Capacity Based Dynamic Analysis with Soft Storey for Regular and Irregular Existing RC Structures

Mahesha B.N [1], Dr. G.Narayana[2]

[1]M.Tech in Structural Engineering, Department of Civil Engineering, SJCIT, Chickballapur, Karnataka, India

[2]Professor & Head, Department of Civil Engg, SJCIT, Chickballapur, Karnataka, India

Abstract: ***In elevated structures or multi story structures, delicate story development is a common component as a result of urbanization and the space inhabitance contemplations. Delicate story breakdown is the primary explanations behind disappointment of surrounded structures amid a seismic tremor. Such abnormalities are incredibly undesirable in the structures worked in quake inclined regions. In these structures, the firmness of the parallel burden opposing frameworks at that story is entirely less contrasted with different stories. In this present work the Non linear pushover analysis is carried out for high rise building at different soft storey levels. There are 'n' numbers of possibilities to provide soft storey such as First storey as soft storey with peripheral bay as core infilled, Middle storey as a soft storey with core infilled masonry wall in central bay, Masonry infilled core wall in adjacent bay in transverse y-direction and middle storey as soft storeys, Bare frame with only masonry infilled core wall at central bay. A typical G+15 storey regular bare frame building is analyzed for various levels of soft storey with core infilled masonry wall and Performance of each storey is carried out through nonlinear static analysis. Mode shapes, Storey drift, Base shear, Pushover curve and Performance point of each model are carried out with different levels of soft storey systems. The Aim of study is to compare the results of seismic analysis of high rise bare frame building with different levels of soft storey systems.***

Keywords: Pushover analysis, Seismic performance evaluation, Nonlinear response, Soft storey at different stories

1. Introduction

An earthquake in other words is also known as quake. Earthquake denotes to the abrupt release of energy that originates seismic waves in the earth crust. The frequency, type and size of earthquake practiced over a period of time are comment on the seismicity and seismic activity of a zone.

An earthquake is a natural occurrence, like rain. Earthquakes affect almost every part of the earth and like rain they can be either mild or catastrophic. Over the sequence of geographical time, the external of our planet earth have been moulded by natural occasions like earthquakes and overflows. Though an earthquake lasts only for a few seconds the operations within the earth takes millions and millions of years in procedure that reasoned earthquake. Fig-1 shows the images of arrival of seismic wave at site.

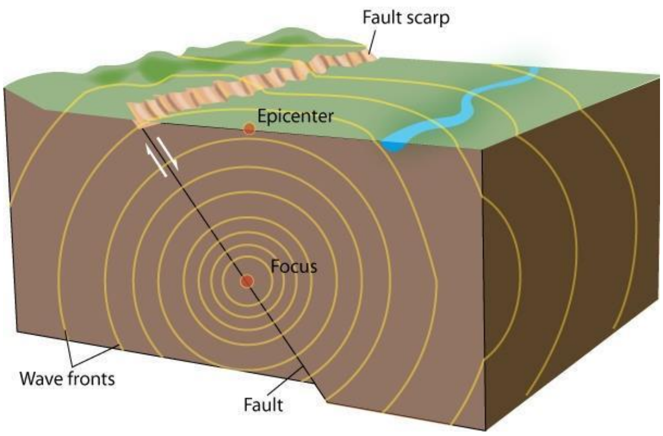

Figure 1: Arrivals of seismic waves at site

2. Objective

In this present study RC building is modeled and analyzed as five parts

1) Building Modelled as Bare Frame
2) Middle storey as a soft storey with core infilled masonry wall in central bay
3) First storey as soft storey with peripheral bay as core infilled masonry walls
4) Bare frame with only masonry infilled core wall at central bay
5) Masonry infilled core wall in adjacent bay in transverse y-direction and middle storey as soft storeys.

The performance of the building is evaluated in terms of storey drifts, lateral displacements, lateral forces, storey stiffness, mode shapes, base shear, performance level, performance point.

3. Methodology

Methodology employed is linear dynamic and non-linear static analysis.

3.1 Modelling of building

A speculative building is accepted for seismic examination that comprises of a G+15 RC private building.The arrangement of the building is standard in nature as it has all segments with equivalent dispersing. The heaps to be drilled on the structures depend on the Indian benchmarks. The study is performed for seismic zone V according to IS 1893:2002. The edges are thought to be solidly altered at the base and the dirt structure cooperation is ignored.

3.2 Building plan and models detail

Table 1: Building Features

Structure	SMRF
No of Stories	G+15
Storey Height	3m
Base Storey	4m
Type of Soil	Medium Soil
Seismic Zone	5
Importance factor	1
Material Property	
Grade of Concrete	M25
Grade of Steel	Fe415
Member Properties	
Bays in x-direction	5
Bays in y-direction	4
Spacing in x-direction	6m
Spacing in y-direction	5m
Beam in longitudinal x-direction size	230x400mm
Beam in transverse y-direction size	230x350mm
column Size	230x650mm
Thickness of Slab	120mm
Thickness of wall	230mm
Live Load on floor	3.5 KN/m2
Live Load on Roof	1.75 KN/m2
Floor Finish	1 KN/m2

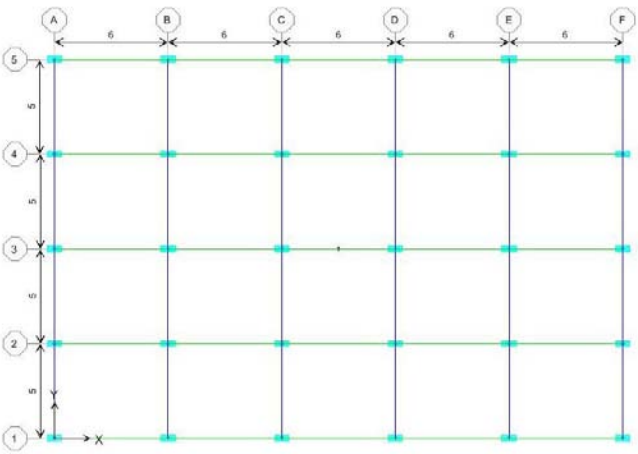

Figure 2: Building Plan

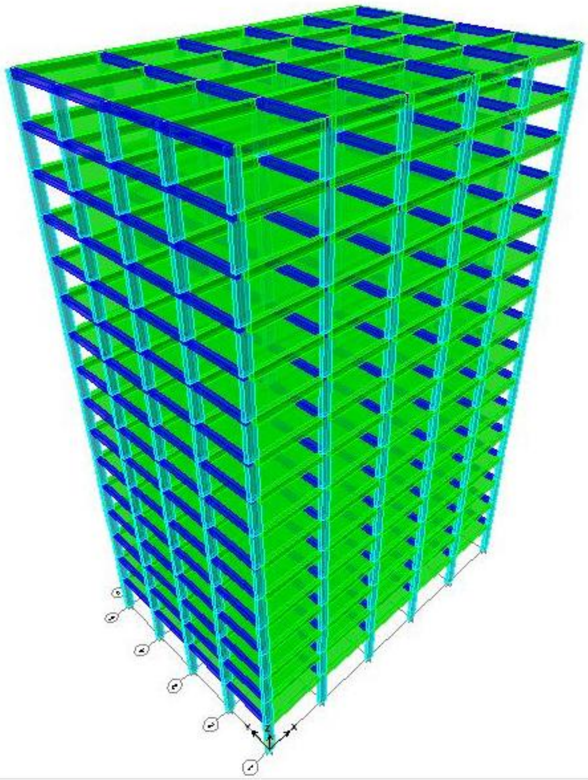

Figure 3: Elevation of the Building

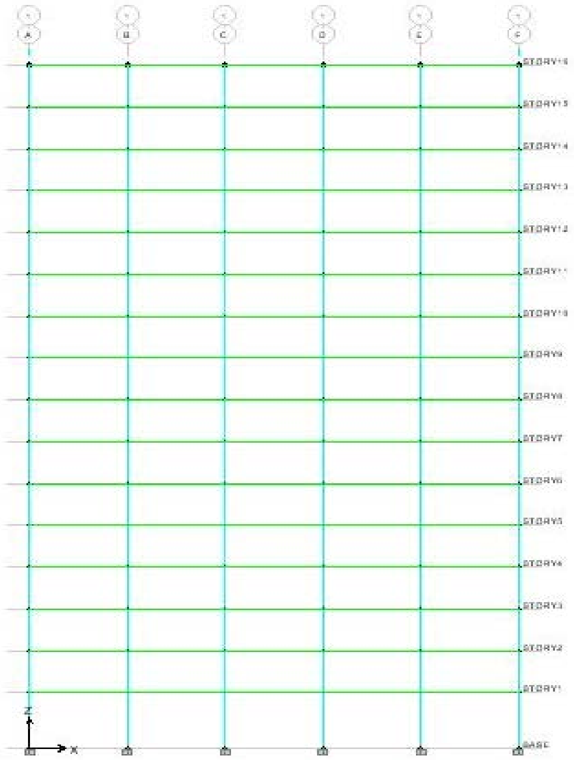

Figure 4: Building Modelled as Bare Frame.

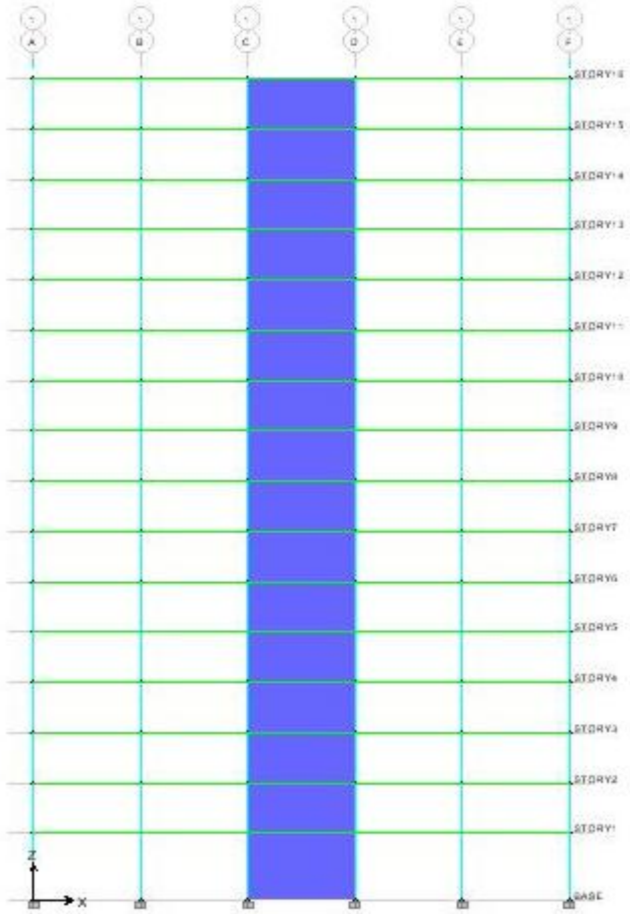

Figure 5: Middle storey as a soft storey with core infilled masonry wall in central bay

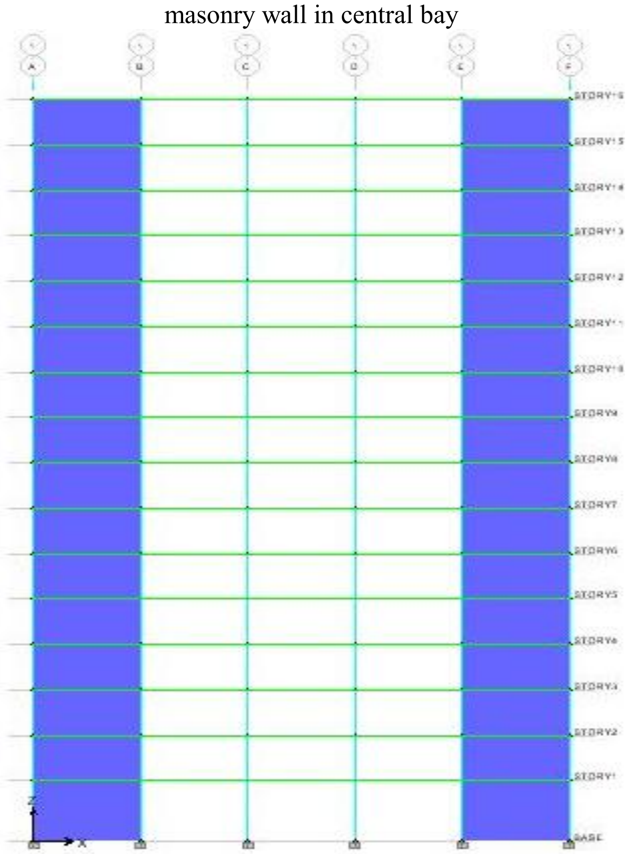

Figure 6: First storey as soft storey with peripheral bay as core infilled masonry walls.

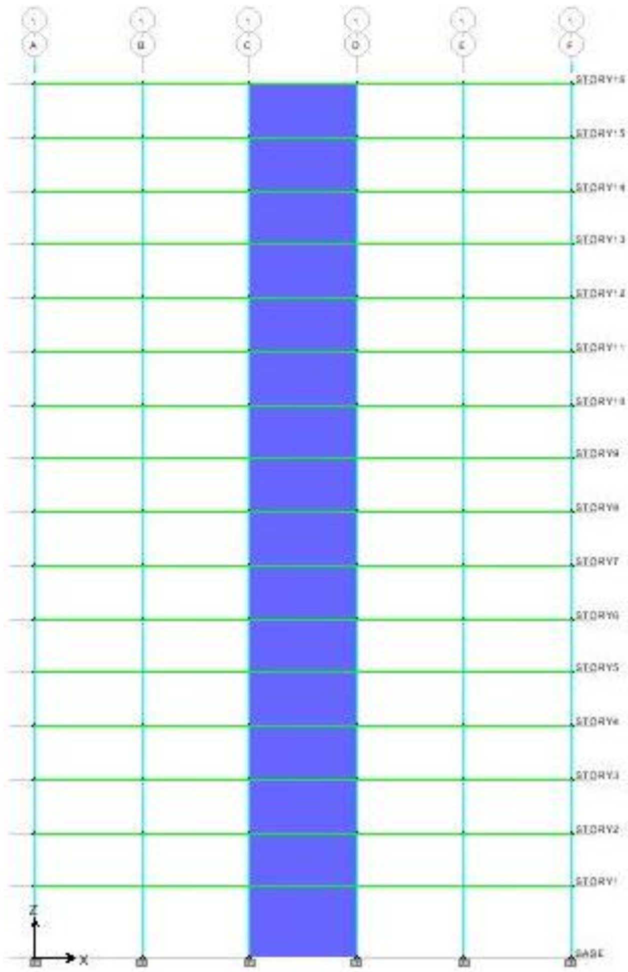

Figure 7: Bare frame with only masonry infilled core wall at central bay

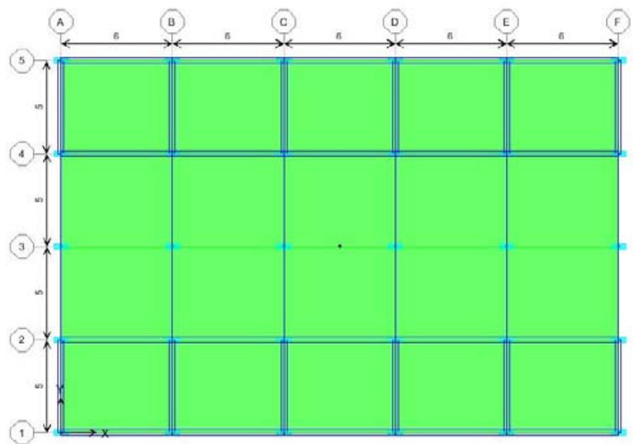

Figure 8: Masonry infilled core wall in adjacent bay in transverse y-direction and middle storey as soft storeys.

4. Comparison of Results

Results obtained from the analysis will be compared and the seismic performance of the building with soft storey at different levels are found.

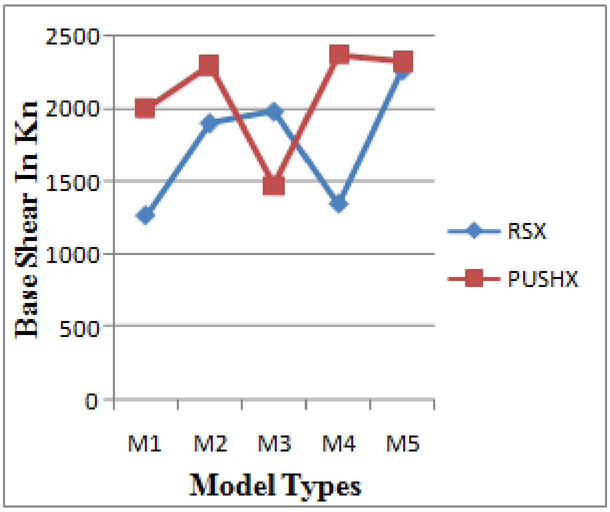

Figure 9: Variation of base shear with respect to different model types.

From Fig 9 it is understood that about 44% of base shear is excessive in Model 5 compared with Model 1 in case of PUSHX and 13.73% in case of RSX

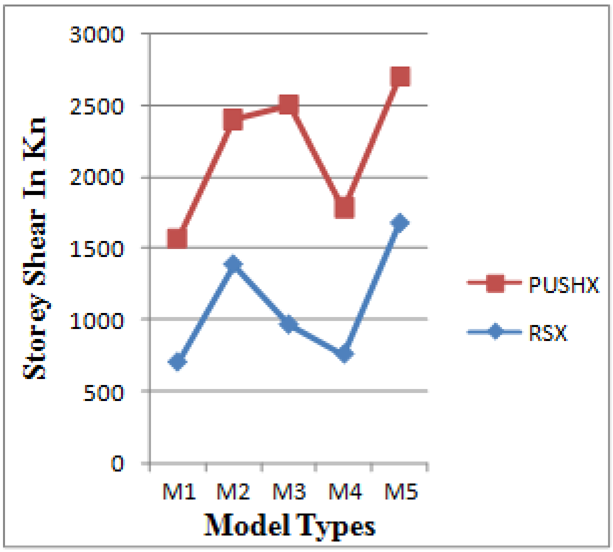

Figure 10: Variation of storey shear with respect to different model types

From Fig 10 it is understood that 44% of storey shear is excessive in Model 5 compsared with Model 1 in case of PUSHX and 23% in case of RSX.

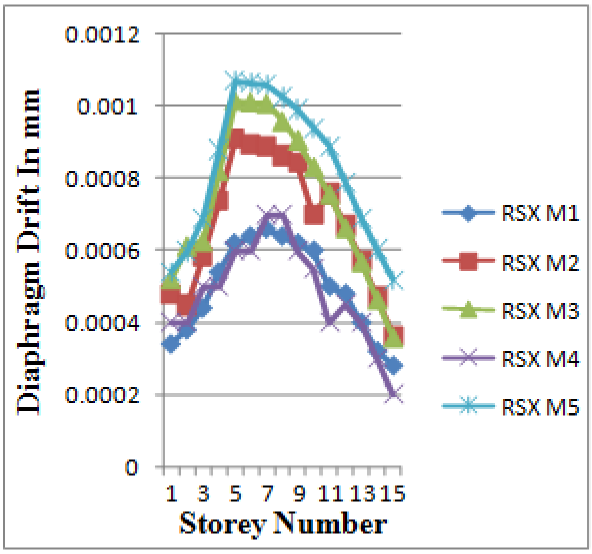

Figure 11: Variation of diaphragm drift with respect to different model types for RSX

From Fig 11 it is understood that about 6% of diaphragm drift is exess in Model 4 compared with Model 1.

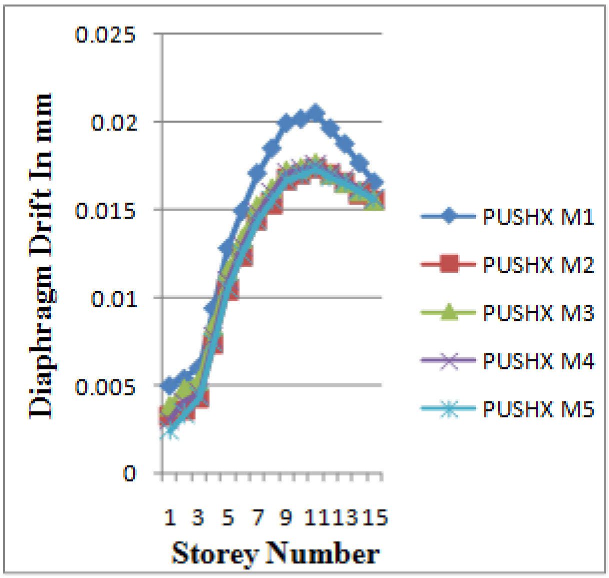

Figure 12: Variation of diaphragm drift with respect to different model types for PUSHX

From Fig 12 it is understood that about 6% of diaphragm drift is exess in Model 4 compared with Model 1.

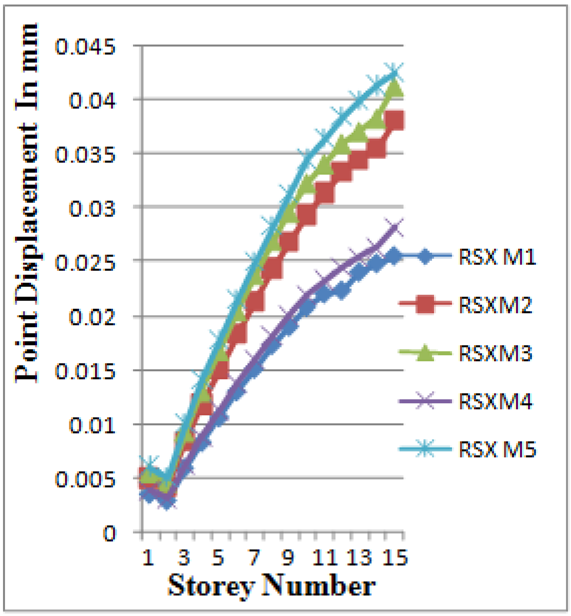

Figure 13: Variation of Point displacements with respect to different model types for RSX

From Fig 13 it is understood that about 10.58% of point displacement is exess in Model 4 when compared with Model 1.

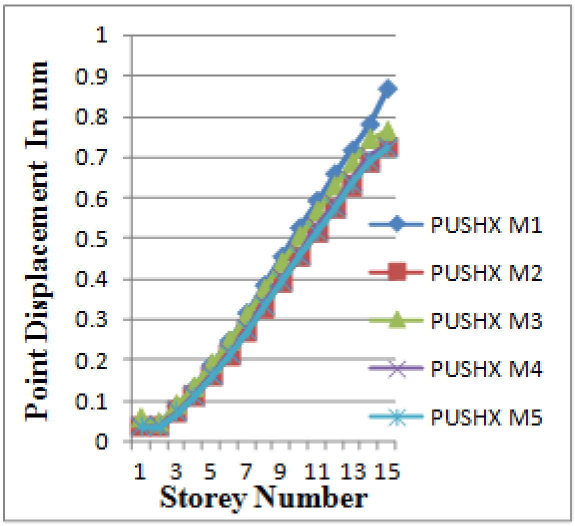

Figure 14: Variation of Point displacements with respect to different model types for PUSHX

From Fig 14 it is understood that about 19.65% of point displacement is exess in Model 4 when compared with Model 1.

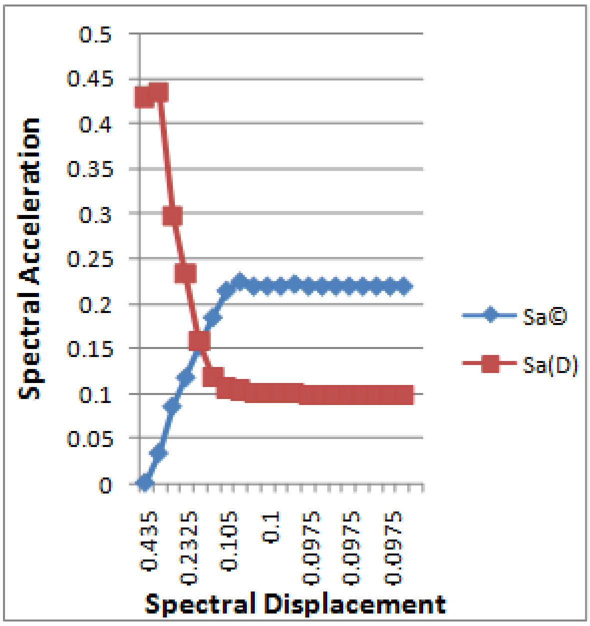

Figure 15: Variation of performance point with respect to different model types

From Fig 15 it is understood that Sign of execution of the working is similar for all models through unearthly methods. From Fig 14 it is understood that about 19.65% of point displacement is exess in Model 4 when compared with Model 1.

5. Conclusions

In the present study the seismic performance of a regular multi-storey reinforced concrete building with different soft storey systems have been studied and the conclusions arrived are as below.

- Based upon the lateral displacement and storey drift, the models to be preferred depending upon different configurations and locations of soft storey systems are M1 Building modelled as Bare Frame, M2 Middle storey as a soft storey with core infilled masonry wall in central bay, M3 First storey as soft storey with peripheral bay as core infilled masonry walls, M4 Bare frame with only masonry infilled core wall at central bay, M5 masonry infilled core wall in adjacent bay in transverse y-direction and middle storey as soft storey.
- With the increase in mass and height of the building. The base shear increases and eventually increasingly distributed as storey shear, which displays that Model 5 is having maximum base shear, when compared to other models in consideration. Also the increasing distributed base shear in terms of storey shear. Storey shear is greatly distributed in M4 building model.
- Although by the comparison of results from these two analysis exhibits that PUSHX results are having upper hand rather than RSX results. About 44% of base shear is excessive in M5 when compared with M1 (bare frame model).
- The diaphragm drift and point displacement for all the models are obtained and is noted that, Model 4 is having less drift and displacement in comparison with all other models which anticulates that M4 model seems better in

seismic zone V. About 6% of diaphragm drift and 19.6% of diaphragm displacements is excess in M4 when compared with M1 (bare frame model).
- The maximum load carrying capacity of building is determined by plotting performance point for the building models situated in seismic zone V.
- The model M5 which is in middle storey as soft storey and masonry infilled core wall in adjacent bay in transverse direction is found to be more vulnerable compared to the other four models considered which are situated in seismic zone V.

6. Future Scope

From the imprecise conclusions drawn, for this present dissertation work, following are the extent of work.
- The building models are analysed using only gravity load combination (DCON-2), but the area of work can be extended by considering different type of load combination as per IS1893-2002 (PART-1)
- The study can be extended by imparting the lateral load resisting systems other than infill.
- The work can be further prolonged for tall buildings, also by considering the wind forces.

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