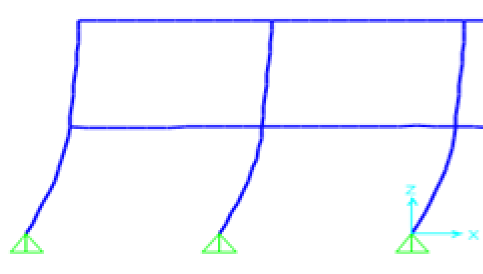

Fig 1.1 Snap shot of model 1 in table no 1 using SAP software.

4.2 Effect of Unreinforced Masonry Infill Walls In RC Frames

In many countries, the space between the beams and columns of building are filled with unreinforced masonry (*URM*) infills. These infills participate in the lateral response of buildings and as a consequence alter the lateral stiffness of buildings. Hence, natural periods (and modes of oscillation) of the building are affected in the presence of *URM*. As a result, lateral stiffness of buildings increases when *URM* infill walls are included in the analysis models. Thus, natural period of a building is lower(fig.1.2) when stiffness of *URM* infill is considered, than when it is not considered i.e in bare frame.

In bare frame, with constant column stiffness the time period is more then the URM infill buildings. This due to increased stiffness of infill wall, which absent in bare frame. In Building with soft storey, the overall stiffness effect is very small and also it has seen that the time period is nearly same for building with soft storey and building with URM infill wall. Result of effect of URM infill wall in table no.1.1

Table 1.1 output for unreinforced Masonry infill walls in RC fames

SR. NO	MODEL	TIME PERIOD FOR FULL MASONRY	TIME PERIOD FOR BF
1	MODEL 1	0.12	0.300
2	MODEL 2	0.14	0.402
3	MODEL 3	0.24	0.883
4	MODEL 4	0.54	3.35
5	MODEL 5	2.23	20.420

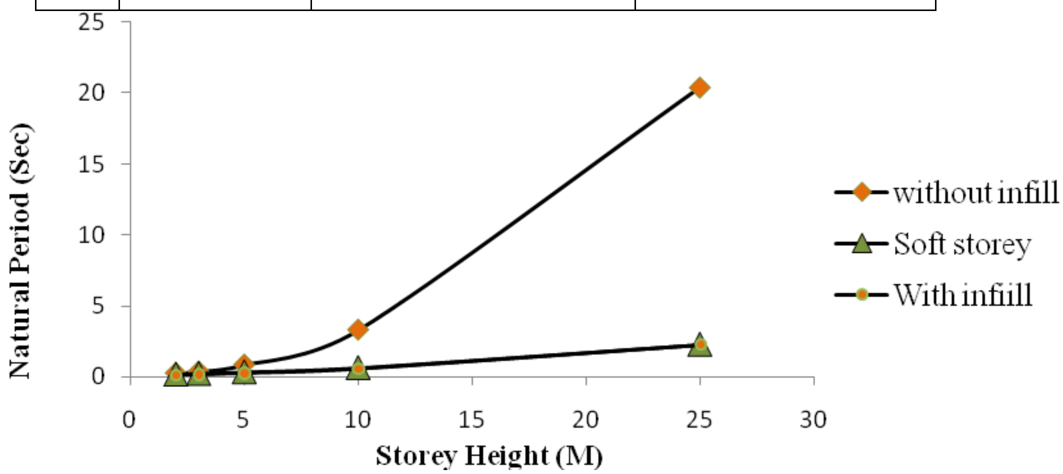

Figure 1.2: Effect of Unreinforced Masonry Infill: Natural period of the building is lower when the masonry infill is provided.

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4.3 Effect of Mass

Mass of a building that is effective in lateral oscillation during earthquake shaking is called the seismic mass of the building. It is the sum of its seismic masses at different floor levels. Seismic mass at each floor level is equal to full dead load plus appropriate fraction of live load. The fraction of live load depends on the intensity of the live load and how it is connected to the floor slab. Seismic design codes of each country/region provide fractions of live loads to be considered for design of buildings to be built in that country/region, An increase in mass of a building increases its natural period. Buildings Model1, Model2 and Model 1re all 8-storey buildings with same plan size, elevation and column sizes, but with different floor mass (Table no 4 in fig).Imposed floor mass in building Model 1 is 10 kN, while that in Model 2 is 20KN and Model 3 is 40KN.Fundamental translational natural periods of heavier mass buildings is more. That is Model 2 and Model 3 are having larger natural period than that of building Model Details of sizes of column and beam in table no.1.2 and results of effect of mass in table no.1.3

Table1.2 Input for effect of mass on building

SR.NO	MODEL	COLUMN SIZE	BEAM SIZE	LIVE LOAD
1	Model1	230x700	230x450	10KN
2	Model2	230x700	230x450	20KN
3	Model3	230x700	230x450	40KN

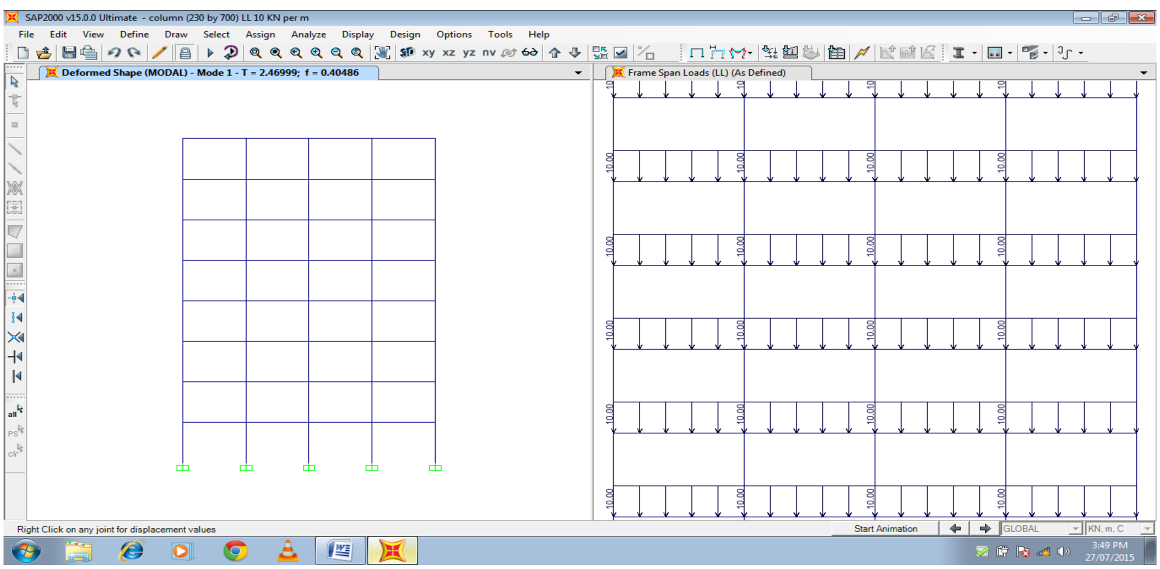

Figure no: 1.3 Snap shot of model 1 in table no 2.3 using SAP software

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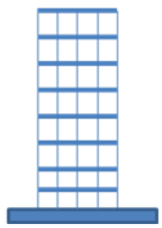
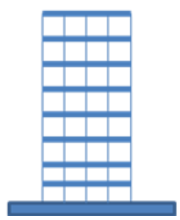
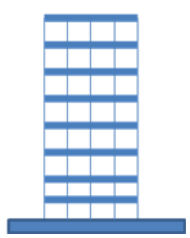
Table1.3 Output for effect of mass on building

SR.NO	FIGURE	MODEL	IMPOSED MASS	TIME PERIOD
1		Model 1	10kN	2.46
2		Model 2	20KN	2.64
3		Model 3	40KN	2.96

V CONCLUSION:

1) Taller building have larger natural period then smaller.

2) Natural period of the building is lower when masonry infill is provided.

3) Fundamental translational natural periods of heavier mass buildings is more.

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