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Effect of RC shear wall & bracing on lateral performance of building having re-entrant corners

Shivaji Mahadeorao Bajare , Prof.B.V.Chavan

Department of Civil Engineering, PankajLaddhad Institute of Technology & Management Studies,Buldana, (M.S), India-443001

ABSTRACT:

The difficulty with the angles of the reentrant is to determine the actual amount of force to be transmitted. There are several reasons why it is difficult to determine the amount of forces in the corners of the reentrant. The first is the difference in rigidity due to the general layout of the structure. The second main difficulty is that the torsional forces superimposed on the structure cause an increase in the deviation in different places throughout the structure. Both of these questions arise simultaneously, which complicates difficulties. From the results it is observed that The maximum horizontal displacement is observed to be for the Model-II: Building with re-entrant corners-Bracings location-1 while the minimum for the Model-III: Building with re-entrant corners-Shear wall location-1.

Keywords: Re-entrant, ETABS, High-rise buildings, lateral displacement and drift

1. General

The concentrated local voltages in the corner of the reentrant are illustrated in Figure 1.3. Two wings are connected in this illustration. When the movement of the earth is applied, the two wings want to move differently from each other because of their orientation. This difference between strong hanging bending verses weak axis bending essentially creates the effect of pressing on the structure. This effect of pressing on the structure creates a local concentration of voltage in the angle of the reentrant.

The second problem with structures that include relay angles is the torsional effect. Torsia is introduced into the structure because the center of mass and the center of rigidity do not necessarily meet in one place. The center of mass and the center of rigidity can also change locations depending on the size and direction of the superimposed lateral load and the overall shape of the structure. The difference in the location of the center of mass and the center of rigidity.

Since the center of mass and the center of rigidity are not located in one place, torsion is introduced into the structure. This torsion also creates local concentrated stress in the relay angle. Because the deformation of the structure is based on the magnitude and direction of the lateral load, it is difficult to analyze how the structure reacts, as the lateral load can vary from event to event. The structure is tormented together with the pressure that occurs from the strong bending of the axis / weak axis, so that these two mechanisms are interconnected.

2.Literature Review

Lohithkumar B C studied and compared seismic requirements for vertically irregular and "regular" personnel, defined by a rigorous nonlinear analysis of response history (RHA), thanks to an ensemble of 20 ground movements. Forty-eight irregular frames, all 12-storey highs with strong columns and weak beams, were designed with three types of rigidity, strength, and combined rigidity and strength, introduced in eight different places by height, using two modification coefficients.

Madan Singh et al. noted that the effect of vertical irregularity on the average values of plot drifts and floor movements is documented. Further, the mean and variance values of the ratio of drift requirements of history, determined by modal analysis of pushover (MPA) and nonlinear RHA, were calculated to measure the bias and variance of estimates (MPA), leading to the following results: bias in the IPA procedure does not increase, ie its accuracy does not deteriorate, despite the inequality of rigidity, strength, or rigidity and strength provided that the average or upper history is incorrect,

MehmedKausevich et al. investigated that the MPA procedure is less accurate for a conventional frame when assessing the seismic requirements of personnel with a strong or rigid and strong first history; soft, weak or soft and weak lower half; rigid, strong or hard and strong lower half, despite the greater bias in assessing drift requirements for some stories, in particular, the MPA procedure identifies the stories with the highest drift requirements and evaluates them sufficiently, revealing critical stories in such frames, and the bias of the MPA procedure for soft frames, a weak or soft and weak first story is about the same as for a regular frame

Naresh Kumar B. G. et al. It has been studied that high-rise concrete shear walls are often supported near or below the class by rigid floor diaphragms connected to the walls of the perimeter foundation. When much of the moment of overturning into the wall is transferred to the foundation walls by power pairs in two or more rigid floor diaphragms, the maximum bending moment of the bending plastic hinge occurs above the diaphragms, and the shear force returns below the bending loop. Depending on the stiffness of the floor diaphragms and the shear stiffness and the bending stiffness of the high concrete walls, the shear force below the bending loop can be much greater than the base shift above the bending hinge.

Rajiv Banerji et al. concluded that a nonlinear shift model could be used to determine whether diagonal cracking of the wall and obtaining horizontal reinforcement of the walls would reduce the force of the return shift without causing a shift failure. Increasing the amount of horizontal reinforcement in the wall above a certain limit may not prevent a shift failure, and therefore it will be necessary to find another design solution. The upper floor diaphragm stiffness limit should be used so as not to underestimate the demand for shear on high-rise walls. This study summarizes current knowledge about the seismic response of vertically incorrect building frames. Criteria determining vertical irregularity in accordance with current building codes were discussed. An overview of studies of seismic behavior of vertically incorrect structures was presented, together with their findings. It has been observed that building codes provide criteria for classifying vertically irregular structures and offer dynamic analysis to achieve design lateral forces. Most studies agree to increase the demand for drift in the part of the receding tower and to increase the seismic demand for buildings with intermittent distribution in mass, rigidity, and strength.

Ravi Kant et al. investigated that the greatest seismic demand is for irregularity of combined stability and strength. It can be concluded that a large number of research studies and building codes have addressed the issue of the impact of vertical disturbances. Building codes provide criteria for classifying vertically irregular structures and offer an analysis of the history of elastic time or an analysis of the spectrum of the elastic reaction to obtain the design lateral distribution of force. The authors conducted a detailed study of the importance of diaphragm stiffness for seismic structure response. Although a rigid floor diaphragm is a good assumption for seismic analysis of most buildings, several building configurations can show considerable flexibility in the floor aperture.

3. Methodology

The different models are created using the STAAD-PRO software and the details are

i. Model-I: Building with re-entrant corners
ii. Model-II: Building with re-entrant corners-Bracings location-1
iii. Model-III: Building with re-entrant corners-Shear wall location-1
iv. Model-IV: Building with re-entrant corners-Shear wall - bracing location-1
v. Model-V: Building with re-entrant corners-Bracings location-2
vi. Model-VI: Building with re-entrant corners-Shear wall location-2
vii. Model-VII: Building with re-entrant corners-Shear wall-bracing location-2
viii. Model-VIII: Building with re-entrant corners-Bracings location-3
ix. Model-IX: Building with re-entrant corners-Shear wall location-3
x. Model-X: Building with re-entrant corners-Shear wall-bracings location-3

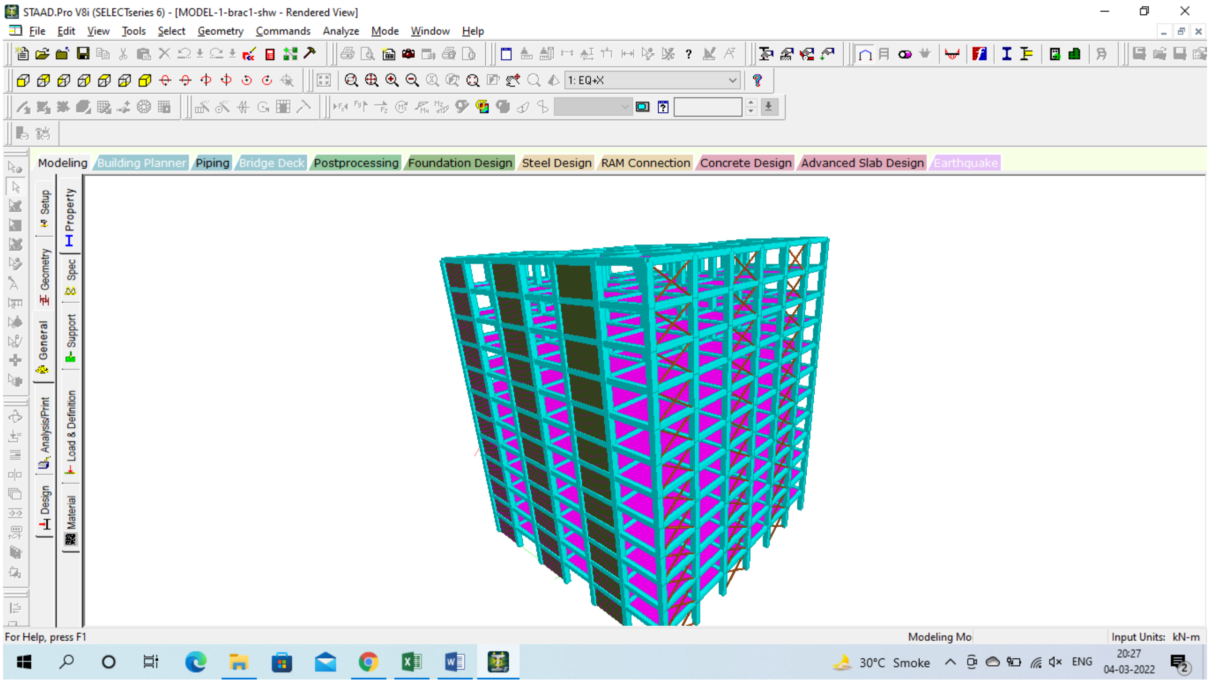
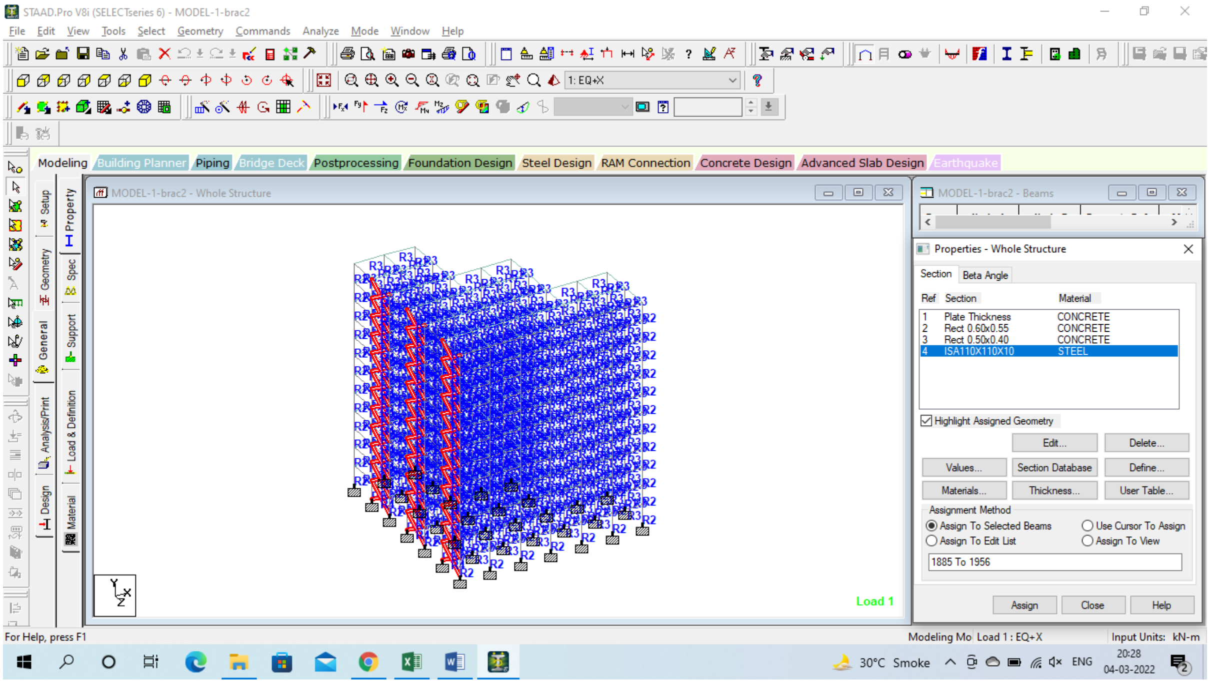


Figure 1: Location of bracings and Shear Wall assigned to model-IV



Ref	Section	Material
1	Plate Thickness	CONCRETE
2	Rect 0.60x0.55	CONCRETE
3	Rect 0.50x0.40	CONCRETE
4	ISA110X110X10	STEEL

☑ Highlight Assigned Geometry

Assignment Method
● Assign To Selected Beams ○ Use Cursor To Assign
○ Assign To Edit List ○ Assign To View

1885 To 1956

Modeling Mo Load 1 : EQ+X Input Units: kN-m

Figure 2: Location of bracings assigned to model-V

4. Results

The results are obtained in the STAAD-PRO software in terms of the displacement, reactions, beam forces, moment and the plate stresses.

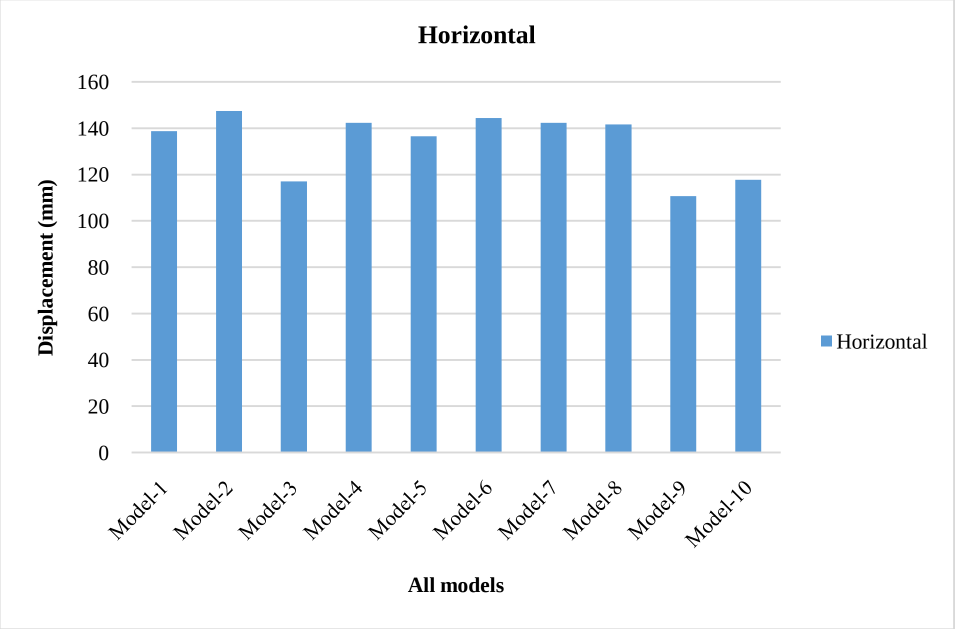


Figure 3: Combined Horizontal (X) Displacement for all the models

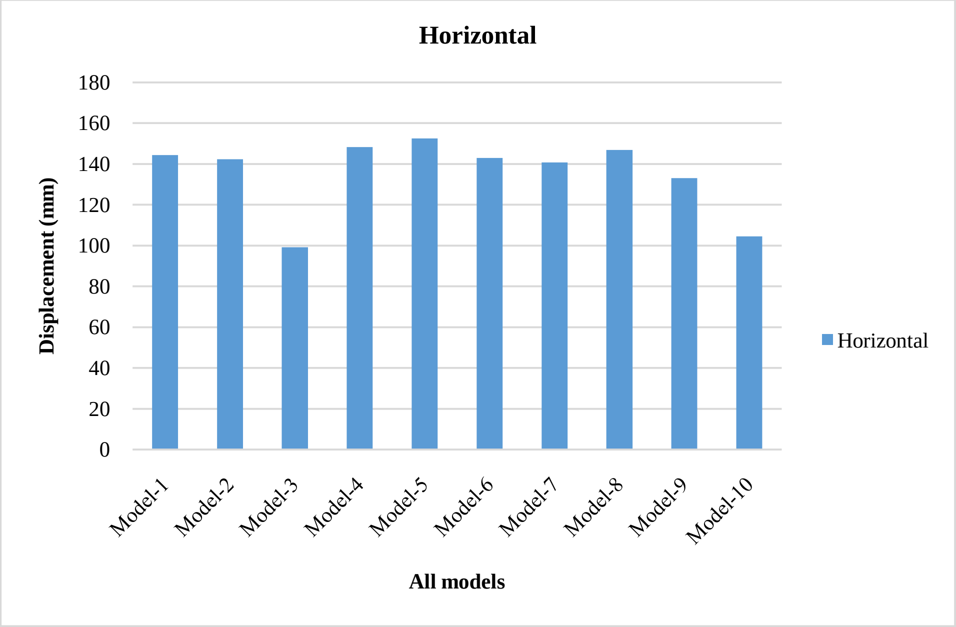


Figure 4: Combined Horizontal (Z) Displacement for all the models

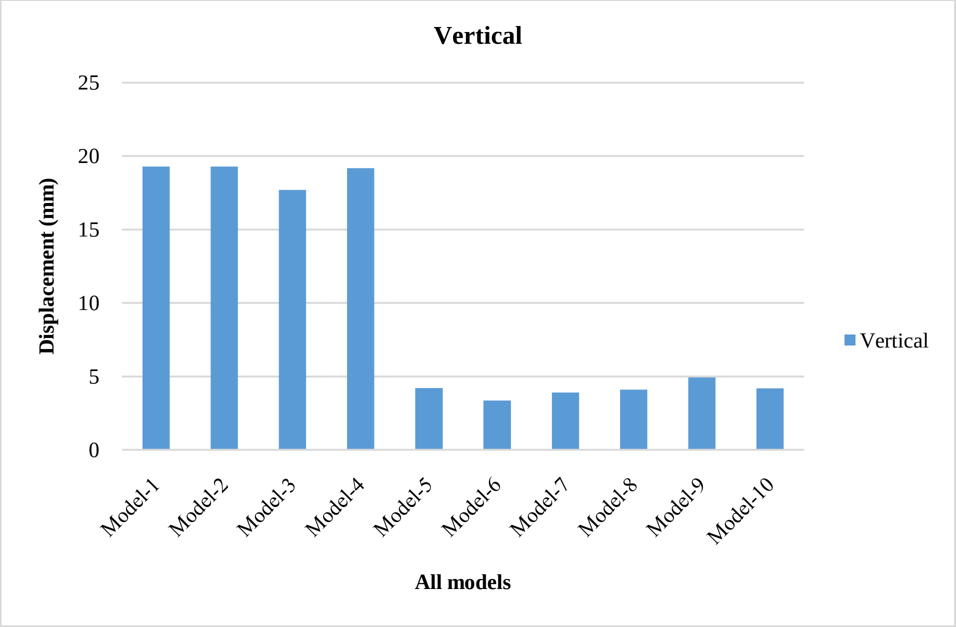


Figure 5: Combined Vertical (Y) Displacement for all the models

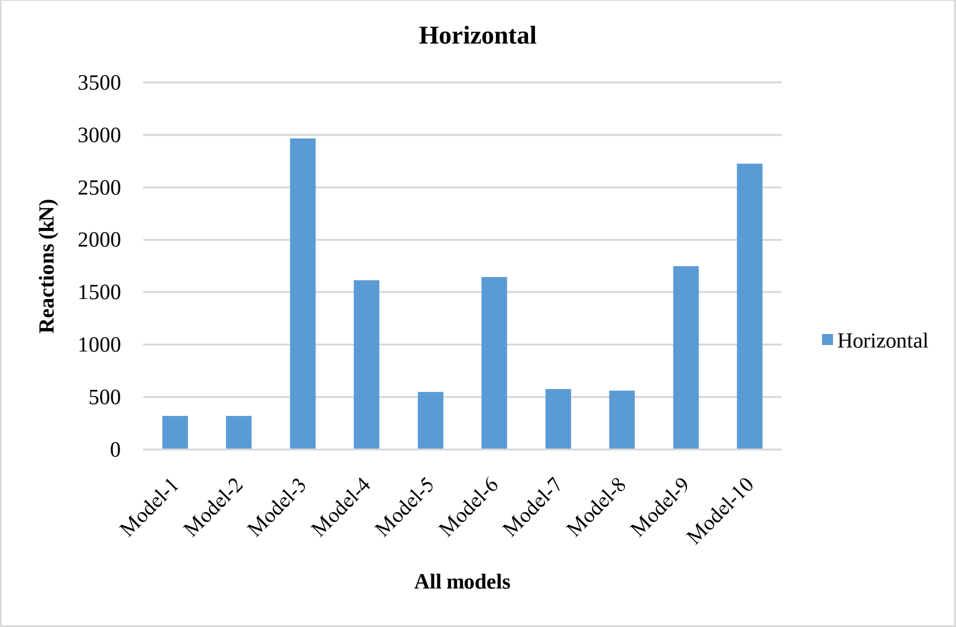


Figure 6: Combined Reactions (Horizontal-Fz) for all the models

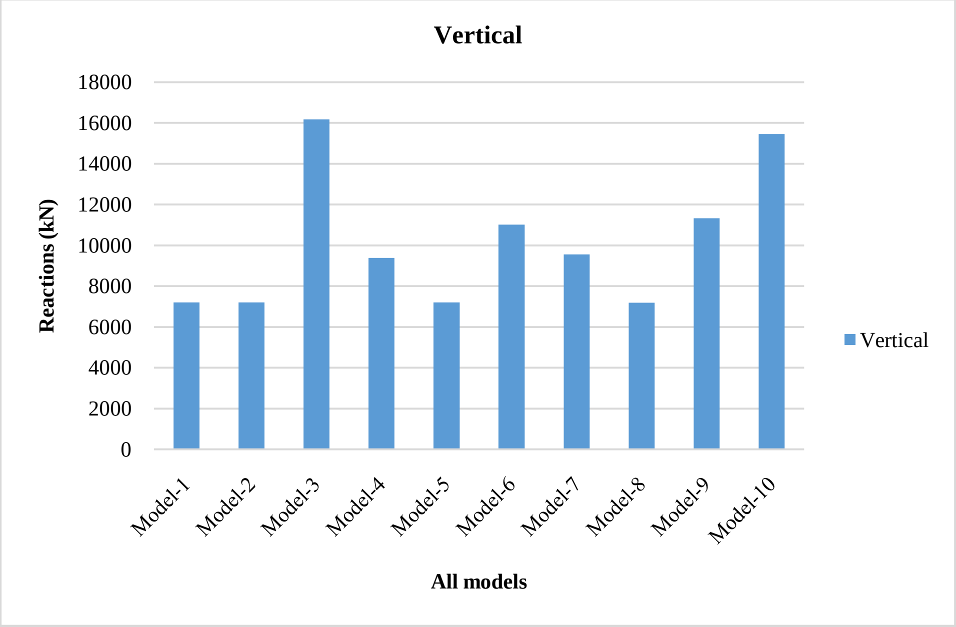


Figure 7: Combined Reactions (Vertical-Fy) for all the models

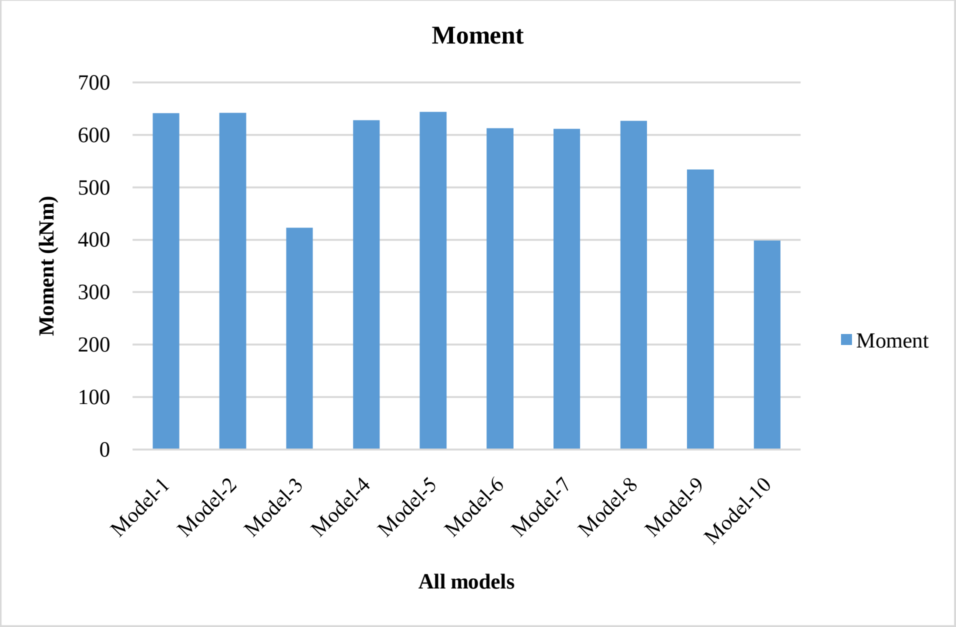


Figure 8: Combined Reactions (Moment-Mx) for all the models

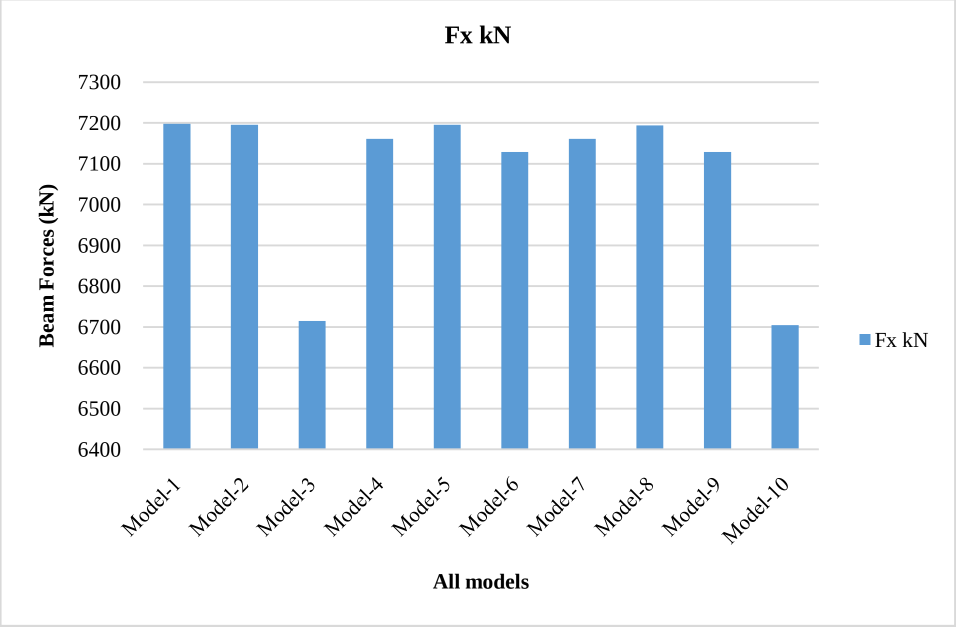


Figure 9: Combined Beam Forces (Fx) for all the models

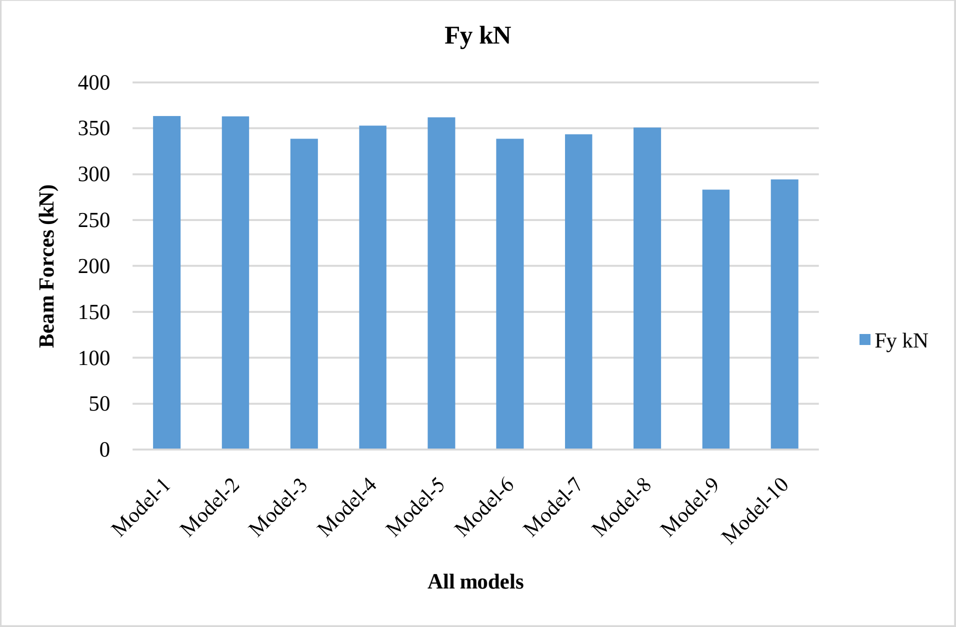


Figure 10: Combined Beam Forces (Fy) for all the models

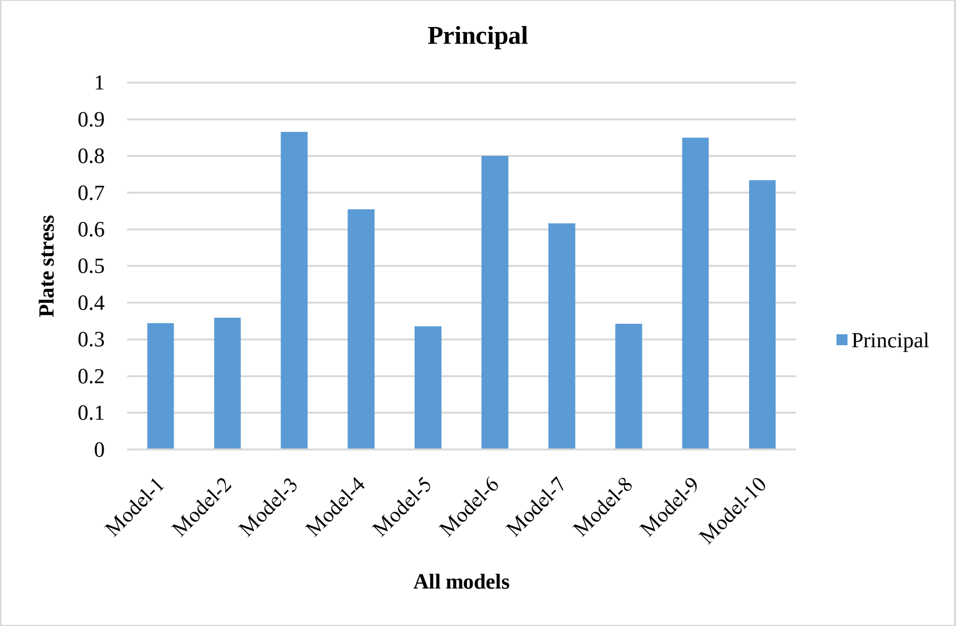


Figure 11: Combined Plate stress (Principal-Top) for all the models

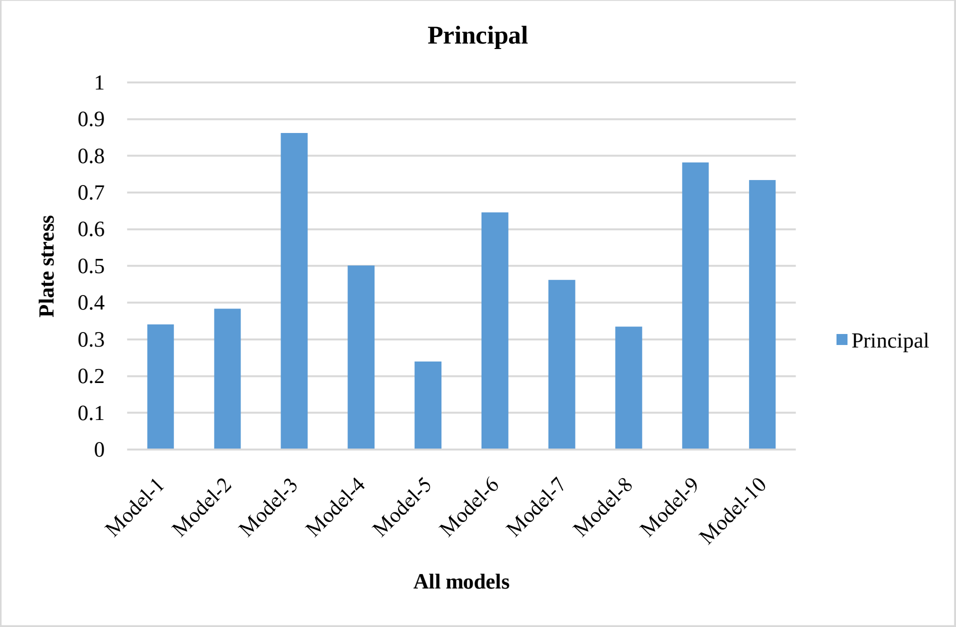


Figure 12: Combined Plate stress (Principal-Bottom) for all the models

Conclusions:

The following conclusions can be drawn for the building with the re-entrant corners:

i. The maximum horizontal displacement is observed to be for the Model-II: Building with re-entrant corners-Bracings location-1 while the minimum for the Model-III: Building with re-entrant corners-Shear wall location-1.

ii. The maximum resultant displacement is observed to be for the Model-V: Building with re-entrant corners-Bracings location-2 while the minimum for the Model-III: Building with re-entrant corners-Shear wall location-1.

iii. The maximum vertical reactions is observed to be for the Model-III: Building with re-entrant corners-Shear wall location-1 while the minimum for the Model-II: Building with re-entrant corners-Bracings location-1.

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