Comparative Study on Diagonal Strut Models of R.C. Building with Different Infill Pannel

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Abstract:-
The main goal is to provide an overview of how infill strength and stiffness affect seismic analyses of open ground floor buildings. Reinforced concrete (RC) frames with brick masonry infills make up the standard multi-story building. Unreinforced infill walls in the frames change how the building responds to lateral loads. It is evident that the masonry infills significantly contribute to the lateral stiffness, strength, general ductility, and energy dissipation capacity of the structure. Infill stiffness is frequently disregarded in frame analysis in practice, though. Between the column and the beam, the infill acts as a compression strut, transferring compression forces from one node to another. The infill walls in the model are calculated using an analogous diagonal technique, as advised in the literature. In this study, the contribution of infill walls to the stiffness of the reinforced concrete framed building was examined.

Index Terms– Equivalent diagonal strut, Masonry Infill walls, Stiffness, Open Ground Storey, Soft Storey.

I. Introduction

Masonry infills are a common building material in India for both utilitarian and aesthetic reasons. The masonry infills are invariably constructed after the basic frameworks of beams, columns, and slabs have attained sufficient strength, making the bond between the masonry infill and bounding RC frames negligible at the sides and top surface of the infill. As such, the infill panels are classified as non-structural elements, and the structures are analysed and designed by treating them as dead load and ignoring any kind of structural interaction of infill panels.

Due to a lack of residential parking due to population increase, the concept of an open ground storey (O.G.S.) building is adopted. Despite the absence of masonry infill at the bottom floor in these constructions, all

The idea of an open ground storey (O.G.S.) building is used because population growth will cause a problem with residential parking. These kinds of structures only have brick walls on the upper stories and not the ground floor.

The upper storeys are substantially stiffer than the open ground story because infill walls are present in every upper storey except for the ground storey. As a result, the upper floors move virtually as a single block, while the majority of the building's horizontal displacement takes place in the soft storey.

When an earthquake shakes, this style of building sways back and forth like an inverted pendulum, placing a great deal of stress on the ground story columns and beams. The rapid decrease in lateral stiffness and strength in the ground level relative to the upper floors with infill walls is thought to be the cause of this style of building's fragility.

The strength and stiffness of infilled-frame structures are known to be impacted by unreinforced masonry (URM) infill walls, also known as masonry-infill walls. Because the infill walls operate as a diagonal strut under lateral loads, drastically increasing the stiffness, it is not always safe to ignore the interaction between the frame and infill panels in seismic locations. This could affect the seismic demand due to a large drop in the stiffness of the infill walls.

II. Objectives

To **investigate the impact of infill wall stiffness and strength on different structural response quantities during seismic analysis under various infill configurations.**

LiteratureReview

[1] Mr.Jasdeep Singh Rehal and DR. G.D. Awchat investigated that the when compared the bare-frame model and equivalent diagonal strut models results for seismic load analysis observed that without considering the stiffness of infilled frame in bare model stiffness of the building is very less where are the strut model which considered the stiffness of infill as strut has more stiffness of the building and also economical in section area of steel.Therefore, strut model gives the accurate performance of building during seismic analysis of the building.

[2]Ramanand shukla, Roopak sasikumar and Dipendu Bhunia investigated that The effect of infill panels cannot be neglected while designing for horizontal forces. Considering infill panels analysis would influence the seismic behavior of frame structure to great extent since the panel increase strength and stiffness of structure.

[3] Vijay N Rathod and Dr.B. S. Munajl investigated that the short naturel periods of height natural frequency indicates a very stiff structure and mass will more or less wholly with the ground since the transmissibility is nearly one. The maximum relative displacement is zero.

[4] Mr Puneeth K investigated that the The Multiplying Factor increases with the height of the building, primarily due to the higher shift in the time period.

III. Methodology

In this study, ETABS v17 was used to analyse the following structures using various types of infill wall arrangements:

Plans that are 1) fairly symmetrical and 2) irregular.

The two constructions' plan areas were different for the study, thus two models were made for each case, one of which considered the infill wall as a dead load and the other of which handled it as an equivalent diagonal strut. The wall is assumed to be completely solid with no openings. For the analysis, the plan areas of the two structures differ; two models were created for each case, one in which the infill wall was treated as a dead load and the other in which it was treated as an equivalent diagonal strut. It is presumed that the wall doesn't have any openings.

a) **Fairly Symmetrical Building:**

Model 1: Considering all the wall.

Model 2: Considering wall at periphery only.

b) **Irregular Building:**

Model 1: Considering all the wall.

Model 2: Considering wall at periphery only.

Comparison of the factors taken into account when studying regular and irregular types of structures.

- The two structures need to be examined in light of the various seismic zones (IV).
- The Base Shear, Displacement, and Drift are the outcome parameters that are compared.

Structure and Section details:

Height of the floor	3.0 meter
Thickness of shear wall	230mm
Grade of Concrete	M20
Grade of steel	Fe –415
Beam	
Symmetrical Building	230mm x525mm
Irregular Building	230mm x 400mm
	300mm x545mm
Column	
Symmetrical Building	300 mm x 750 mm
	450mm x450mm
Irregular Building	230mm x 575mm
	300mm x650mm
Slab thickness	150mm
Live load	2KN/m^2
Floor finish load	1kN/m^2
Wall dead load	12.67kN/m

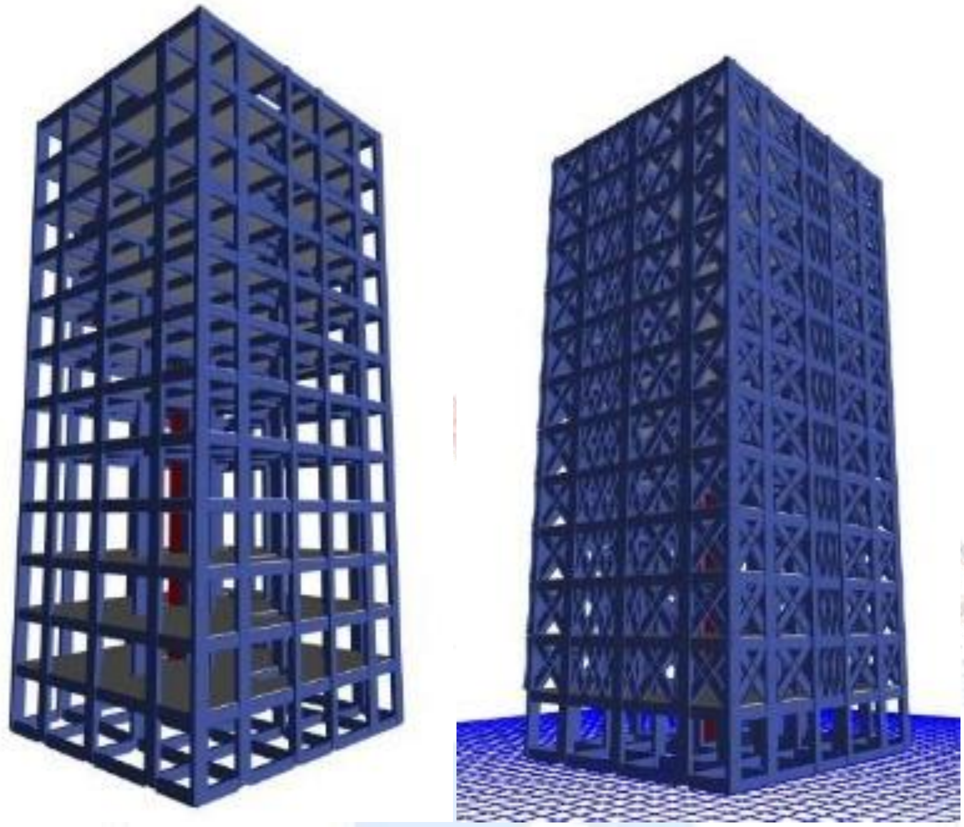


Fig:1Symmetrical plan bare frame & equivalent diagonal strut model

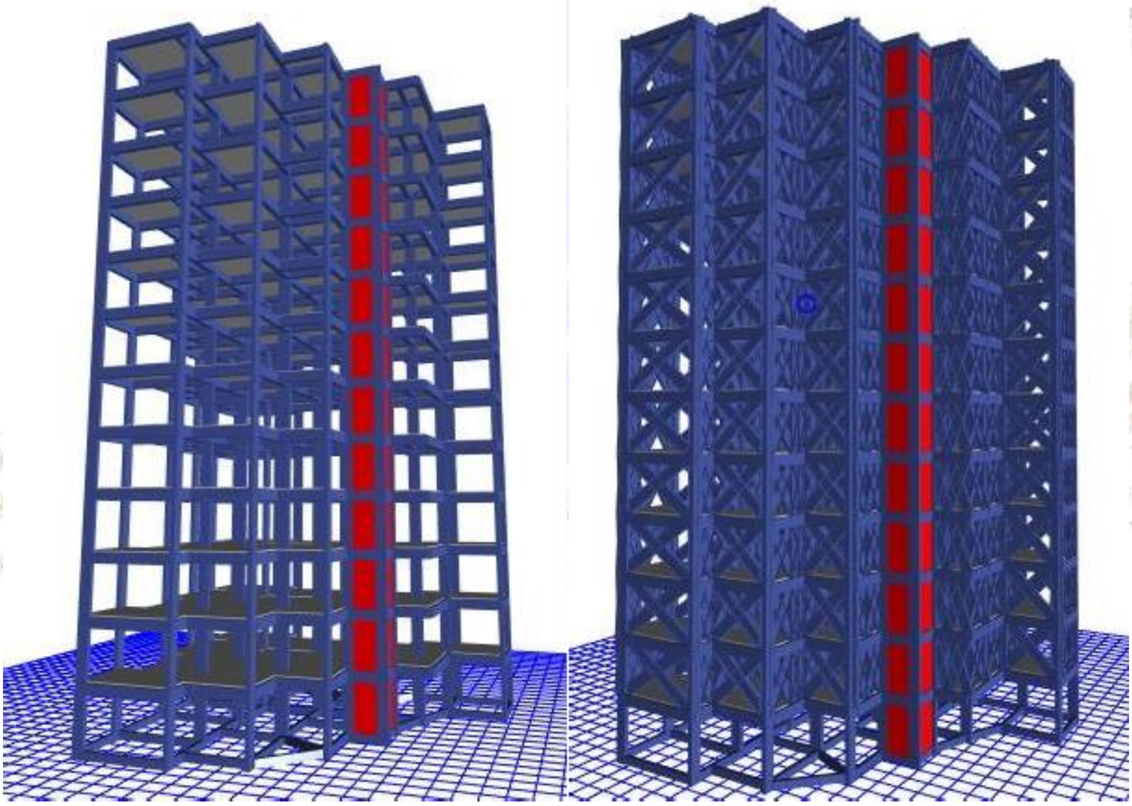
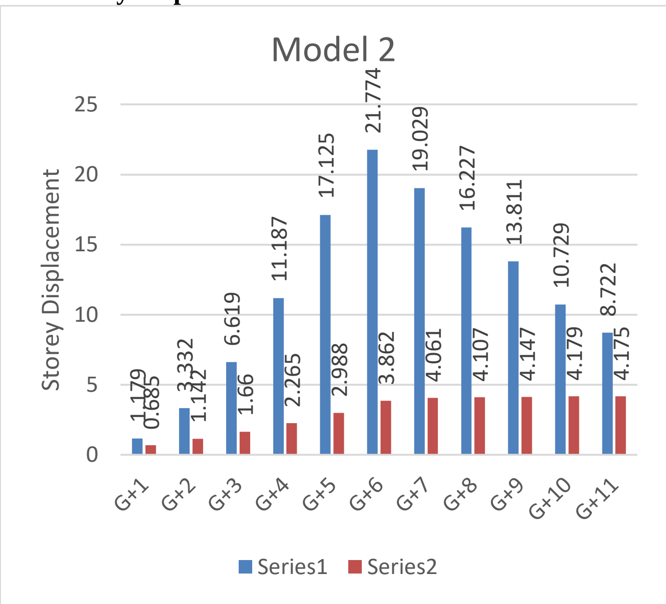


Fig:2 Irregular plan bare frame & equivalent diagonal strut model

IV. RESULTS:-

Below are the findings from an investigation of a multi-story symmetrical and asymmetrical structure that was subjected to seismic stresses in Zone IV. The impacts of wall dead load and related diagonal strut were taken into consideration, along with various wall configurations. The infill wall is depicted as a dead load in all of the graphs in series 1, but as an equivalent diagonal strut in series 2.

Storey Displacement:



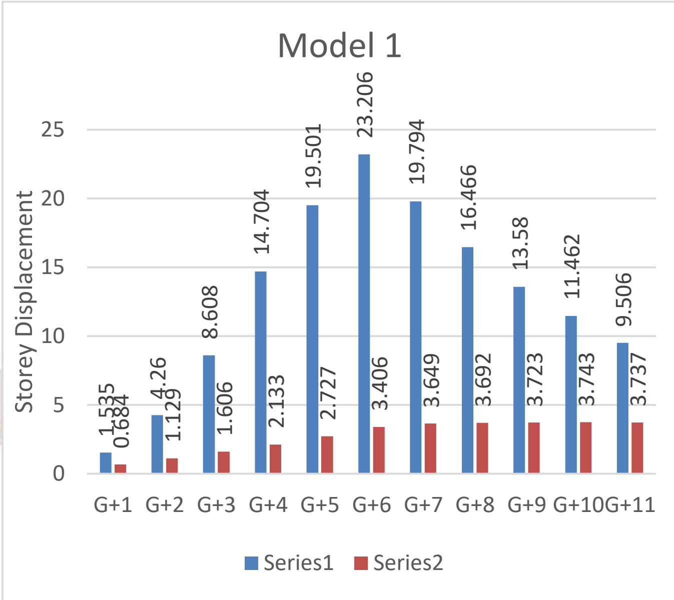
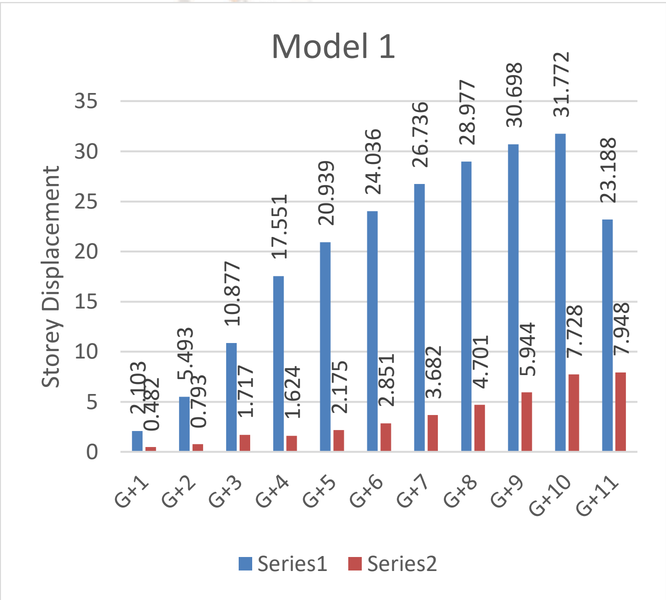


Fig:3 Storey Displacement in Symmetrical Building



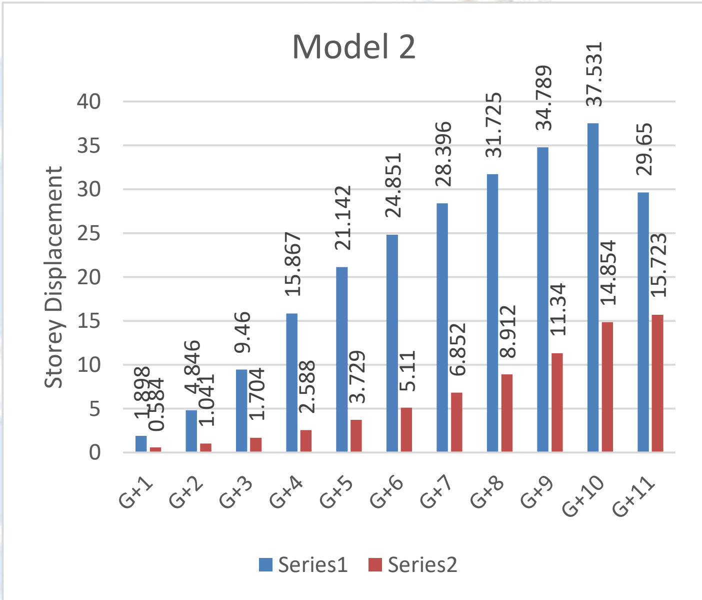
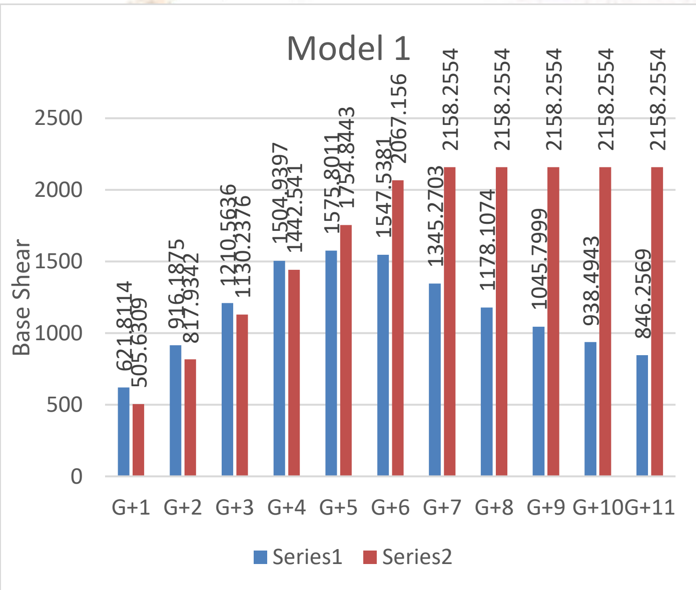


Fig:4 Storey Displacement in Irregular Building

Base Shear:-



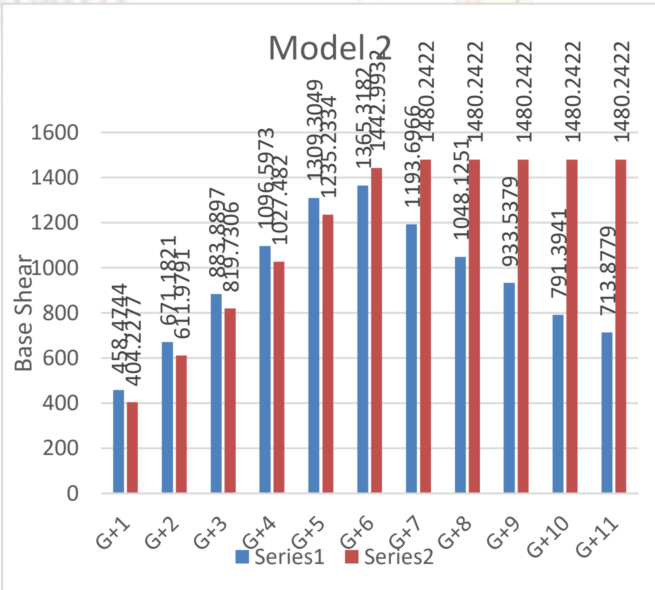


Fig:5 Base Shear in Symmetrical Building

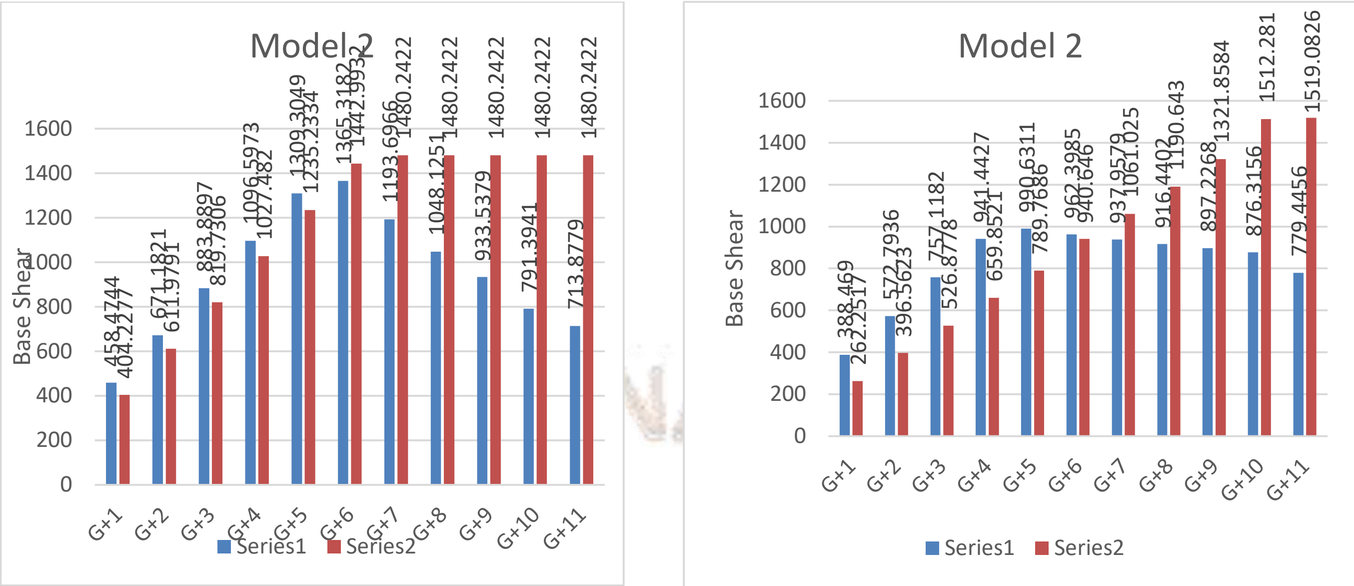


Fig:6 Base Shear in Irregular Building

StoreyDrift:

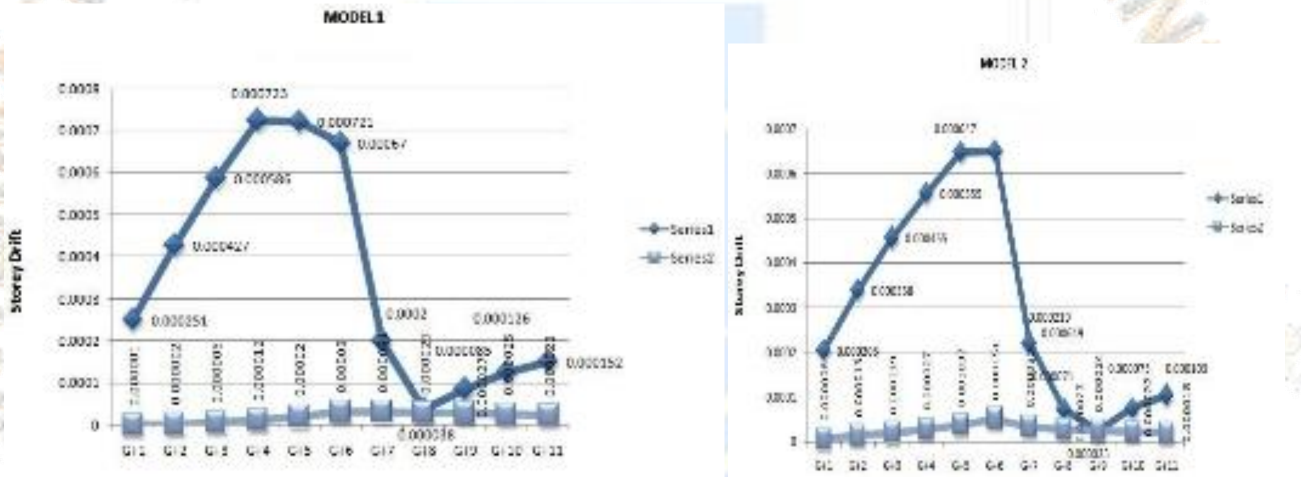
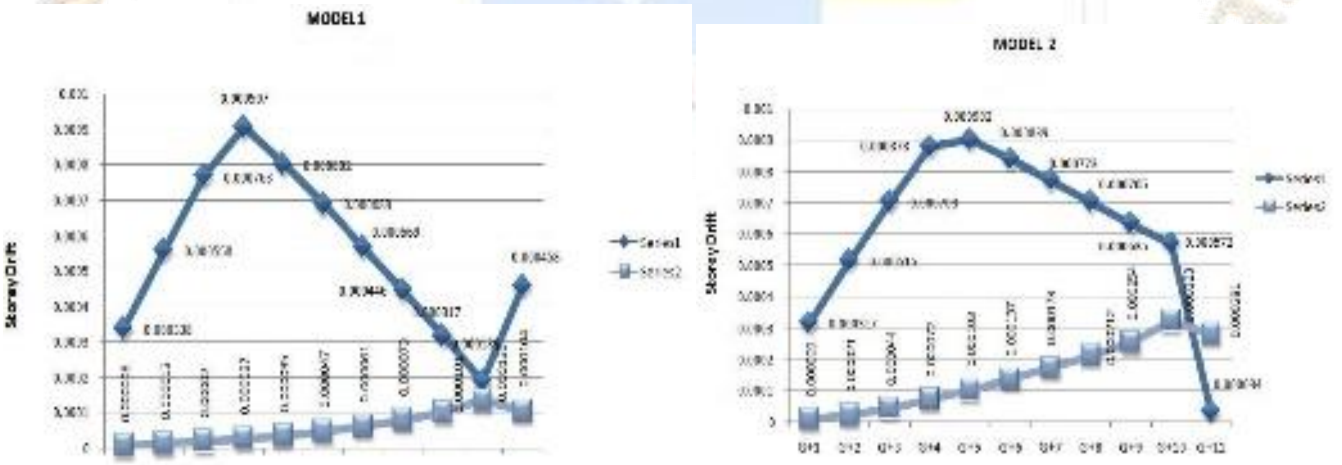


Fig:7 Story Drift in Symmetrical Building



V. CONCLUSIONS:-

- The behaviour of the structure is significantly altered by the infill wall, hence infill walls must be taken into account while doing a seismic study of the building.
- In contrast to an infill frame, a bare frame exhibits a significantly greater degree of deflection. The displacement of the storeys increases up to a particular height, after which it progressively declines.
- Base shear in infill walls as dead load models increases up to a particular height and then significantly decreases.The increase in rigidity is the cause of the decline in base salary.
- Up to six storeys, a wall acting as a dead load will result in an increase in storey drift and a significant drop in value, while a wall acting as an equivalent diagonal strut will only see a modest change in value. The results of storeydrift varies slightly after eight stories and beyond.
- The introduction of infill panels in the RC frame minimises the time that the frames are left exposed and also increases the stiffness of the structure, as can be inferred from all the issues raised above. The lowest storey drift value and maximum base shear value are found in the fully infilled frame. And it is evident that, up to a certain height, there is a significant discrepancy in the results, but that gap narrows as height is steadily increased. These illustrations indicate that the infill wall's effects as a dead load and as an equivalent diagonal strut are almost identical above a certain height.

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