IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Hexagrid – An Innovative Approach 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 are 3 different cross sectional shapes i.e., star angle section, BRB - bolted section and cold form C section. Finally the results generated due to the variation of the above parameters were compared in terms of maximum top storey displacement, storey drift and base shear.

Index Terms **- Hexagird, Star angle section, BRB – Bolted section, cold form C section.**

I. 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, different height of buildings having hexagrid system as a lateral load resisting system will be analysed and different parameters will be studied to find the suitability of system for different stories of the building. From this research one can arrive on the conclusion that whether hexagrid structural system can be efficiently used efficiently or not in future.

II. PROBLEM FORMULATION

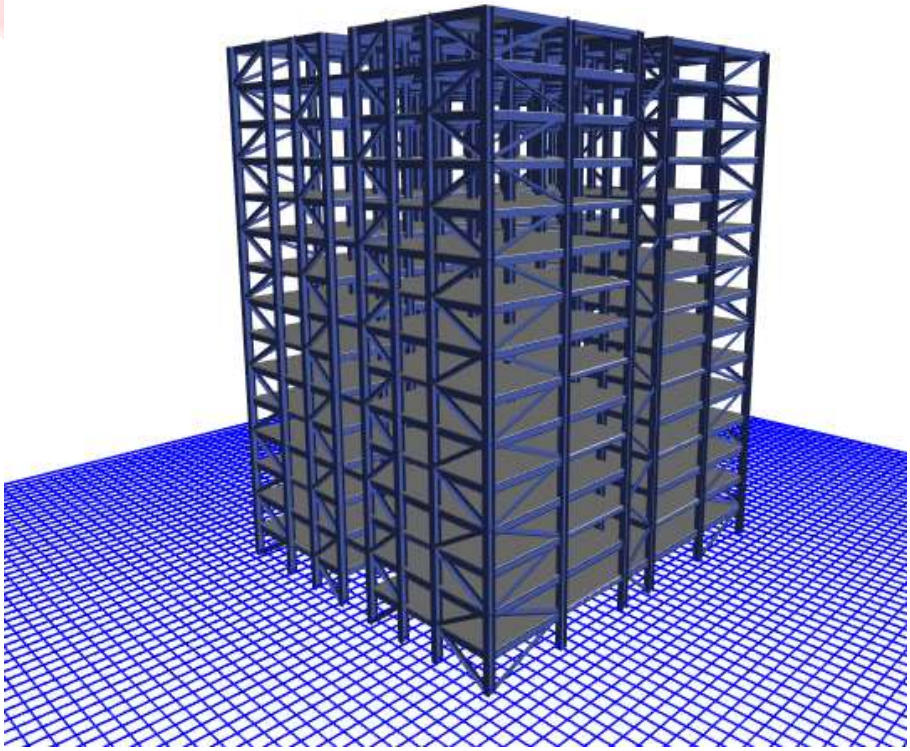
The above mentioned structural system was studied on an existing 14 Storey Tall Suvarna Bhumi Building Rajkot. Building was analyzed and designed for dead load, live load, seismic load and wind load.

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

III. 3D RENDERED VIEW OF THE STRUCTURE



IV. SECTION DETAILS

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

Details 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

Star Angle Section
Total Depth of Single Angle Section = 200 mm
Total Width of Single Angle Section = 200 mm
Flange Thickness of Single Angle Section = 25 mm
Web Thickness of Single Angle Section = 25 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 C Section
Web Depth: - 350 mm
Flange Width: - 85 mm
Thickness: - 3.8 mm
Radius: - 5.1 mm
Lip Depth: - 15 mm

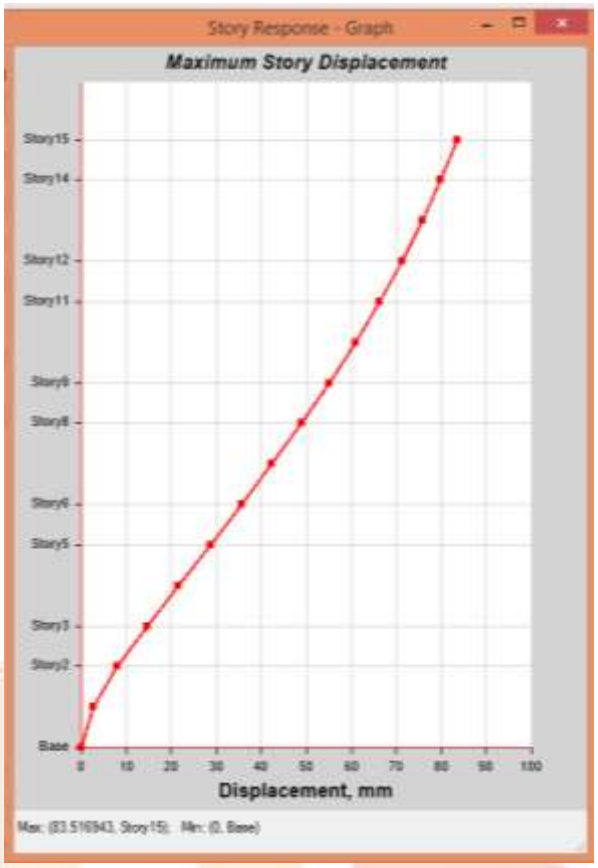
V. RESULTS

Result summary for Box Section, Channel Section, and I Section for Top Storey Displacement, Lateral Drift and Base Shear is presented below.

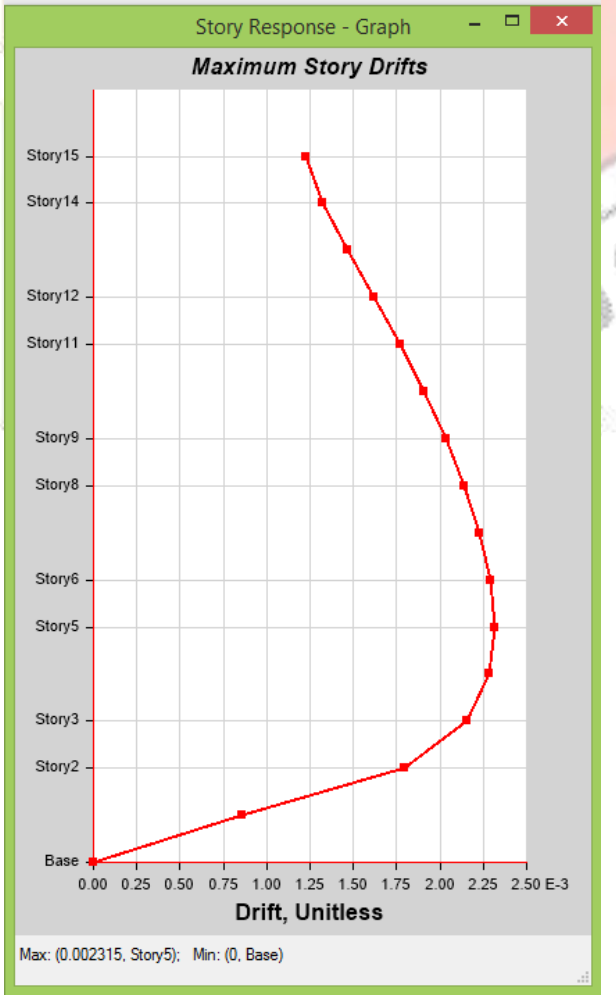
	Top Storey Displacement (mm)	Lateral Drift	Base Shear (kN)
Star Angle Section	36.852	0.000956	2662.459
BRB Bolted Section	76.90	0.002079	2662.46
Cold form C Section	83.51	0.002315	2662.45

Figure V.1

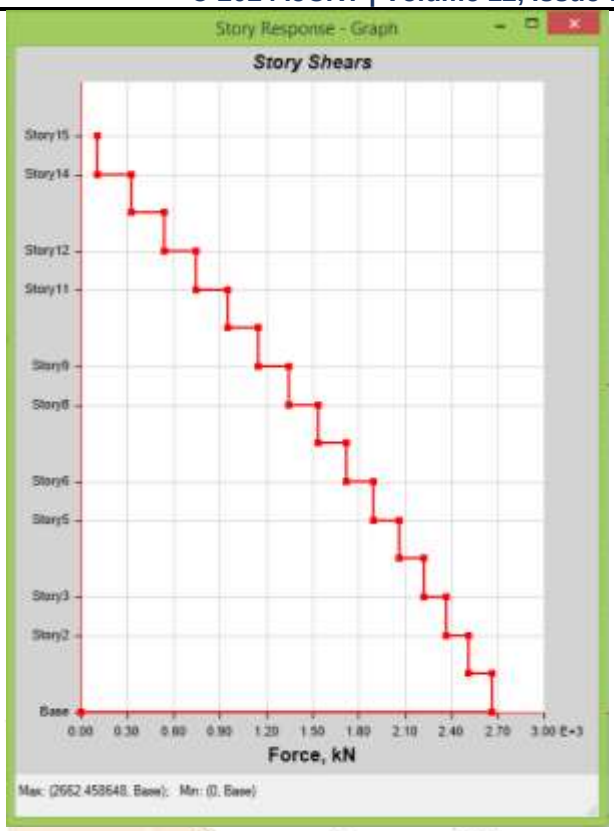
VI. GRAPHS



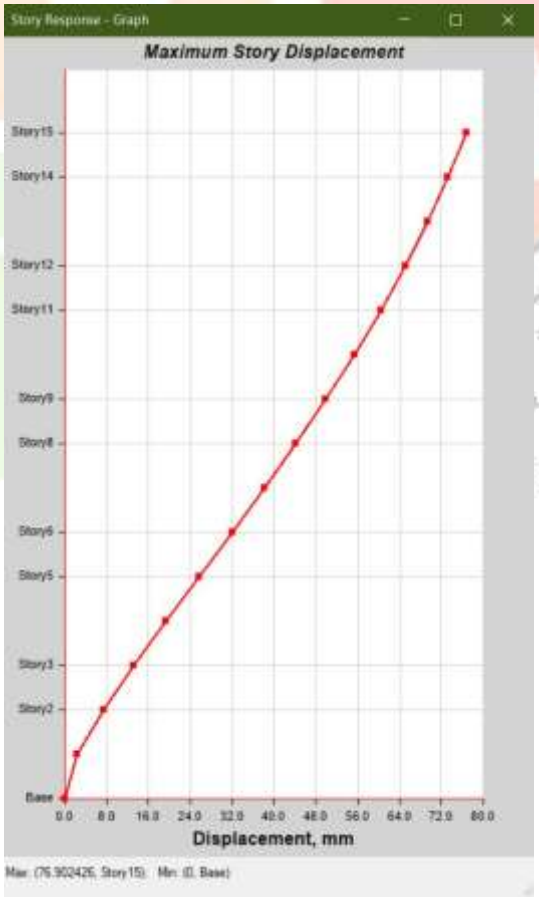
Displacement for Cold form C Section



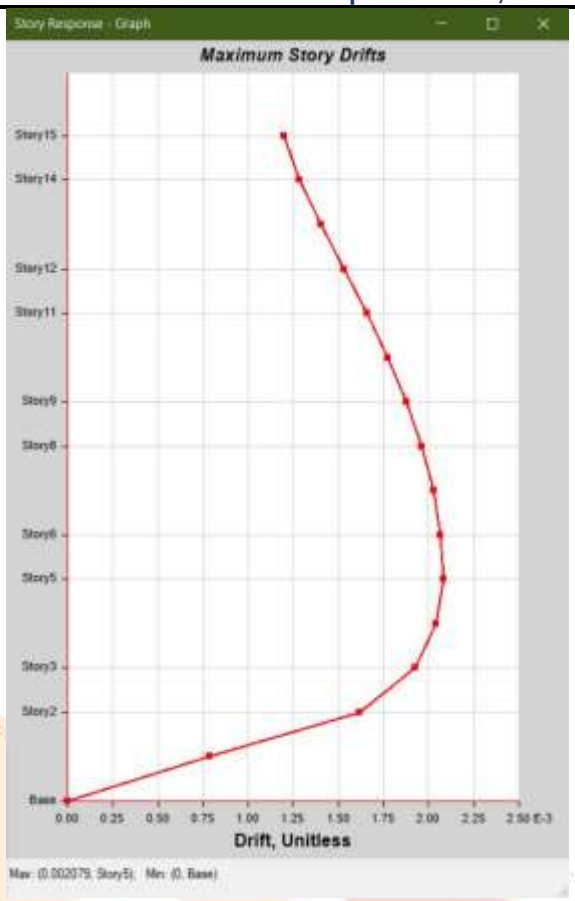
Storey drift for Cold form C Section



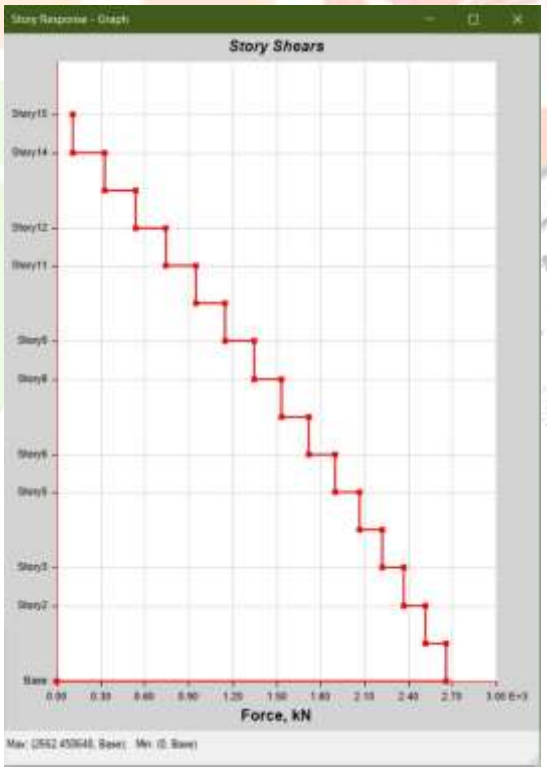
Base Shear for Cold form C Section



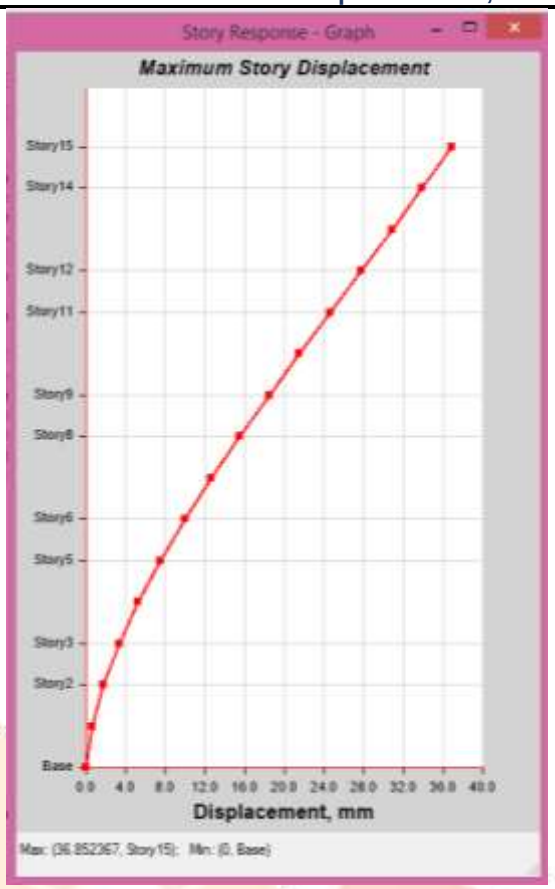
Displacement for BRB – Bolted Section



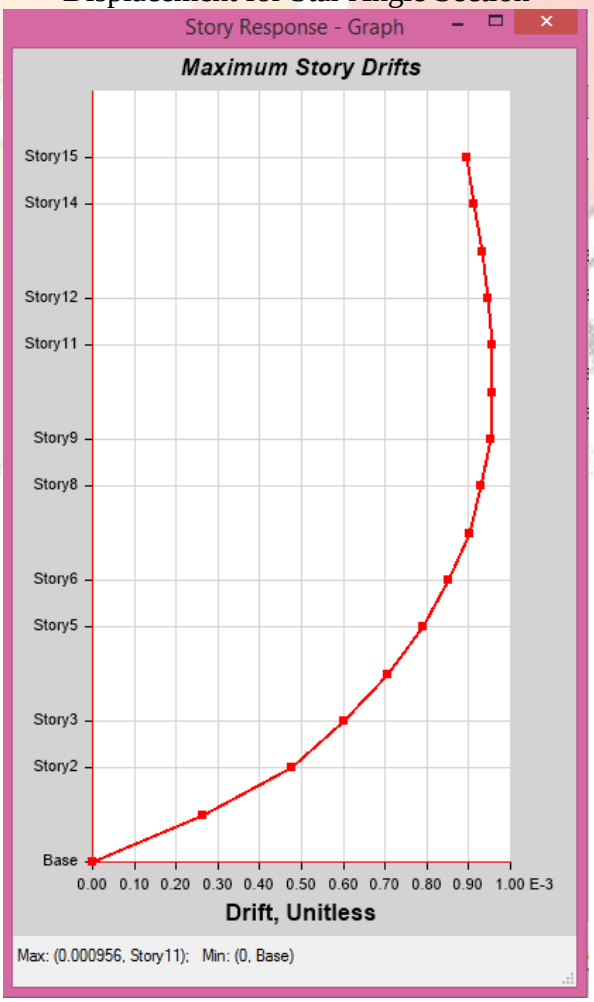
Storey drift for BRB - Bolted Section



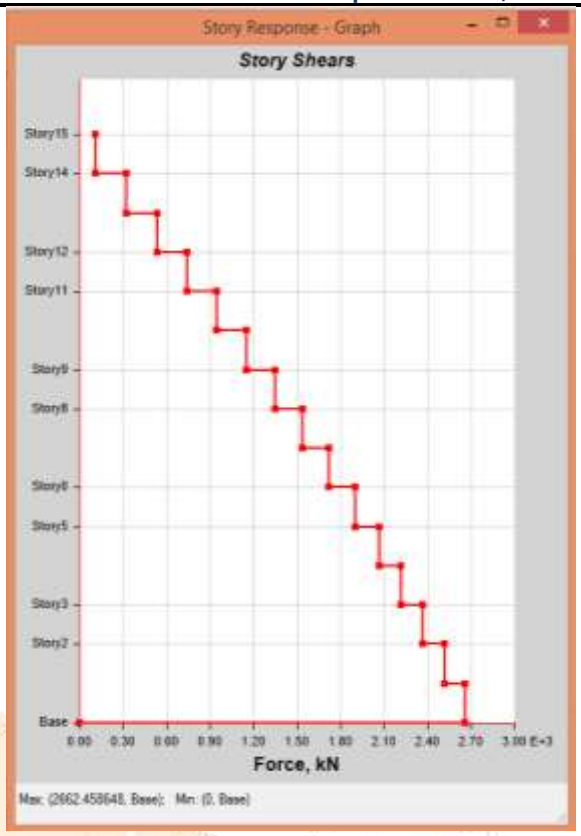
Base Shear for BRB - Bolted Section



Displacement for Star Angle Section

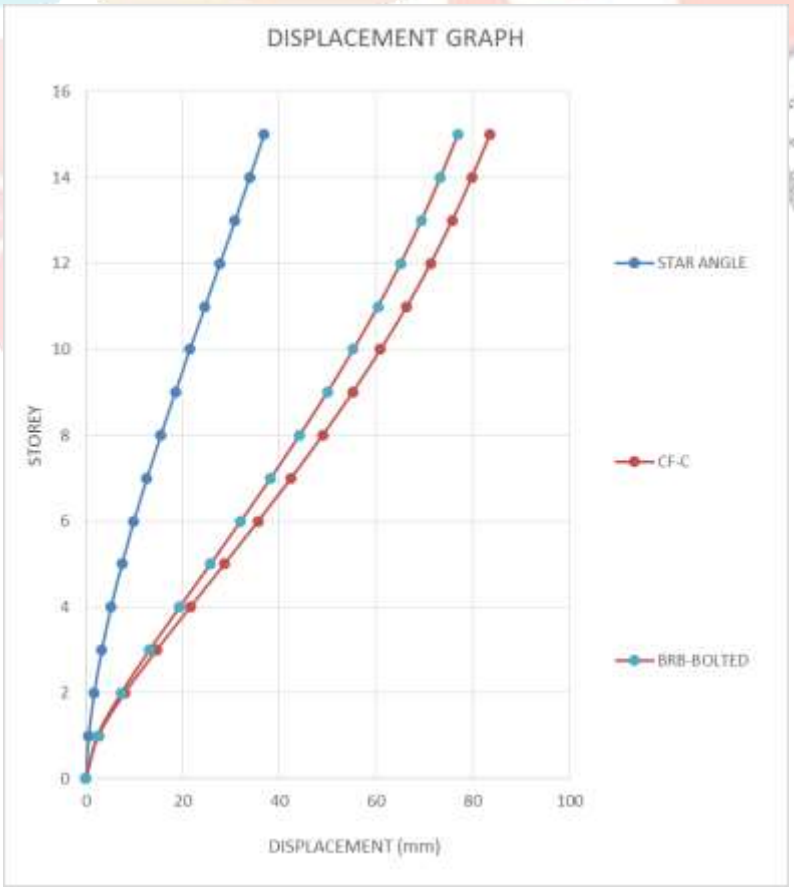


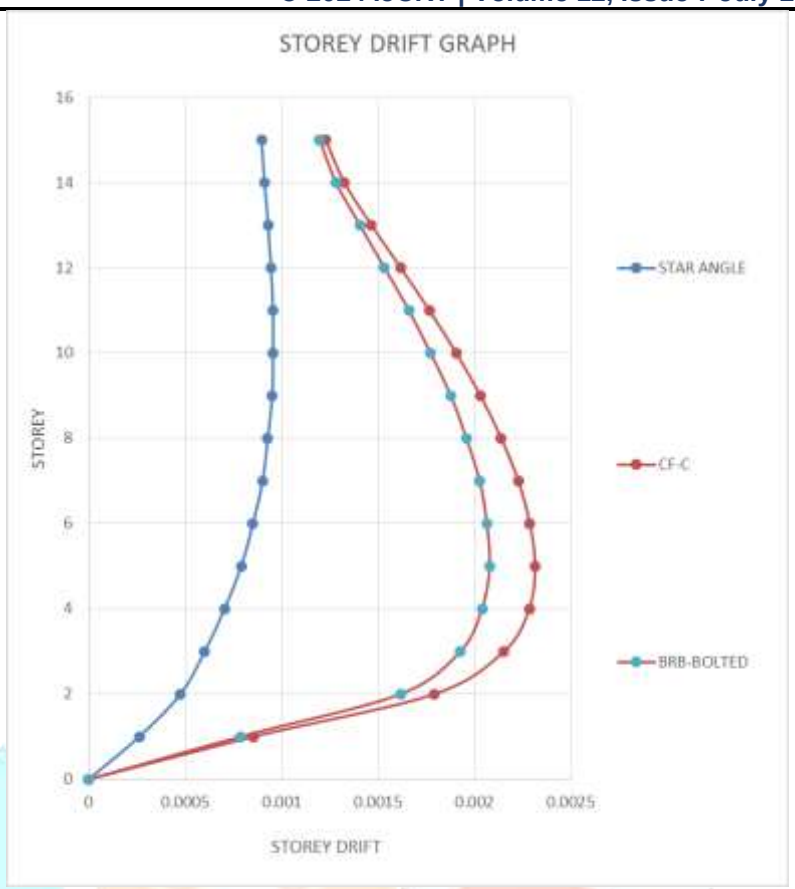
Storey drift for Star Angle Section



Base Shear for Star Angle Section

VII. COMPARISON OF RESULTS





VIII. CONCLUSION

Comparatively, Maximum displacement was observed with a hexagrid having cold form C section, while minimum displacement was observed in case of star angle section. Shear force lies in the same range for all three sections.

Overall, it was found that cold form C section is having more flexibility compared to the other two, while star angle section is having comparatively less flexibility.

IX. REFERENCES

1. Proposing the Hexagrid System as a New Structural System for Tall Buildings by Niloufar Mashhadiali and Ali Kheyroddin.
2. Diagrid: An innovative, sustainable, and efficient structural system.
3. Structural Developments in Tall Buildings: Current Trends and Future Prospects by Mir M. Ali & Kyoung Sun Moon.
4. Dissipative steel exoskeletons for the seismic control of reinforced concrete framed buildings.
5. High-rise modular buildings with innovative precast concrete shear walls as a lateral force resisting system.
6. Determining the optimum outrigger locations for steel tall buildings by using time history analyze.
7. A Review on Novel Structural Development in Tall Building: Diagrid Structure Joshi R S, Dhyani D J.
8. A Review of the Diagrid Structural System for Tall Buildings By Chengqing Liu, Qinfeng Li, Zheng Lu and Handan Wu.
9. A Seismic Study on Diagrid Structure by Yogeesh H.S, and V. Devaraj.
10. Analysis and Design of Concrete Diagrid Building and it's Comparison with Conventional Frame Building by Singh, Rohit Kumar, Vivek Garg, and Abhay Sharma
11. Analysis and Design of Diagrid Structural System for High Rise Steel Buildings by Jani, Khushbu, and Paresh V. Patel.
12. Comparative Study of Diagrid Structures with Conventional Frame Structures By Manthan I. Shah, Snehal V. Mevada, and Vishal B. Patel.
13. Constructability of Diagrid Structures by Ar. Megha Shroti.
14. Design criteria for diagrid tall buildings: Stiffness versus strength by Giovanni, Maria Montuori, Mele Elena, Brandonisio Giuseppe, and De Luca Antonello.
15. Design of Diagrid Structural System for High Rise Steel Buildings as per Indian Standards by Jani, Khushbu D., and Paresh V. Patel.
16. Diagrid- An Innovative Technique for High Rise Structure by Nikesh Ganesh Rathod and P. Saha.
17. Diagrid Structural System for Tall Buildings: Characteristics and Methodology for Preliminary Design by Kyoung Sun Moon, Jerome J. Connor and John E. Fernandez.
18. Diagrid Structural System: Strategies to Reduce Lateral Forces on High-Rise Buildings by Nishith B. Panchal, Vinubhai R. Patel.
19. Diagrid Structures for Tall Buildings: Case Studies and Design Considerations by Elena Mele, Maurizio Toreno, Giuseppe Brandonisio and Antonello De Luca.
20. Diagrid Structures: Innovation and Detailing 2013 by Boake, T. M.