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Seismic Behaviour of Multistorey RC Frame with Shear wall and Octagrid Sructure

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Abstract - *In this paper total six Octagrid buildings are modelled and analyzed for earthquake and gravity load. Three buildings have been modelled with 3m, 6m and 9m Octagrid modules and three with shear wall with Octagrid modules. The floor plan of 18m x 18m and 19 storey building is considered here. The comparison of parameters like base shear, overturning moment, storey drift and storey displacement is done between buildings to determine efficient alternative. Response spectrum method is used for dynamic analysis. STAAD. Pro software is used for modelling and analysis of buildings.*

Key Words: Octagrid, Shear wall, Response spectrum analysis, Storey drift, Storey displacements, Base shear, Overturning moment, etc…

1. INTRODUCTION

Now a days due to increase in population cost of land is increasing and therefore there is limitations on land availability. Scarcity of land shows picture of construction of high rise buildings. High rise buildings requires lateral load resisting system for stability. Because as height of building increases lateral applied loads increases. So early tall buildings were having lateral load resisting systems like bracing systems, trusses, tubular structure, shear wall buildings. Now a days Diagrid, Hexagrid, Octagrid structures are being used as lateral load resisting systems. These patterns are arranged at perimeter of structure. External columns are absent in this structure. These structures are made up of horizontal, vertical, and inclined members. This patterns resists shear by carrying load axially which provides stiffness and strength against horizontal shear. These structures consumes less amount of material and are aesthetically beautiful.

Objective of the study is to model and analyze RC frame with varying sizes of Octagrid pattern and shear wall building with varying sizes of Octagrid pattern and compare the parameters like storey drift, storey displacements, base shear and overturning moment between the buildings.

2. BUILDING DESCRIPTON

The floor plan of 18m x 18m, building height 57m and storey height 3m is considered. Location of shear wall is taken at center. Octagrid of varying sizes i.e 3m, 6m, and 9m Octagrid modules are used to modelling and analyze the buildings. Total six buildings are modelled and analyzed. Three buildings have been modelled with 3m, 6m and 9m Octagrid modules and 3 with shear wall at center with 3m, 6m, 9m Octagrid modules at periphery.

Table -1: Description

Floor Plan	18m x 18m
Building Height	57m
Storey Height	3m
Number of Storeys	19
Shear wall location	Center
Thickness of Shear wall	150mm
Column Size	600mm x 600mm
Beam Size	450mm x 450mm
Octagrid	300mm x 300mm x 15mm
Grade of Concrete	M20
Grade of Steel	Fe550
Dead Load	4.75 kN/m^2
Live Load	4 kN/m^2
Seismic Analysis Method	Response Spectrum Analysis
Seismic Zone	III (Zone factor 0.16)
Soil type	Medium
Response reduction factor	5
Importance factor	1.5
Damping Ratio	0.05

3. MODELLING

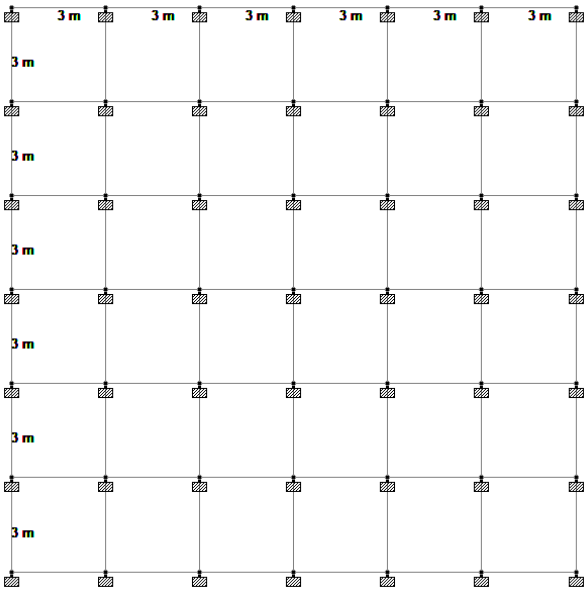

Fig -1: Plan View

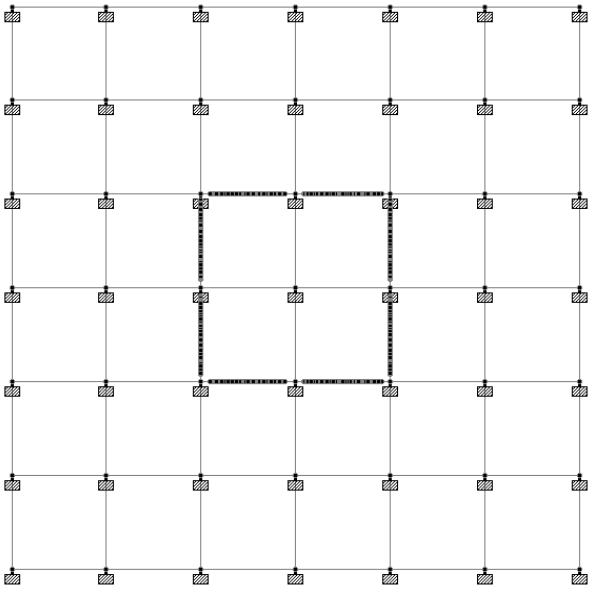

Fig -2: Location of shear wall

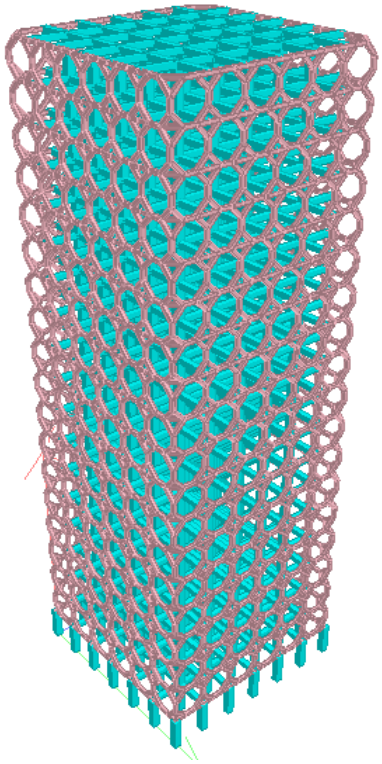

Fig -3: 3D view of 3m Octagrid module building

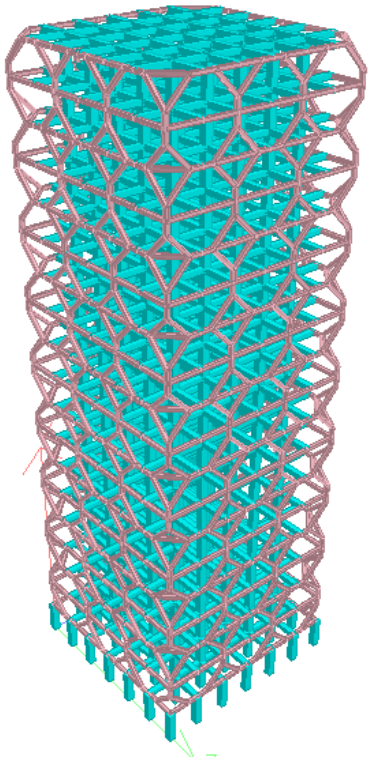

Fig -4: 3D view of 6m Octagrid module building

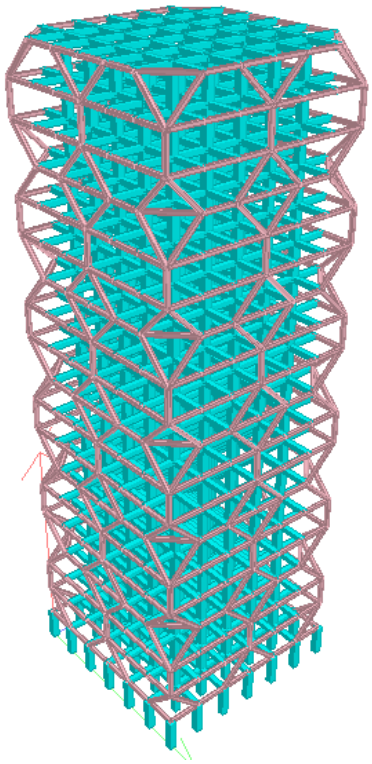

Fig -5: 3D view of 9m Octagrid module building

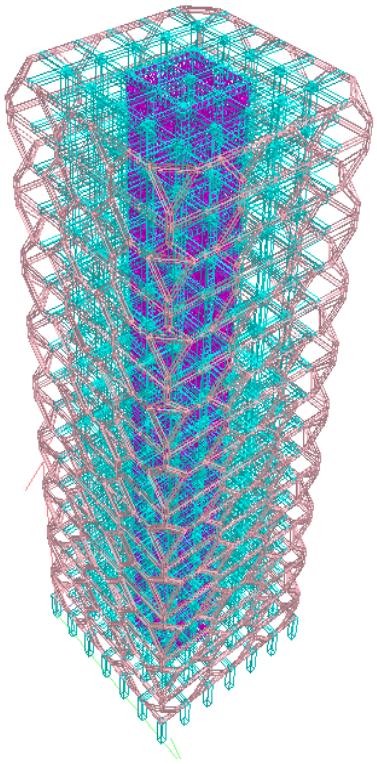

Fig -7: Wireframe view of shear wall+6m Octagrid module building

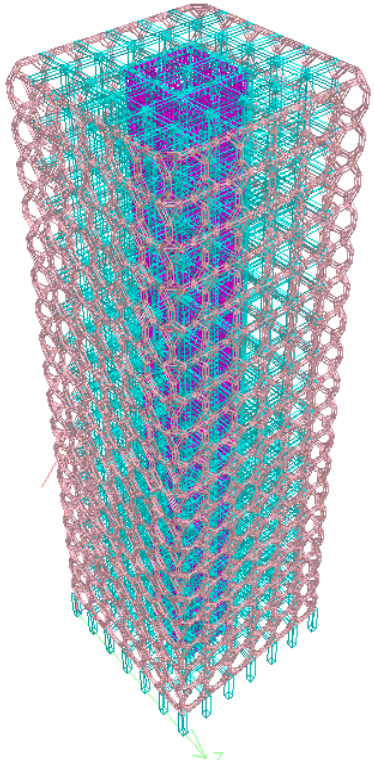

Fig -6: Wireframe view of shear wall+3m Octagrid module building

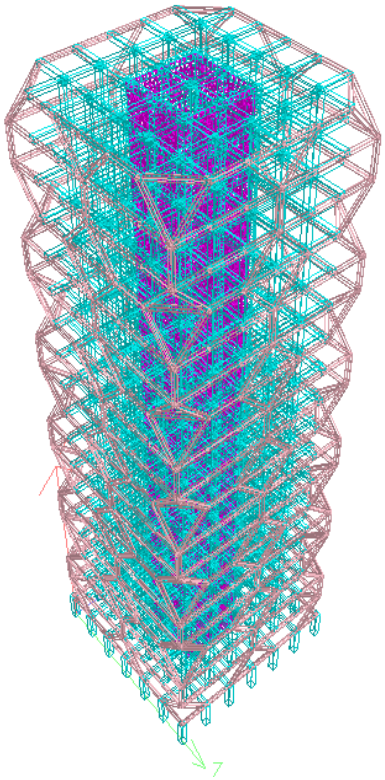

Fig -8: Wireframe view of shear wall+9m Octagrid module building

4. ANALYSIS AND RESULTS

4.1. STOREY DRIFT

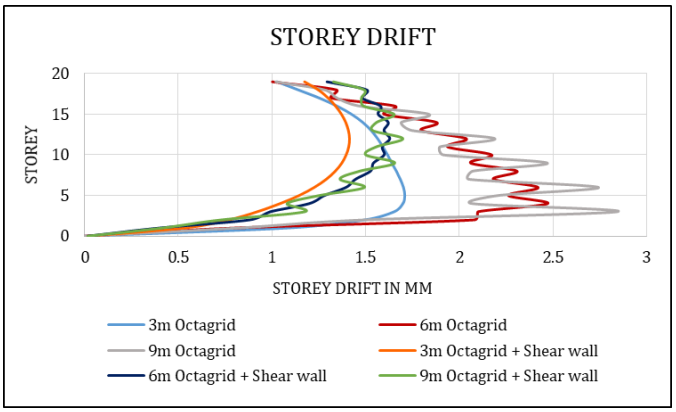

Chart- 1: Storey drift

Permissible maximum storey drift as per IS 1893 part1: 2002 is 0.004h = 0.004*3= 0.012m, where h= Height of storey. The values of storey drift of all the buildings for earthquake load in both X & Z directions are within limit. Frames with varying sizes of Octagrid pattern shows less storey drift compare to shear wall +Octagrid buildings. 6m and 9m Octagrid building shows less top storey drift 1.002 mm and 1.02 mm respectively compare to other models.

4.2. STOREY DISPLACEMENT

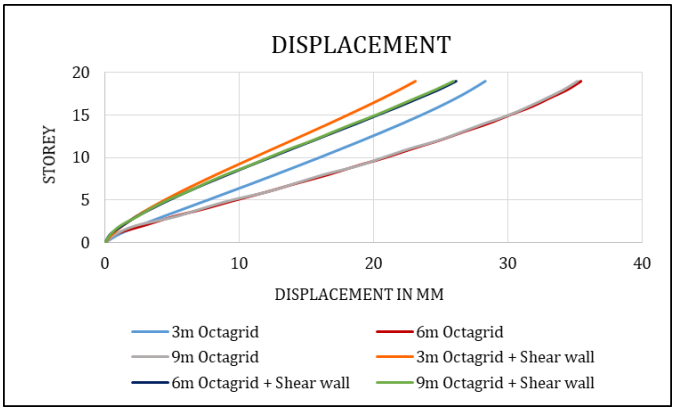

Chart - 2: Storey displacement

Permissible maximum storey displacement as per IS1893 part1: 2002, is H/500=57/500=0.114 m, where H= Height of building. The values of storey displacement of all the buildings in both X & Z directions for earthquake are within limit. Shear wall +Octagrid buildings shows less top storey displacement compare to Octagrid buildings. Shear wall buildings with 3 m and 9m Octagrid shows least top storey displacement 23.112 mm and 25.94 mm respectively compare to other buildings.

4.3. BASE SHEAR

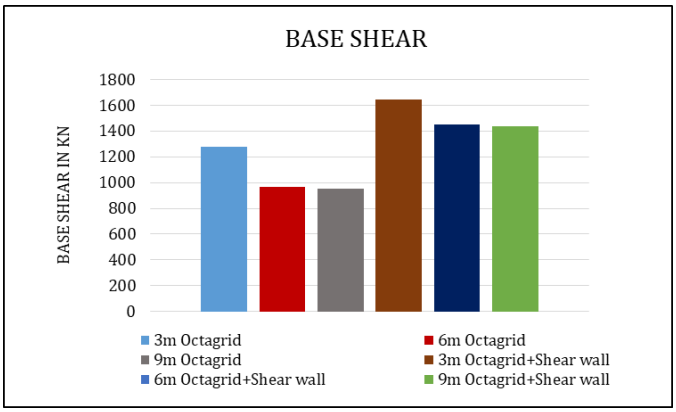

Chart - 3: Base Shear

Base shear is less for frames with varying sizes of Octagrid pattern than shear wall+ Octagrid buildings. 6 m and 9m Octagrid building are having least base shear 964.32 kN and 953. 35 kN respectively. As module size increases base shear decreases.

4.4. OVERTURNING MOMENT

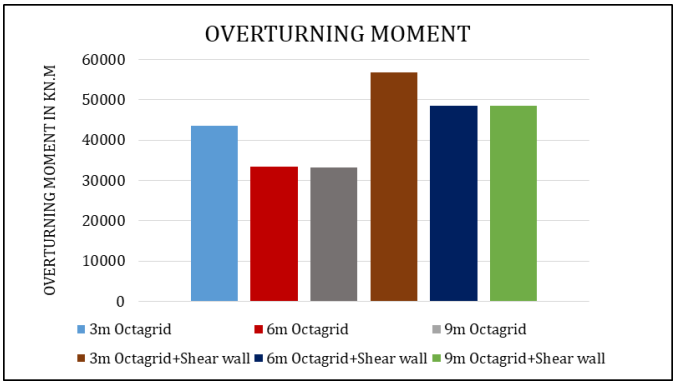

Chart - 4: Overturning Moment

Overturning moment is less for frames with varying sizes of Octagrid pattern than shear wall+ Octagrid building. 6 and 9m Octagrid buildings are having least overturning moment 33389.95 kN.m and 33121.56 kN.m respectively. As module size increases Overturning moment decreases.

4.4. FORCE AND MOMENT

Internal columns carries maximum load and are subjected to lower moment than that of external columns.

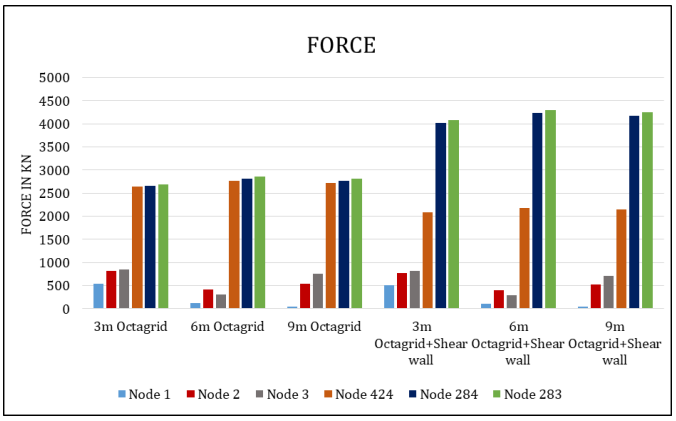

Chart - 5: Force

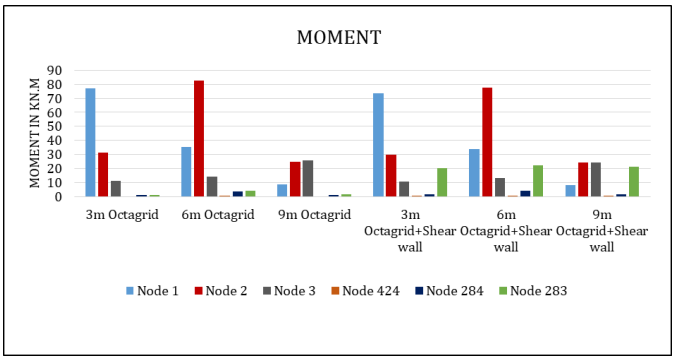

Chart - 6: Moment

5. CONCLUSION

- Each model has satisfied the limits for displacement and storey drift as per IS1893 part1: 2002.
- Octagrid with 6m and 9 m module shows less top storey drift, base shear and overturning moment.
- The structural performance of Octagrid system decreases with increase in module density.
- Buildings with 6m and 9m Octagrid, can be consider as an efficient alternative.

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