COMPARITIVE STUDY OF REGULAR AND IRREGULAR RC BUILDING CONSIDERING THE EFFECT OF INFILL

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Abstract-Masonry infill is generally considered as non structural element. Structures with brick work infill wall in RC buildings generally increase stiffness and strength of the frame structure. The infills are normally not considered in the design of buildings as they are designed as bare frames. This study investigates the effect of masonry infill wall to check non linear behavior of RC frame building. For this purpose, Three RC frame buildings of G+20 i.e. regular building and buildings with vertical irregularity are considered (with bottom story considering as soft story/open story). For modeling masonry infill wall the equivalent diagonal strut approach is adopted. Displacement v/s base shear curves (pushover curves) are obtained for the structures using ETABS Nonlinear version 2016 software. To obtain pushover curves, Non linear analysis is carried out and results are presented in comparison with bare frame and with infill wall frame with soft story or open story. From the pushover curves, story displacements, inter-story drift, base shear are determined.

Key words; **Masonry infill wall, diagonal strut, pushover analysis, performance point, pushover curve**.

1. INTRODUCTION

1.1 General

Masonry infill in RC framed building cause several effects under lateral loadings. Short-column effect, soft-storey effect, displacement and tensional effect and collapse due to .Hence, IS codes for seismic loads tend to discourage such constructions in differential seismic regions. However, in several moderate earthquakes, such buildings have shown excellent performance even though many such buildings were not designed and detailed for earthquake forces. It is seen that the masonry infills contribute significant lateral stiffness and strength.

The main advantage of pushover analysis is it makes the computation time lower. The use of pushover analysis of the structure for considering the effect of infill's on the RC frame have been studied broadly in previous studies, but limited work is done on the study of effect of infill's on regular and irregular structures. From the literature review it is found that the use of pushover analysis on the regular and irregular RC infill frames is appropriate and for modeling and analysis of the same software have been used.

1.2 Effect of masonry infill on RC structure

At this time it is crucial to study the quake effect of the structure with infill walls in earthquake engineering. RC outline structures with infill wall have been generally built for commercial, mechanical and multi story private uses in upheaval districts. infill wall regularly comprises of blocks built amongst sections of a solid casing. Infill wall for the most part not considered in the configuration procedure and the quality based outline in the code consider infill wall as regarded as structural segments. By large examination of the RC encircled structures it is accepted that thesee infill wall won't avoid any oblique load thus its significance in the analysis of the structures is neglected. more over the non availability of easy and analytical models of masonry infill has become another interference for its application in the analysis.

In accuracy the presence of infill wall undoubtedly advance the rigidity and strength of the RC building. In any case, providing infill wall significantly affects the reaction of a solid casing building, expanding basic quality and hardness. Very much defined infill's can expand the general execution, quality, sidelong resistance and vitality scattering of the structure. The seismic vibration power dispersion is reliant on the firmness and mass of the working along the tallness. The auxiliary commitment of infill divider results into stiffer structure in this manner lessening the story floats or parallel uprooting at ground level. This enhanced execution makes the basic outline more reasonable to consider infill dividers as an auxiliary component in the vibration safe configuration of structures. Researchers have proved that using equivalent strut and model shown ideal behavior of masonry infill.

2. OBJECTIVES

- Comparative study of regular and irregular RC structures with infill considering parameters such as story displacements, inter-story Drift, base shears and plastic hinge.
- The frame is analyzed using ETABS software up to the failure and the load deformation curves i.e. pushover curve are plotted.
- To explore the effects of a different configuration multi story RC frame Building (G+20) with and without infill walls by pushover analysis, using ETABS 2016 Finite element software. The response parameters such as story displacements, inter-story Drift , base shears and plastic hinge locations are compared there by assessing the Effect of infill walls on the performance of structure.
- In the present study, modeling and designing of the RCC frame with and without infill walls under the loads will be analyzed using ETABS software and the results so obtained have been compared. The frame is analyzed using ETABS software up to the failure and the load deformation curves i.e. pushover curve are plotted.
- Design of RC framed building as per IS Codal provisions, regular, irregular in plan and analysis of the same, support are fixed at the foundation level.
- Presence of openings is not considered in the infill walls.

3. METHODOLOGY

3.1 pushover analysis and its requirements

Pushover analysis is generally adopted to carry out as nonlinear static analysis, which is carried under step by step increasing lateral loads. Graphs are obtained for base shear v/s displacement and structures strength and failure patterns are compared. In structural elements like beams, columns yield point; crushing and even fractures can be identified. And also graph of base shear Vs inter story drift is obtained. Building experience inertial forces, which subjected to Seismic forces, are represented by gradually increase lateral forces patterns in pushover analysis. Many structural elements might yield one after the other due to increasing in lateral loads. Due to this at each step, a decrease in the stiffness and strength will be experienced by the structure. Base shear versus displacement graphs are obtained by non linear static analysis.

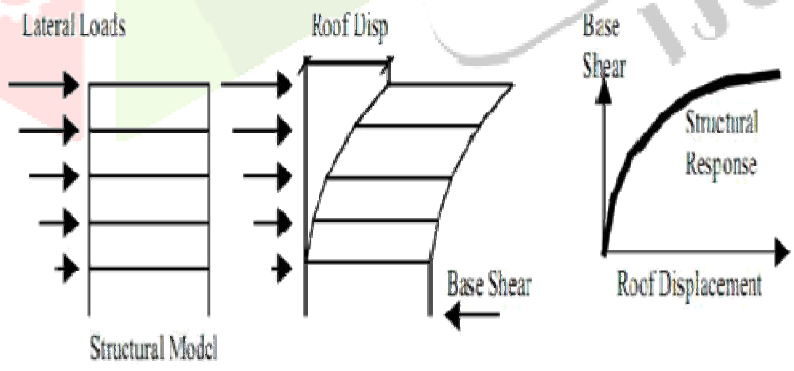


Fig: 3.1 pushover curve

3.2 Software requirements

There are various soft wares depending on computer configurations to carryout pushover analysis they are:

- SAP2000
- ETABS
- STAAD Pro
- ANSYS etc…

3.3 *Details of model*

Intensities of load, material properties, dimensions of the structural members of various parameters are considered in the modeling of regular and irregular shape structures.

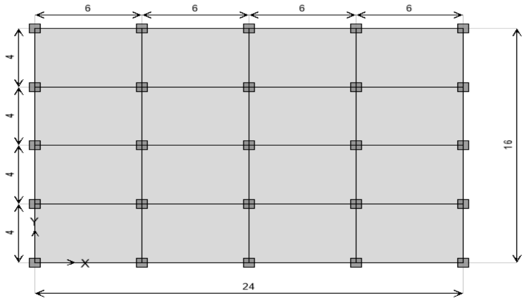


Fig: 3.3 Plan view of model

3.4 *models*

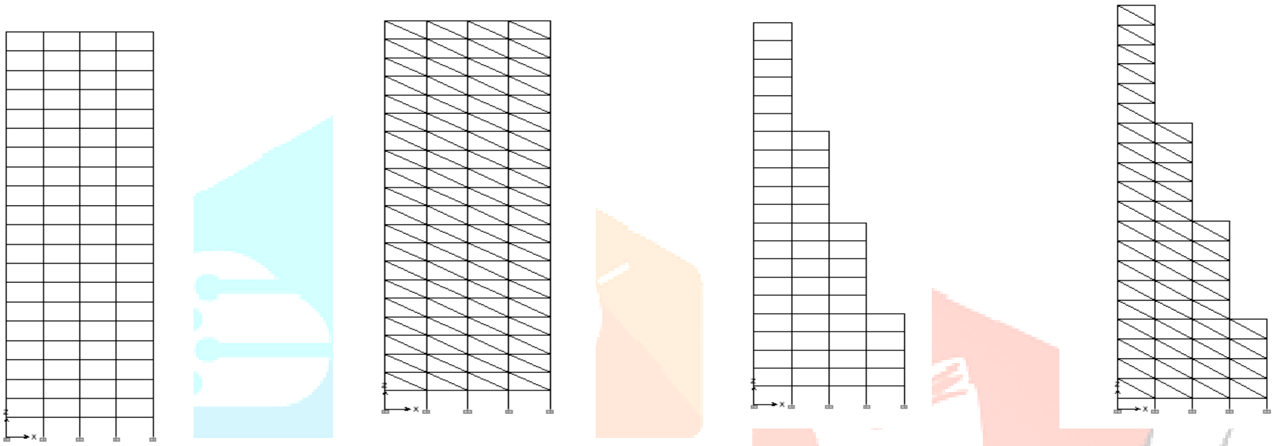


Fig: 3.4(a) model 1 bare. frame. Fig: 3.4(b) model 2 infill frame with softy story. Fig:3.4(c) model 3 bare frame. Fig:3.4(d) model 4 infill frame with soft story.

G+20 (24m*16m) plan. Story height 3.5m. seismic zone 111. (Other factors according to code 1893:2002).

3.5 *Materials details*

M25 & M20 concrete. Fe500 Steel.

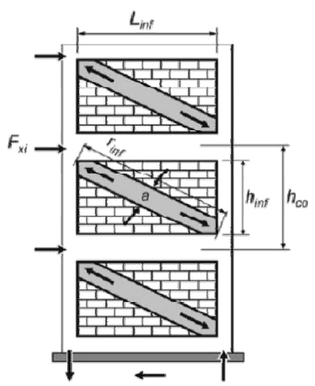
Density of concrete-25 KN/m^2. E= 27386*10^{3}KN/m^2.poison's ratio=0.2. density of block masonry= 20KN/m^3.

Column (600mm*600mm). Beam (300mm*600mm). Slab=120 mm. Wall thickness =200 mm.

3.6 *load intensities*

- Live load- 3KN/m^2. Floor finish-1.5 KN/m^2 (0.75KN/m^2 on roof). Roof live load = 1.5 KN/м^2.
- Wall load on members - (h*t*l)*20 =12 KN/m^2.

3.7 *Calculation of diagonal strut width (according to FEMA 356)*



Using IS code 1905. And FEMA 356

a = 0.175 $(\lambda_l * h_{col})^{-0.4} * r_{inf}$………..equ 3.7(a)

λ_l =[E_{me}*t_{inf}*sin2Ø/4E_{fe}*I_{col}*h_{inf}]…..equ 3.7(b)

λ_l = 1.3225*10$^{4.}$

Width of diagonal strut (a) = 1.54 m.

Fig: 3.7 modeling of masonry infill wall as diagonal strut.

4 RESULTS AND DISCUSSION

The pushover analysis is performed for all four models with bare and infill frames. Infill frame buildings are modeled with soft story i.e. with open story at the bottom. Various curves for different parameters like story displacement, inter story drift and base shear are obtained after comparison of models. The pushover curves i.e. the graph of base shear versus top displacement is obtained for the each case.

4.1 displacement comparison of model 1 and model 2

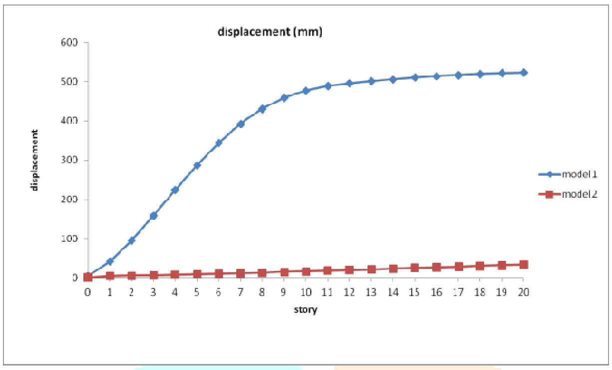


Fig: 4.1.1 displacement due to PUX

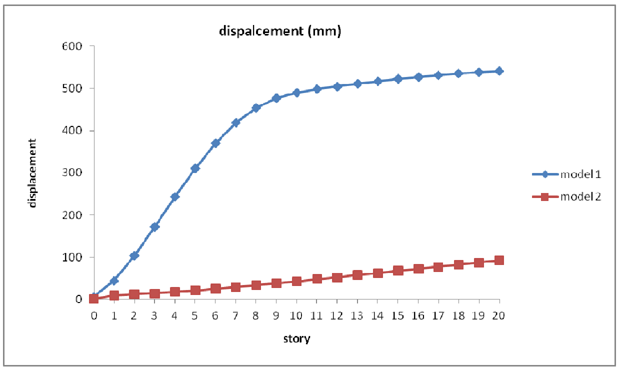


Fig: 4.1.2 displacement due to PUY

4.2 displacement comparison of model 3 & model 4

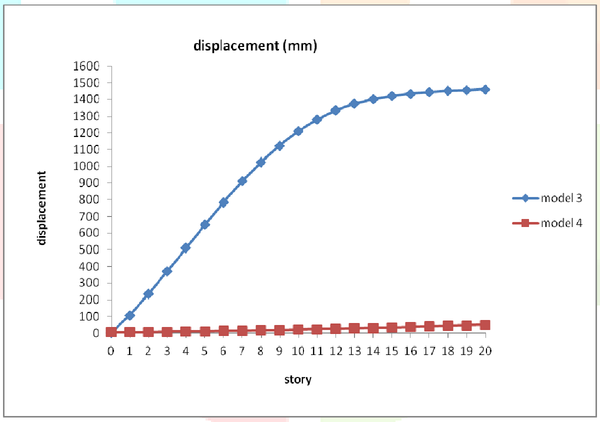


Fig: 4.2.1 displacement due to PUX

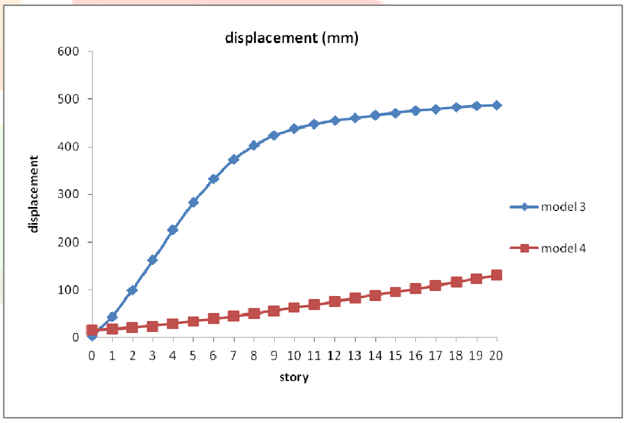


Fig: 4.2.2 displacement due to PUY

4.3 drift comparison of model 1 & model 2

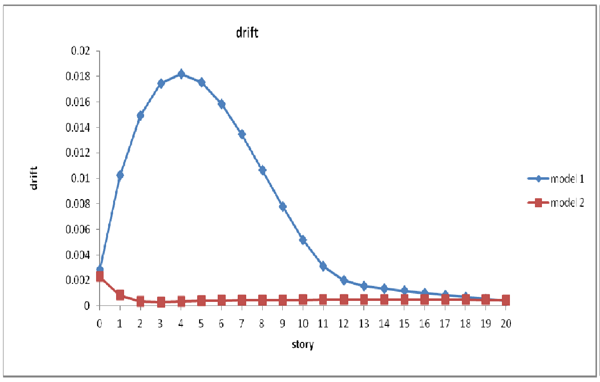


Fig: 4.3.1 Drift due to PUX

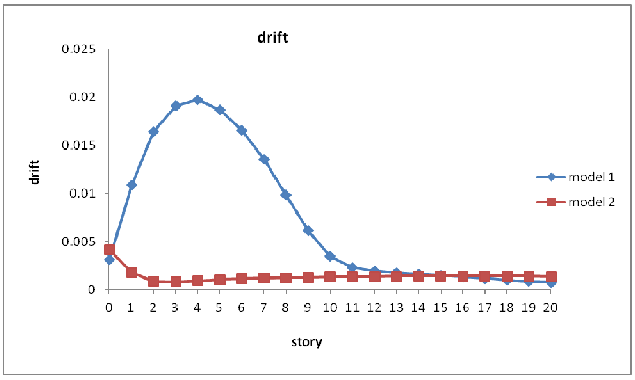
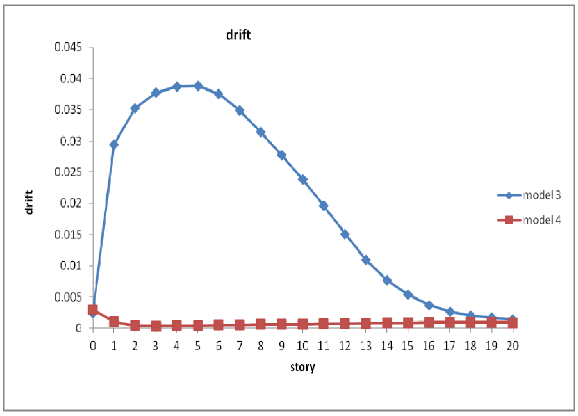


Fig: 4.3.2 drift due to PUY

4.4 drift comparison of model 3 & model 4



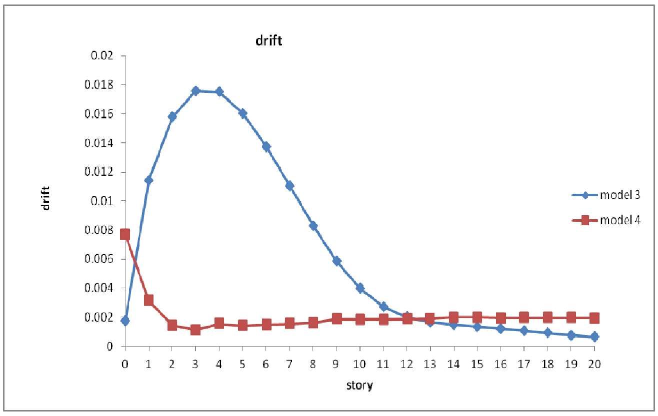
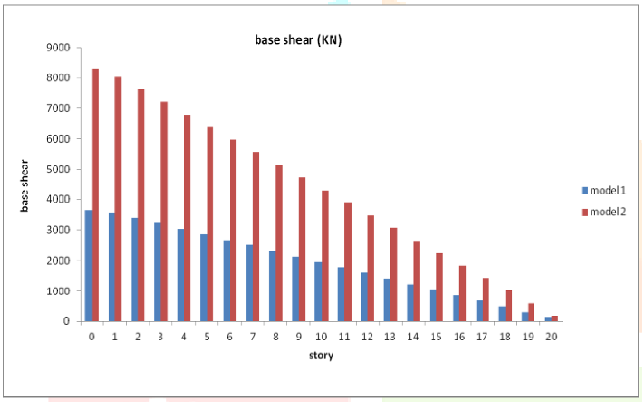


Fig: 4.4.1 drift due to PUX

Fig: 4.4.2 drift due to PUX

4.5 base shear comparison of model 1 & model 2



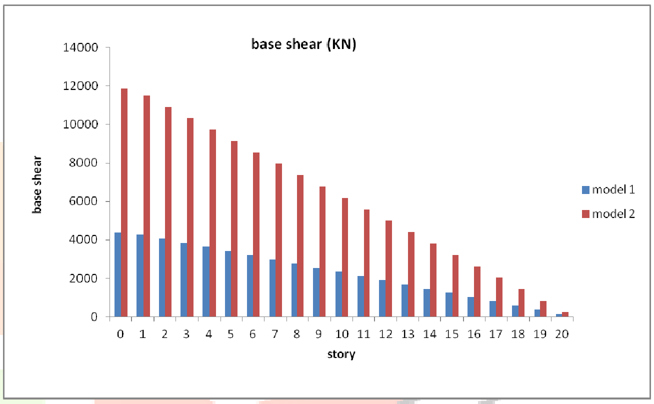
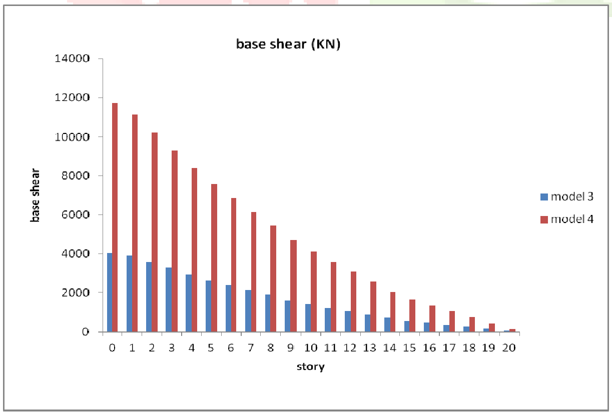


Fig: 4.5.1 base shear due to PUX

Fig: 4.5.2 base shear due to PUY

4.6 base shear comparison of model 3 & model 4



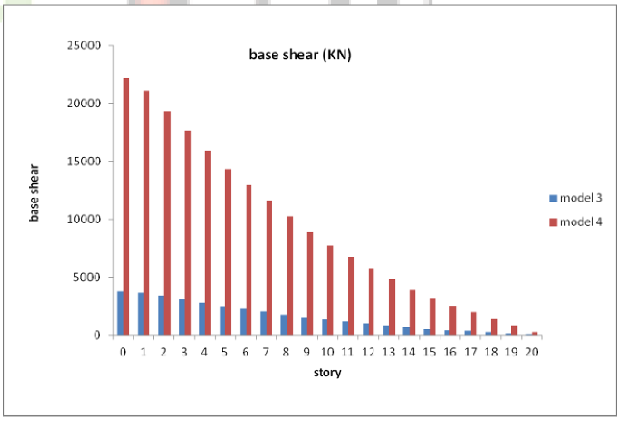


Fig: 4.6.1 base shear due to PUX

Fig: 4.6.2 base shear due to PUY

5 SUMMARY AND CONCLUSION

- By comparing above results from graphs of model 1.2.3 & 4. There is difference in structural stiffness, drift and base shear due to bare and infill frames.
- We can observe that there is increase in drift and displacement values in model 2 & model 4 due presence of soft story at the bottom level compared to other higher levels.
- There is increase in base shear values in infill frame models compared to bare frames models.
- Compare to bare frames with infill frame models are superior or we can conclude the performance of infill frame is improved due to presence of infill which provides sufficient stiffness against lateral loads.

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