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Hexagrid: - The Avant Garde Pathway To Resist Lateral Load

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Abstract. *The parametric study of hexagrid structure has been carried out by analyzing and designing 14 storey real life structure. The parameters nominated for evaluation were 3 different cross sectional shapes i.e., channel section, cold form hat section and buckling restrained brace section.*
Keywords: *Hexagrid, buckling restrained brace – pinned, cold form hat, channel section.*

INTRODUCTION

The scarcity of land restricted the horizontal development and resulted in the evolution of vertical growth of the town. The best alternative available for the vertical growth is to construct building as high as possible. In high rise buildings lateral load like earthquake load and wind load will be the governing load which creates the necessity of special types of resisting systems known as lateral load resisting systems. Different types of lateral load resisting system are shear wall, diagrid system, hexagrid system, exoskeleton system, belt truss system, outrigger system, tube in tube system and composite system i.e. combination of any two system. In this research, hexagrid system as a lateral load resisting system was applied on an existing building and behavior was studied to find the suitability of system. From this research one can arrive on the conclusion that whether hexagrid structural system can be efficiently used or not in future.

Problem Formulation

The above mentioned structural system was studied on an existing 14 Storey Tall Suvarna Bhumi Building Rajkot. Building was analyzed and designed for dead load, live load, seismic load and wind load.

Grade of structural steel is taken as a Fe 345 and grade of concrete is taken as a M30. Loads considered for analysis are dead load, live load, floor finish, earthquake load as well as wind load. For earthquake, static analysis as well as response spectrum analysis will be carried out. Other data considered are mentioned below with their values. Density of masonry wall is assumed to be 20 kN/m3 and typical storey height is 3 m.

Load values are considered as per IS 875.

- Zone Factor: - 0.16 (zone 3)
- Importance Factor: - 1.2
- Response Reduction Factor: - 5
- Site type: - I
- Basic wind speed: - 39 m/s
- Terrain category: - I
- Analysis Method: - Static and Response Spectrum
- Maximum Permissible Top Storey Deflection: - H/500

3D Rendered view of the structure

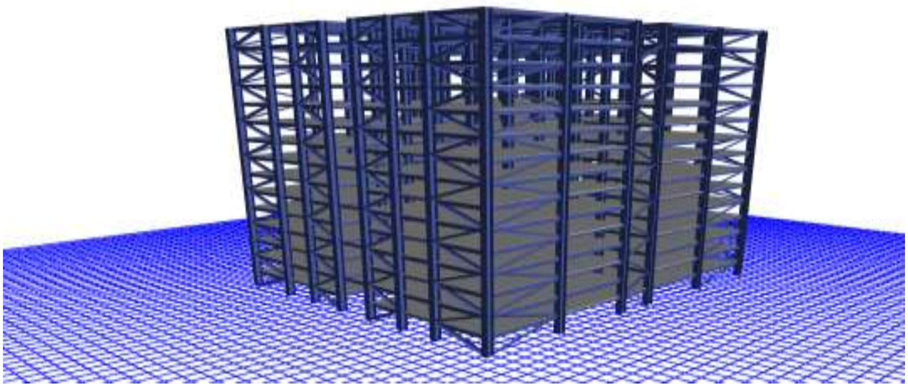

Figure 1 3D rendered view of the structure

Section details

Cross sectional details of beam, column and hexagrid elements are mentioned as below.

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Detail of beam
- Primary Beam = ISWB550
- Secondary Beam = ISMB500

Details of column
- Column (Built Up Section)
- Total Depth = 625 mm
- Top Flange Width = 625 mm
- Bottom Flange Width = 625 mm
- Web Thickness = 25 mm
- Flange Thickness = 30 mm

Details of hexagrid
- Channel Section
- Total Depth = 850 mm
- Total Width = 350 mm
- Flange Thickness = 30 mm
- Web Thickness = 30 mm

BRB Section (CoreBRB-2.25)
- Overall Depth: - 203.2 mm
- Overall Width: - 203.2 mm
- Area of yielding core: - 14.5 cm2 (2.25 sq in)

Cold form Hat Section
- Web Depth: - 250 mm
- Flange Width: - 250 mm
- Thickness: - 3.2 mm
- Radius: - 5.1 mm
- Lip Depth: - 25.4 mm

Result

Results along with graphs for channel section, buckling restrained brace pinned and cold form hat section for top storey displacement, lateral drift and base shear are presented below.

	Top Storey Displacement (mm)	Lateral Drift	Base Shear (kN)
Channel Section	35.408	0.00088	2885.070
BRB Pinned Section	75.980	0.00205	2662.450
Cold form Hat Section	74.083	0.00199	2662.458

Table 1 Result Summary of all 3 section

- Channel Section

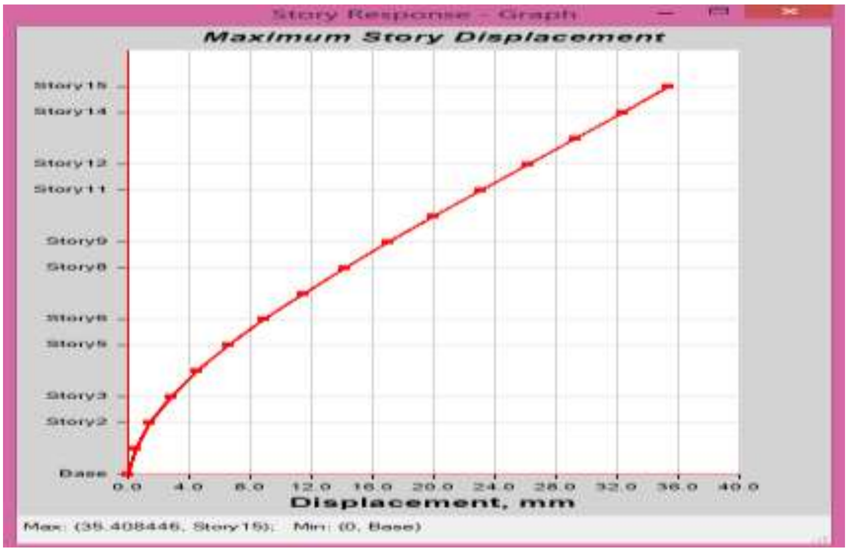

Figure 2 Displacement graph of channel section

Figure 3 Storey drift graph of channel section

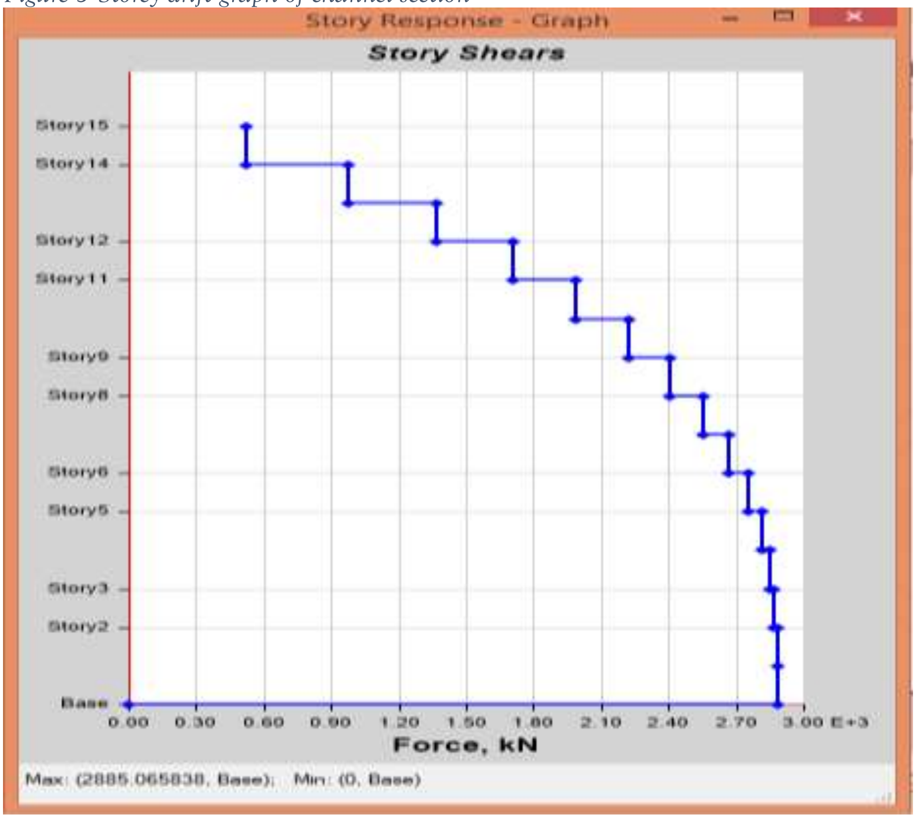

Figure 4 Storey shear graph of channel section

- Buckling restrained brace – pinned section

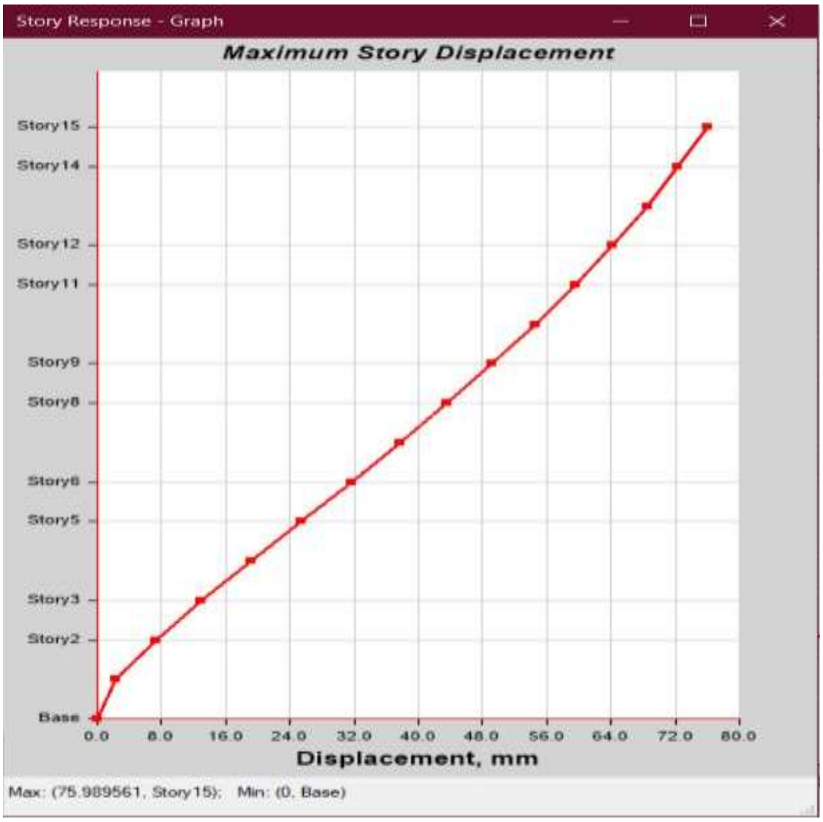

Figure 5 Displacement graph of BRB pinned section

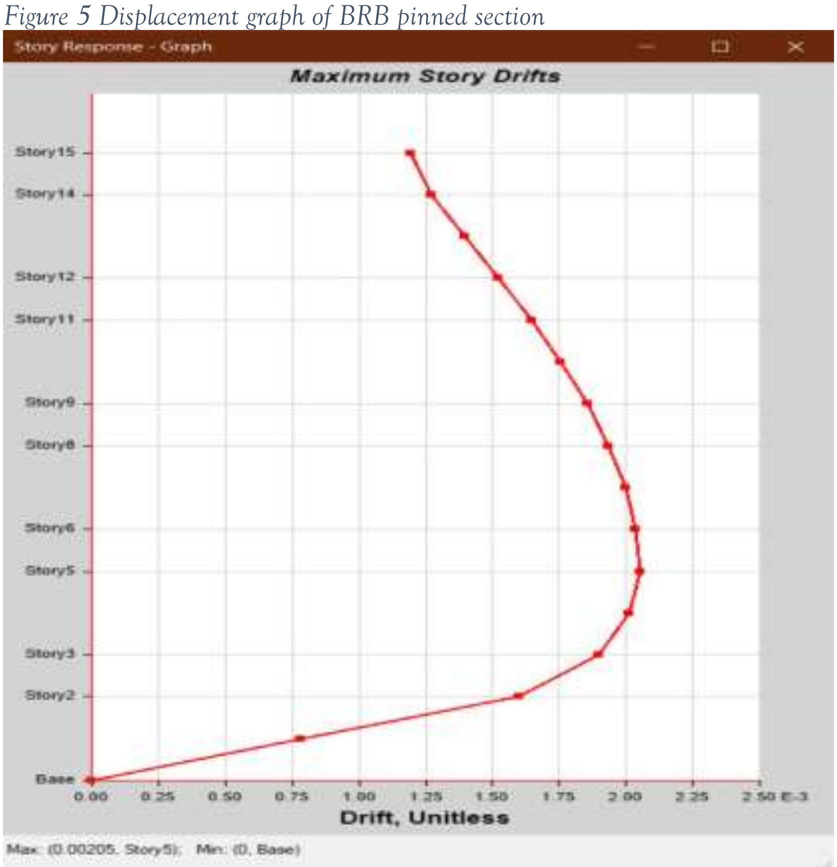

Figure 6 Storey drift graph of BRB pinned section

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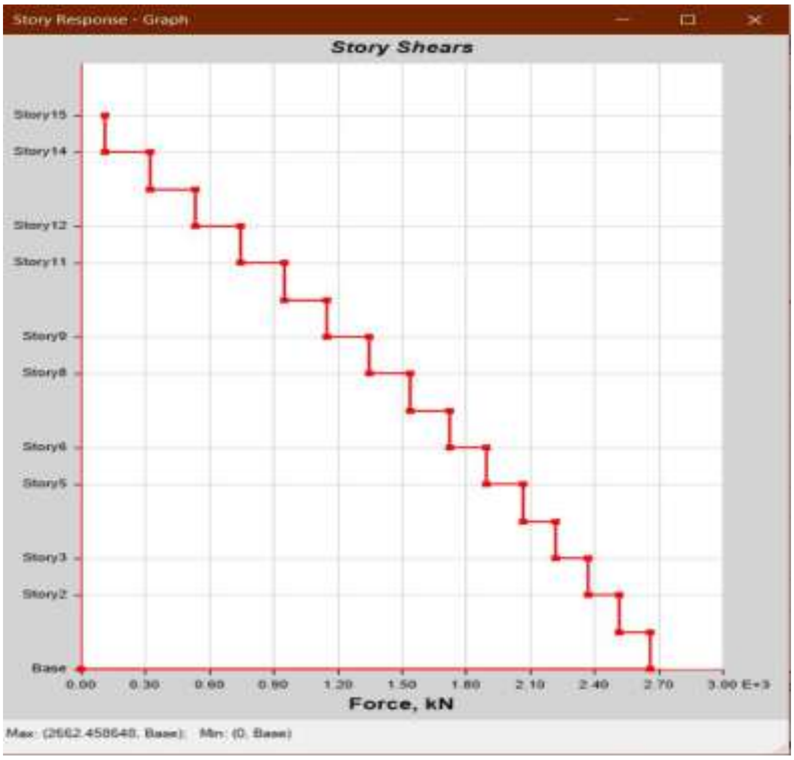

Figure 7 Storey shear graph of BRB pinned section

- Cold form hat section

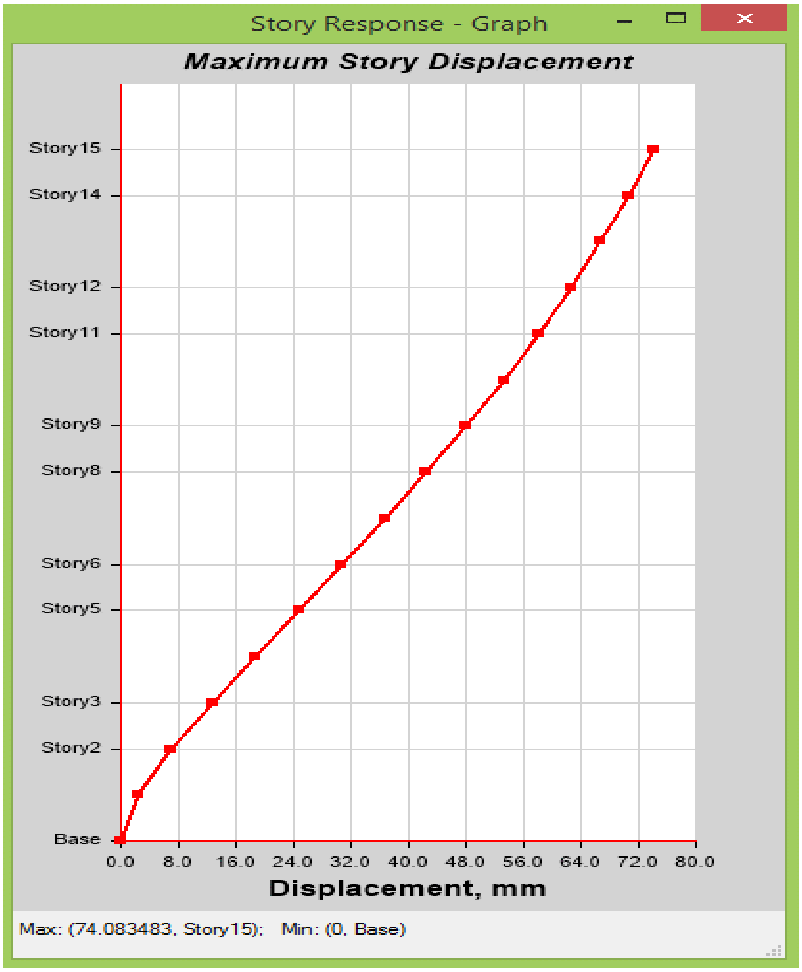

Figure 8 Displacement graph for hat section

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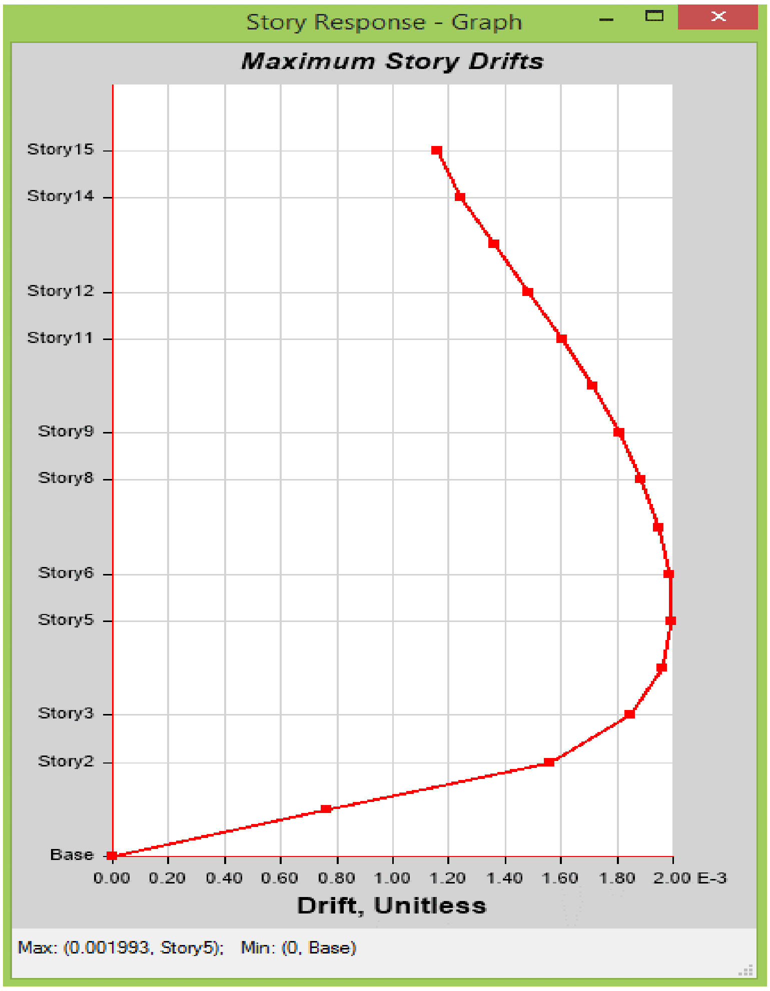

Figure 9 Storey drift graph for hat section

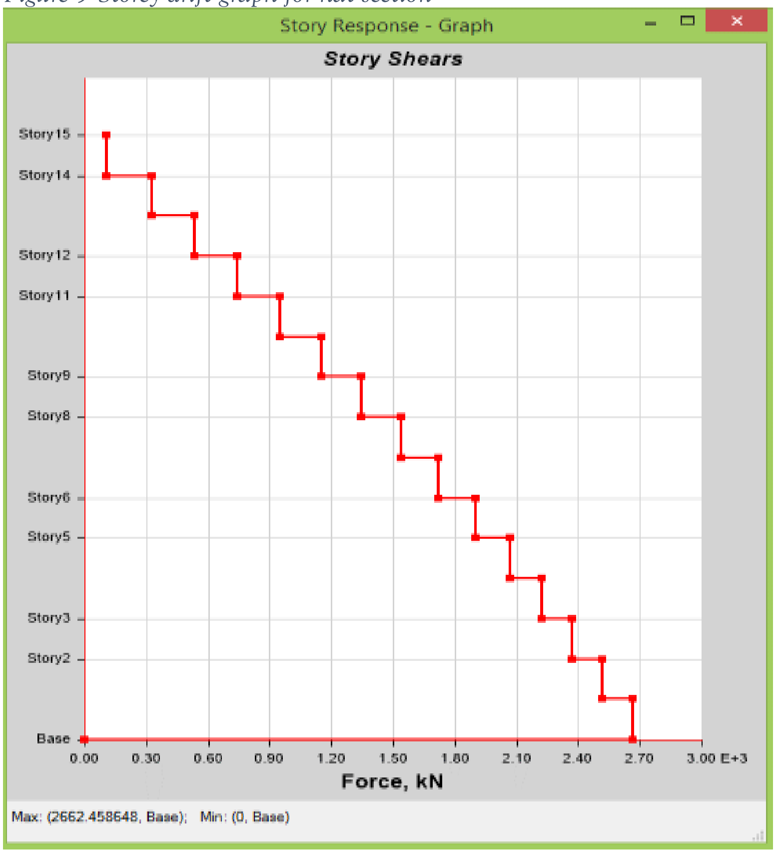

Figure 10 Storey shear graph for hat section

Summary

Comparatively, maximum displacement was observed with a hexagrid having BRB pinned section, while minimum displacement was observed in case of channel section. Shear force for channel section was found to be bit higher compared to other 2 sections.

Overall, it was found that cold form hat and BRB pinned section is having more flexibility compared to the channel section.

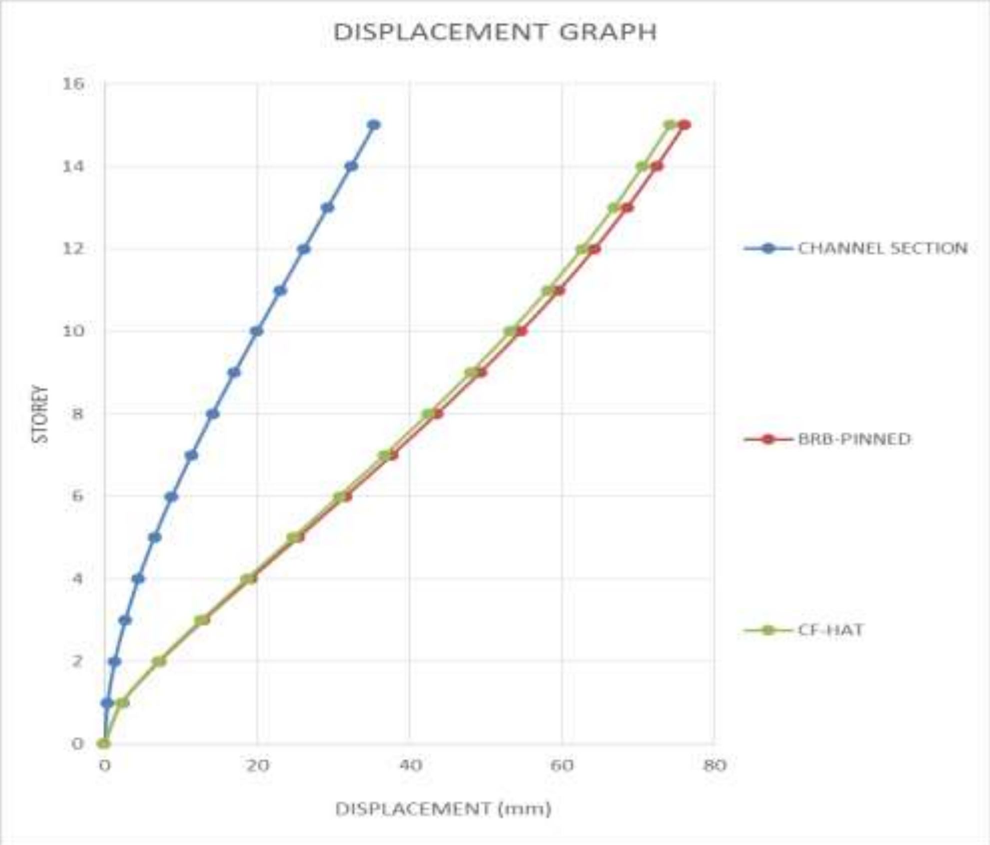

Figure 11 Summary of displacement

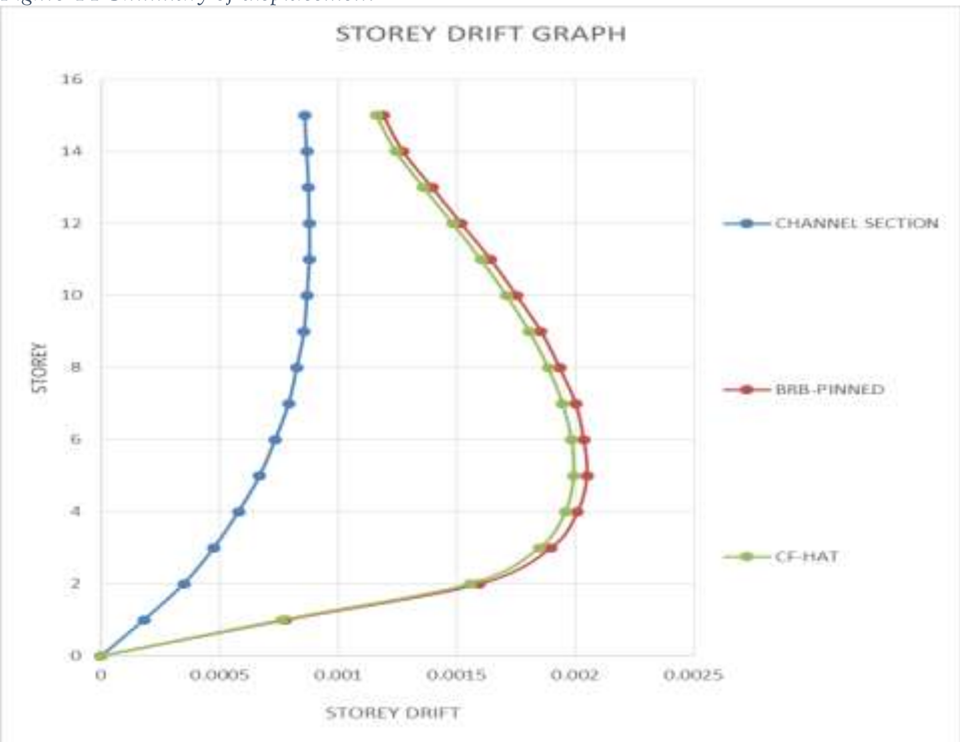

Figure 12 Summary of storey drift

Figure 13 Summary of base shear

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