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# Pushover Analysis of a Multi Storey Building with Its Effects on Different Sections of Soft Storey by Using Sap 2000

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## ABSTRACT

The Pushover is the accurate presentation for structures subjected to strong ground vibrations is the history analysis based. The earthquake resistant construction of hard bound structures requires that structures should capable of any ground vibrations of intensity that occur during their construction age. This analysis involves the integration of the equations which are based on motion of static equations in the time domain using a accurate solution. Pushover analysis is the reduction of the Multi-degree-of-freedom, MDOF system, to convert to single-degree- of-freedom, SDOF system, with characteristics relatively by a nonlinear MDOF system. The single DOF system is subjected to a nonlinear time- history analysis or to a high degree response spectrum analysis. The whole system is based on the degree of freedom. In this method 8,12,15 storey's are so created to analyze the bending behavior of a section in a structure. usually storey drift and storey displacement are calculated on the basis of their design criteria. Also their comparative graphs are designed to accommodate the values in it. In this study models are taken on various shapes to formulate the degree of freedom at the hinges which are formed in a structure. Also the values of various bending moment related to their respective shapes are calculated.

***Keywords*** —Storey drift, storey displacement, Bending Stress; Shear Lag; Transverse Bending Stress; SAP 2000.

## I. INTRODUCTION

In this methodology various kinds of hollow blocks are taken which are used of 8,12,15 storeys And having various types of characteristics which relates to their respective hinges in the structure it means these are the weakest point that derives the whole structure. Storey displacement and storey drift is calculated on each floor

With their respective weakest position all the forces acting on each floor are calculated with the increase in the height of a building the value of storey drift and displacement increases to their respective floor and plotting of values of these indicated on proper graphics representation to their local groups

Bending moment and their respective failure are indicated on the graphs also for 8 storey and 12 storey and 15 storey buildings. They have their respective values relatively to 8,12 and 15 storey building. Finally comparative graphs are plotted having their respective values indicated top to bottom. maximum and minimum values are given by their colours.

With the development of modern method such as the finite element method and the finite band method, these discrete methods can now be used to analyze structures, and all structural effects can be found in these methods. The forces are calculated in vertical and horizontal directions and the interaction between them can be considered together. In the present paper a detailed study of five cross-sections (Chamfer, Rectangular and Square) has been carried out using finite element code SAP- 2000.

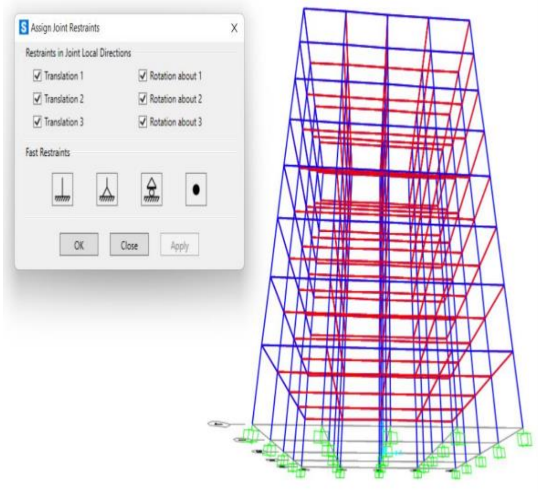


**Fig.1: Different models**

## DESIGN OF PROPOSED WORK

Five hollow cross-sections (Chamfer, Circular, Hexagonal, Rectangular and Square) beams are considered with constant span length and unchanged perimeter. The example of hollow beam is modelled and analysed in SAP 2000 and the responses are found to be fairly matching. For the purpose of the parametric study, the five hollow cross-sections are modeled in SAP2000. The span length, cross-section and material proper tyre main unchanged.

Calculation of Section Dimension with Constant Perimeter (P)

- Square Section: 4000*400mm
- Rectangular Section:
  Length= 500mm,Width = 400mm
- Circular Section:
  Perimeter(P) =1000mm
  r=318.30mm
- Chamfer Section: 4x+4y =1000mm Let, x=300mmtheny=200mm
- Column Size =300*300mm

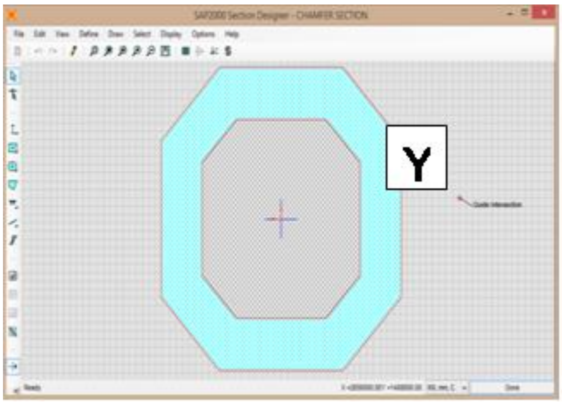


**Fig.2: Hollow Chamfer Section**

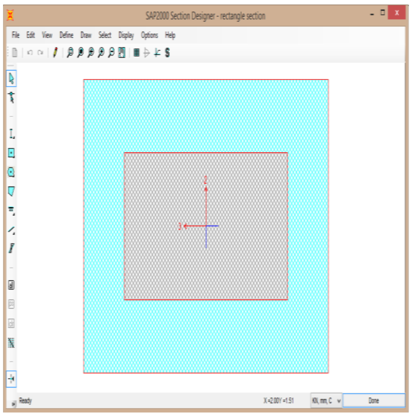

**Fig.3: Hollow Rectangular Section**

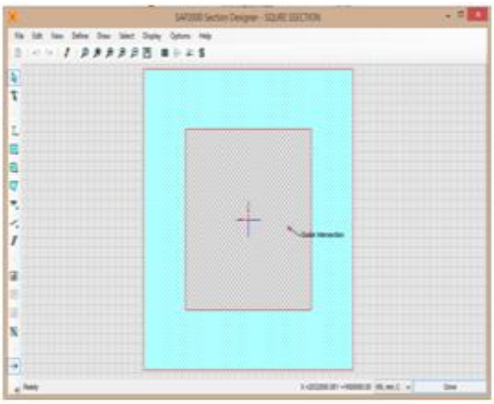

**Fig.4: Hollow Square Section**

## II. RESULT AND DISCUSSION

In this study for taking the best cross section and find minimum bending moment we choose a 10, 15, and 20-storey buildings of 20-meter-wide and height of each column is 3m, for run and analysis of this structure we use CSI software SAP2000. This section provides structure results, including items such as structural periods and base reactions.

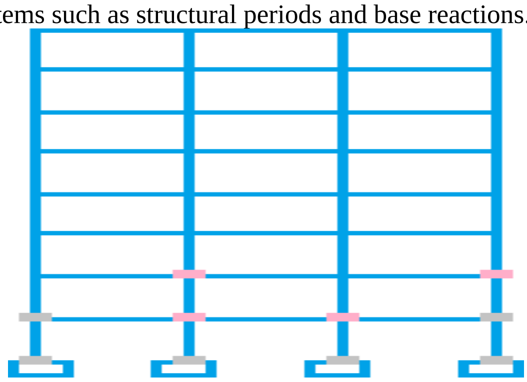

**Fig. 5: 8-Storey Model**

Graphical Representation of Bending Moment of 8 Storey Model

On X-axis plot storey height (m) and on Y-axis bending moment (KN-mm)

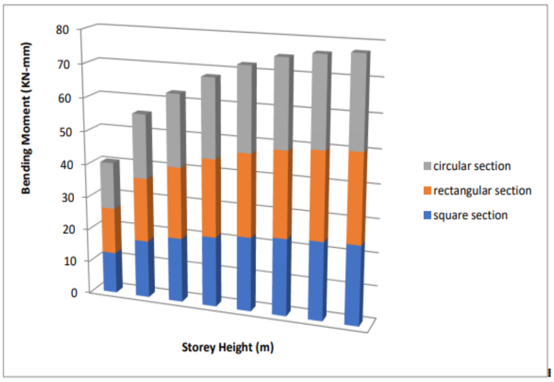


**Fig. 6: Bending Moment (KN-mm) for Column No. 1**

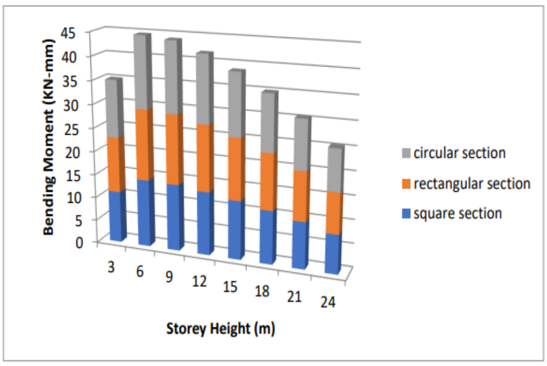


**Fig. 7: Bending Moment (KN-mm) for Column No. 2**

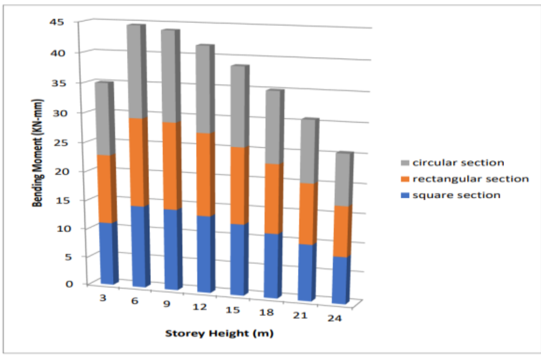


**Fig. 8: Bending Moment (KN-mm) for Column No. 3**

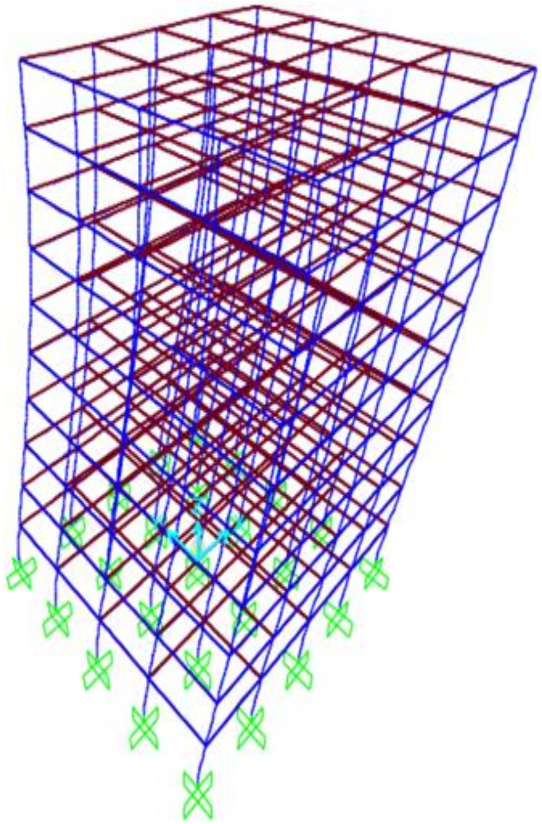

**Fig. 9: Deformed shape of 8-Storey Model**

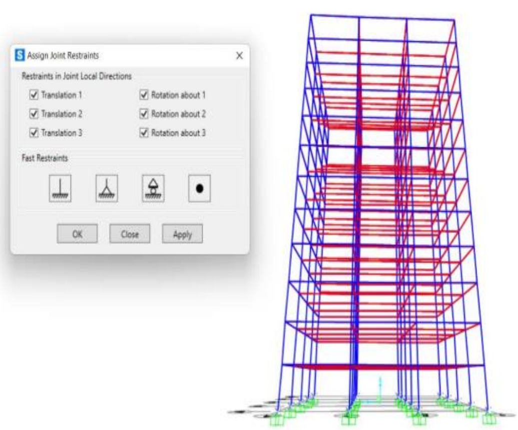


**Fig. 10: 12 -Storey Model**

Graphical Representation of Bending Moment of 12 Storey Model

On X-axis plot storey height (m) and on Y-axis bending moment (KN-mm)

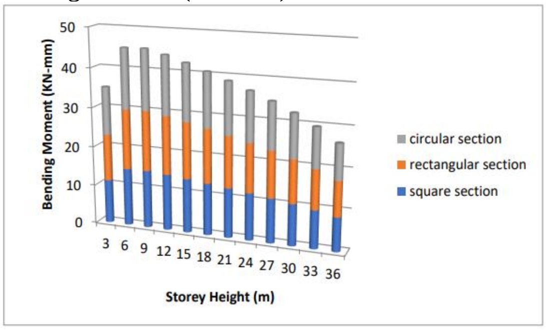


**Fig. 11: Bending Moment (KN-mm) for Column No. 7**

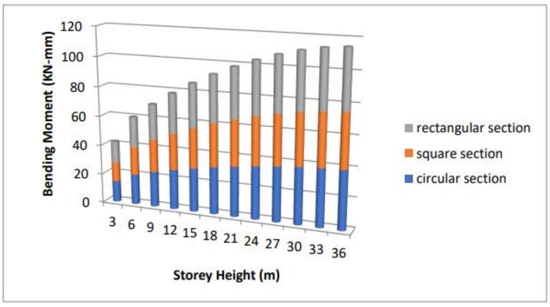


**Fig. 12: Bending Moment (KN-mm) for Column No. 8**

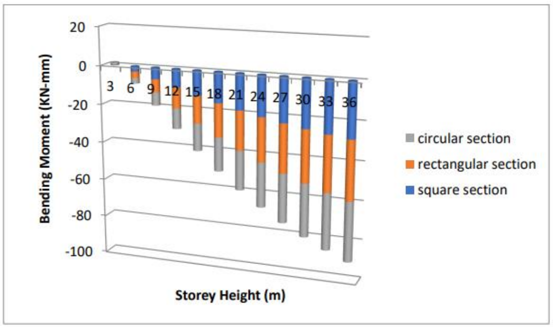


**Fig. 13: Bending Moment (KN-mm) for Column No. 9**

Graphical Representation of 10th Storey's Model-Storey Displacement

On X-axis plot storey height (m) and on Y-axis storey displacement (mm)

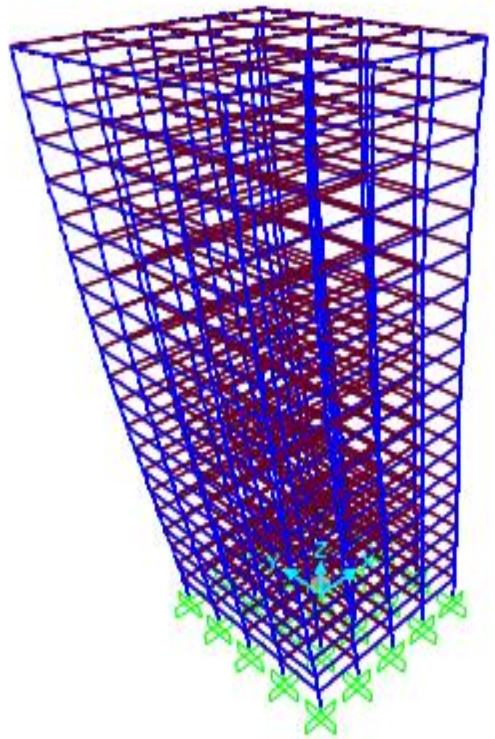

**Fig. 14: Deformed shape of 15-Storey Model**

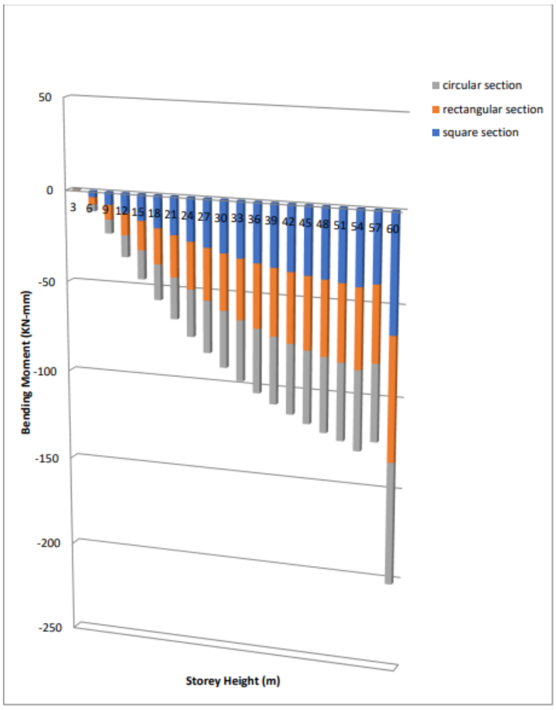


**Fig. 15: 15th Storey's Model- Storey Displacement (mm) for Different Sections**

## III. CONCLUSIONS

- As per the analysis records the location of hinges are determined
- The comparison is made with all 3 different type of cross-section condition of beam.

**Bending Moment Results**

- Bending Moment is Maximum for square cross-section.
- Bending Moment is Minimum for circular section and its value increases continuously for change in cross section property.
- Bending Moment for columns on outer boundary increases continuously with increase in height of model.

**Base Shear Results**

**08-Storey Model**

- Base shear for 8-storey Model y-direction due to dead load maximum in rectangular section.
- Base Shear for 8-Storey Model in X-Direction Due to Load Combination maximum in circular section.

**15-Storey Model**

- Base shear for 15-storey model in z-direction due to dead load maximum in rectangular section.
- Base Shear for 15-Storey Model in X-Direction Due to Load Combination maximum in circular section.

**20-Storey Model**

- Base shear for 20-storey model in z-direction due to dead load maximum in rectangular section.
- Base Shear for 20-Storey Model in X-Direction Due to Load Combination maximum in circular section.

**Storey Displacement**

- Storey hinges predominant with the increase in height.
- Minimum and maximum values for every storey depends on their configuration

## IV. FUTURE SCOPE OF THE WORK

- Model can be further examined for stresses by using finite element method.
- Geometry of section can be considered with different parameters like variation in thickness of top & bottom slabs, depth of section, and number of cells.
- Parametric study with different curvature can be done along with different cases considered in this study.

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