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COMPARATIVE STUDY ON SEISMIC ANALYSIS OF G+30 RECTANGULAR AND CIRCULAR BUILDING WITH OR WITHOUT SHEAR WALL BY USING STAAD PRO.

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Abstract: Significant advances have been made in the field of seismic structure design, requiring constant research and innovation. There is growing awareness of the ability to use non-destructive materials and technologies to reduce seismic risk. Structure movement during seismic events highlights the importance of building structures that can withstand external loads to prevent collapse and reduce damage. Among new solutions, composite walls have proven effective in overcoming these challenges. This study conducts a comparative study of the responses of high-rise buildings with RCC frames of different shapes (rectangular and circular) under seismic loading conditions. The shape of the building affects its behavior during an earthquake, especially when the building is high up. To be clear, building standards may not accurately reflect all aspects of the earthquake's impact, especially for non-pressure buildings. Therefore, further research and development is needed in this area to close existing gaps and improve the resilience process. The study focused on comparing various responses such as base shear force, maximum bending moment, shear and deflection between similar buildings and high-rise buildings with mixed lines. A detailed analysis was carried out using advanced software tools such as Bentley STAAD Pro to evaluate the performance of the 3m-storey G+ 30 models under seismic loading. In summary, this study contributes to the ongoing debate on seismic design, explains the impact of building quality on structural response, and highlights the need for continued innovation to improve the seismic resistance of tall buildings. Significant progress has been made in the field of seismic design and further research and innovation is needed. The use of non-traditional materials and new technologies will reduce the risk of earthquakes. During seismic events, dynamic forces occur in structures due to inertial forces, which indicate that structures that can withstand lateral loads are needed to prevent collapse. In this case, combined shear walls turned out to be a good solution. This study also makes a comparison between the responses of tall buildings with rectangular and circular RCC frames under seismic loads. The shape of the building affects its response to earthquakes, especially as the height increases. Given the limitations of the code in addressing various aspects of seismic impact, especially for tall buildings, further research is needed. This study aims to compare the base shear force, maximum bending moment, shear force and deflection responses of composite beams for similar buildings and structures. It was modeled using Bentley STAAD Pro software to evaluate the response of the G+30 model, with a floor height of 3m, to seismic loading. Keywords: high-rise buildings, shape coefficient, wind load analysis, composite columns, foundation shear force, and building deflection

Key Words: High Rise Building, Shape factor, Wind load analysis, Composite columns, Base Shear, Building Deflection

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INTRODUCTION

Research background with the rapid increase in the world population, the demand for housing has also increased. However, this increased demand is limited due to land scarcity. Strictly speaking, the total area of the earth is about 510.1 million square kilometers, of which about 71% is covered by water and only 29% is land. In particular, the land area is approximately 148.94 million square kilometers and the coastline is more than 356,000 kilometers long. Russia is not enough to meet the increasing real estate demand. There is an urgent need for new urban development, efficient land use and sustainable housing solutions due to the limited space available for living and development on Earth. Approaches such as urban planning, mixed-use and vertical urban development (such as the construction of high-rise buildings) can help increase land use efficiency while reducing environmental impacts. In addition, exploring alternative housing options such as modular houses, micro houses and reuse of urban waste can help meet the housing need on less land. In addition, the implementation of policies that promote sustainable growth, encourage growth, and protect green areas and natural areas is important to ensure sustainable urban development while protecting our ecosystems. In summary, as the world population increases, the demand for housing continues to increase, while the demand for housing is limited. Land procurement requires consideration and security in terms of urban development and housing provision. By carefully monitoring land use, using innovative housing solutions, and employing urban thinking strategies, we can work to meet the housing needs of growing clans while preserving valuable land resources for future generations. Please see the map below for details on available lands.

1.1 EARTHQUAKE EFFECT

The earthquake is defined as a phenomenon occurring when the tectonic plates beneath the Earth's surface abruptly shift or move against each other. Key terms associated with earthquakes are the hypocenter and epicenter. The hypocenter denotes the point within the Earth's crust where seismic activity originates, while the epicenter refers to the spot directly above the hypocenter on the Earth's surface. While the hypocenter lies inside the Earth's crust, the epicenter is located on the surface.

3.1.Equivalent Static Method of Seismic Analysis

The method is also called The Lateral Forces Method as seismic effects are assumed to be similar as the ones resulting from the statically transverse loadings. This method is possibly the simplest procedure for a structural engineer to perform a seismic analysis and achieve reasonable results. It is prescribed in any relevant code for earthquake analysis and is widely used especially for the designing of buildings and other common structures meeting certain regularity conditions.

Rayleigh system says that indolence lading provides a good approximation to the natural vibration over the structure. If the structural response isn't significantly affected by benefactions from advanced modes of vibration it's reasonable to assume that with an applicable set of indolence forces one may achieve a good approximation for the response. This is the introductory conception of the Equivalent Static Method.

The structure to be anatomized by the original static system should admire certain criteria regarding its geometrical chronicity and stiffness distribution similar

• Each side cargo defying rudiments (similar as columns or walls) should run from the base to the top without any interruption;

• Mass and side stiffness shouldn't change suddenly from the base to the top;

• Geometrical asymmetries in height or in plan due to lapses shouldn't exceed certain values;

Defining seismic methodology

In Seismic analysis we are finding the V_B which is defining as follow:

$$VB = W. Ah$$

Where VB is the design base shear

W is the weight of the structure

Ah = design horizontal coefficient, whose value can be evaluated by

$$Ah = \frac{Z}{2}\frac{Sa}{g}\frac{I}{R}$$

Where Z is the zone factor whose value is given in table 2 of IS 1893

Table no. 3.1 different seismic zone as per IS 1893 (part1)-2002.

Seismic zones	II	III	IV	V
Intensity	Low	Moderate	Severe	Very severe
Zone factor	0.1	0.16	0.24	0.36

Sa/g is the spectral acceleration coefficient depends on soil condition and time periods. The value is derived from the graph given in IS 1893 part

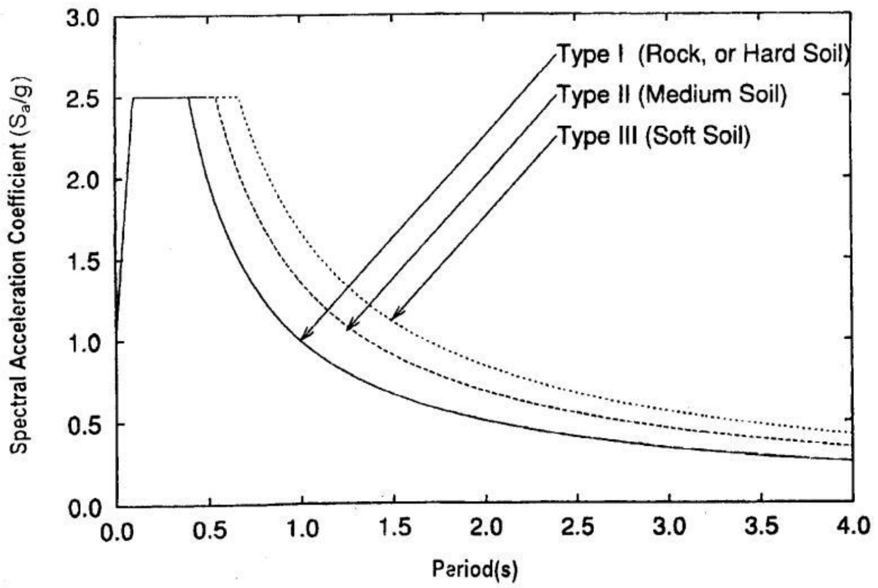
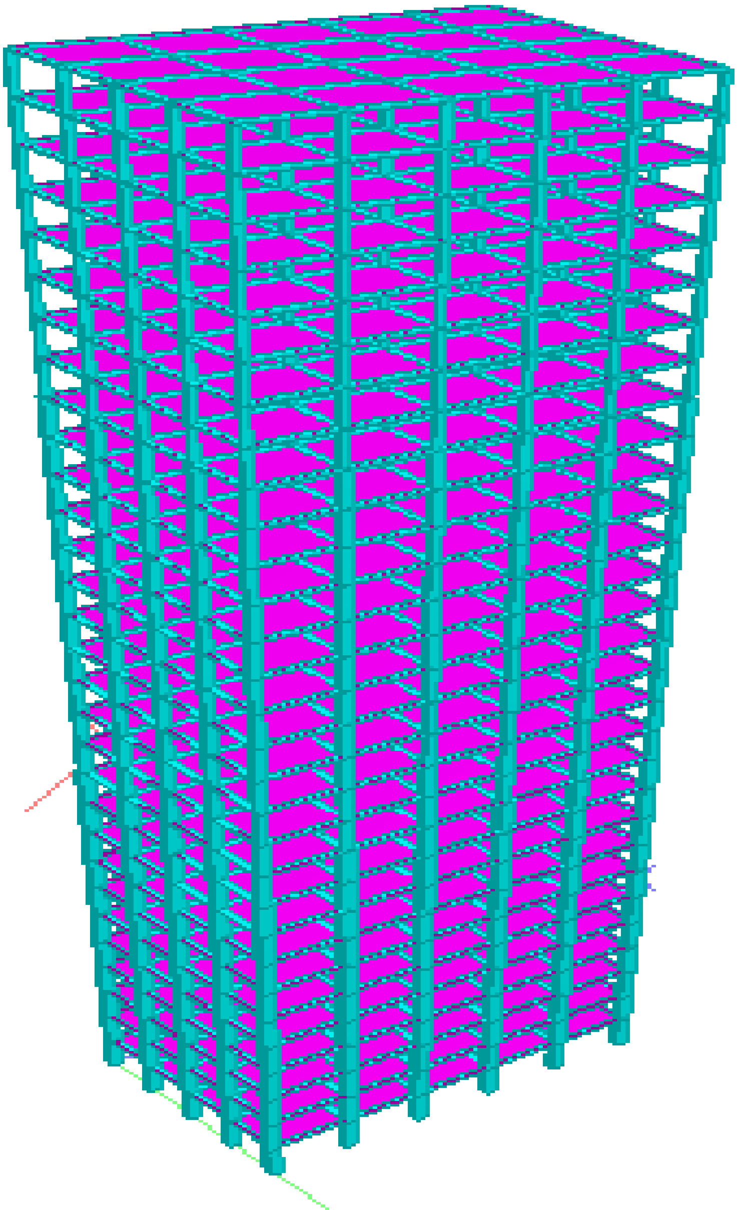


Fig 3.1 response spectrum graph

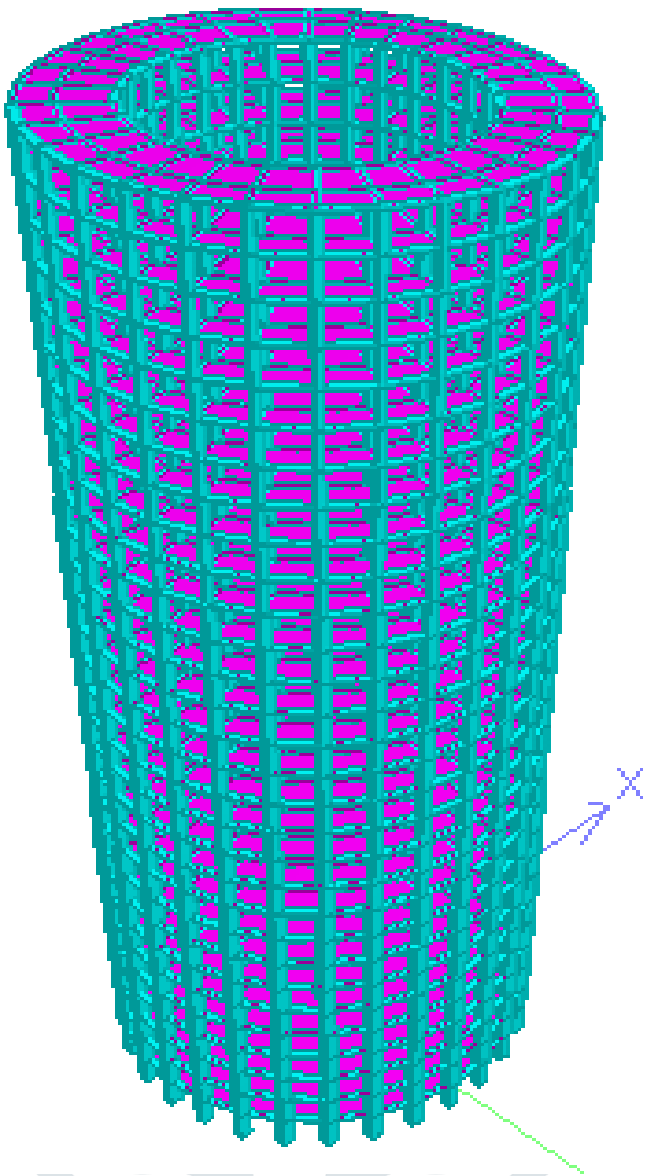
Time period is calculated from the formula given in IS 1893 (Part1)2002

$\mathbf{T}_a = \mathbf{0.09}\frac{\mathbf{h}}{\sqrt{d}}$ For all other buildings, moment-resisting Frame with brick infill panels

"I" is the importance factor given to the type of structure and its value is taken from the table given in IS 1893 (Part1) table no. 6



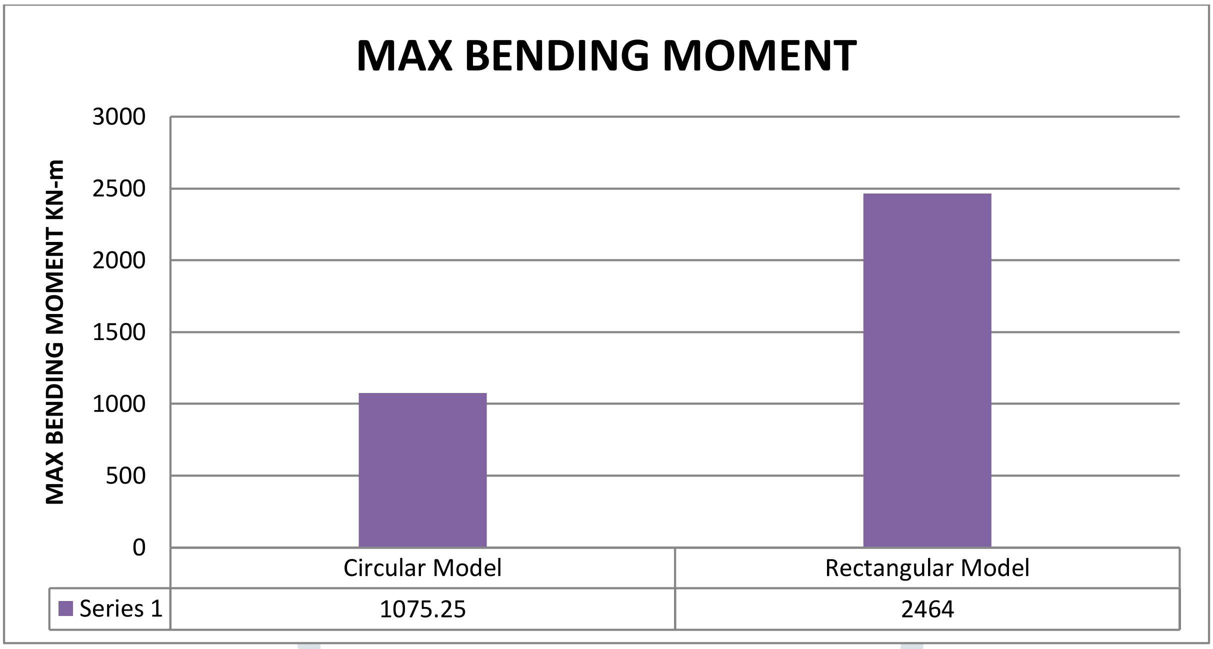
Three-dimensional view of rectangular frame

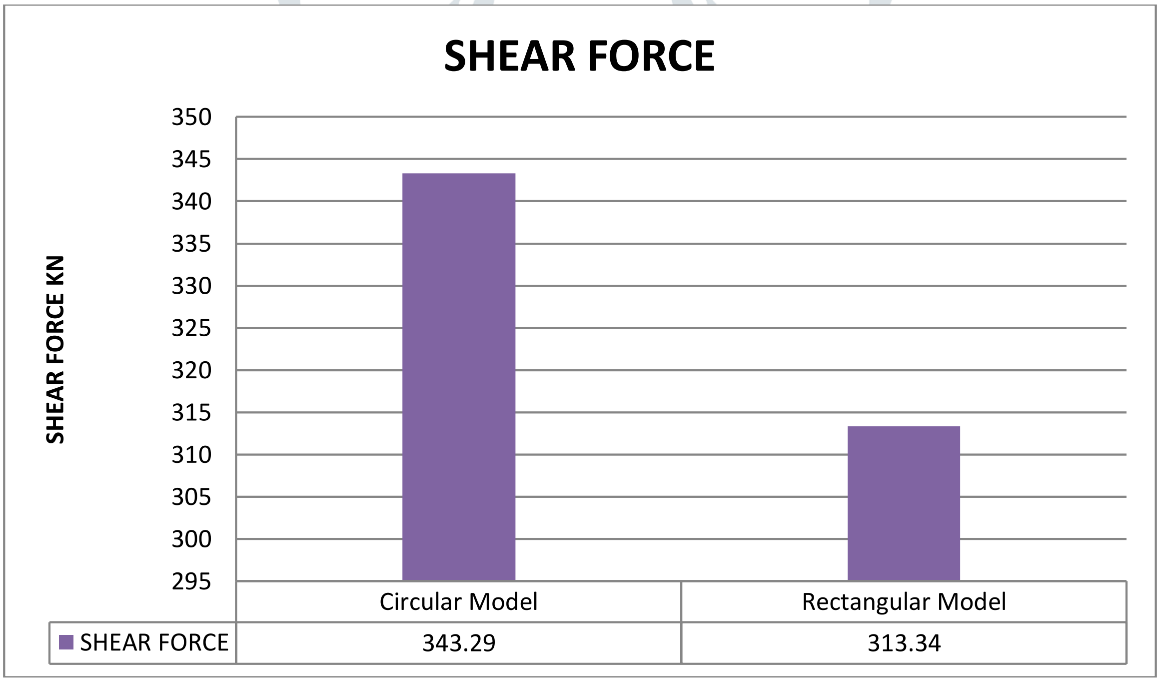


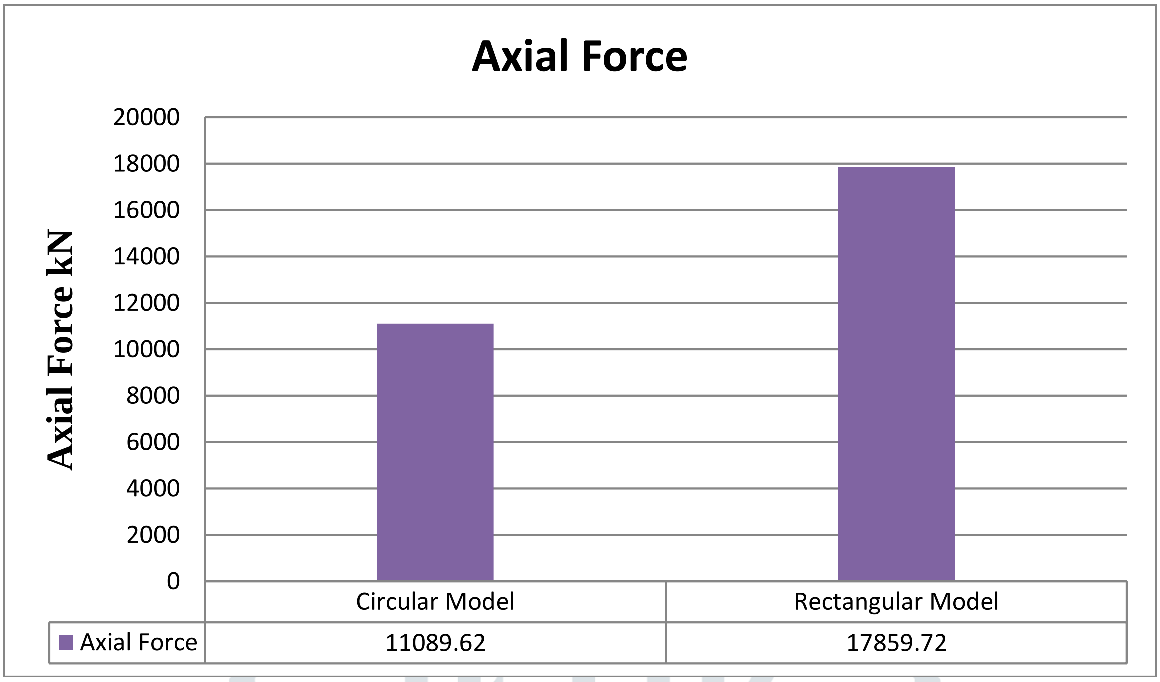
Three-dimensional view of Circular frame

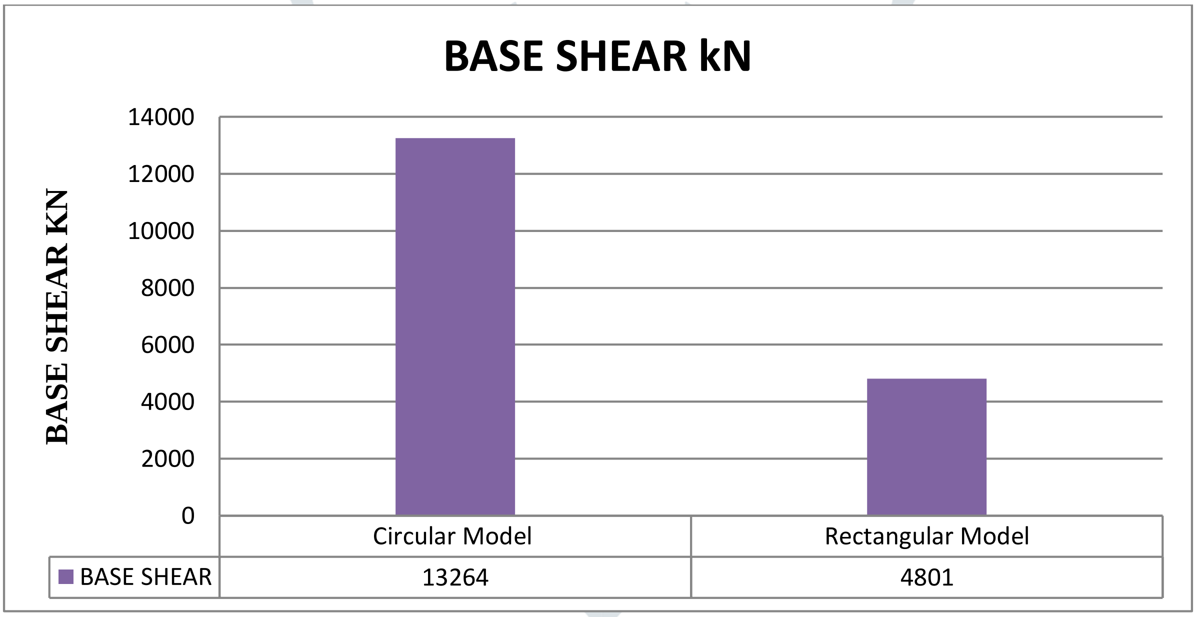
Brick masonry wall load					**Remark**
For floor height 3.0 m	=	0.23 m x (3.0 - 0.4) m x 20 kN/m^3	11.96	kN/m	U.D.L.
Plaster finish	=	0.024m x (3.0-0.4) m x22 kN/m^3	1.64		
Parapet wall	=	0.18 m x (1.2) m x 20 kN/m^3	4.32	kN/m	U.D.L.
Floor Load					
Slab Load	=	0.150 m x 25kN/m^3	3.75	kN/m^2	Slab thick. 150 mm adopted
Floor Finish	=	As per is code	1.2	kN/m^2	flooring

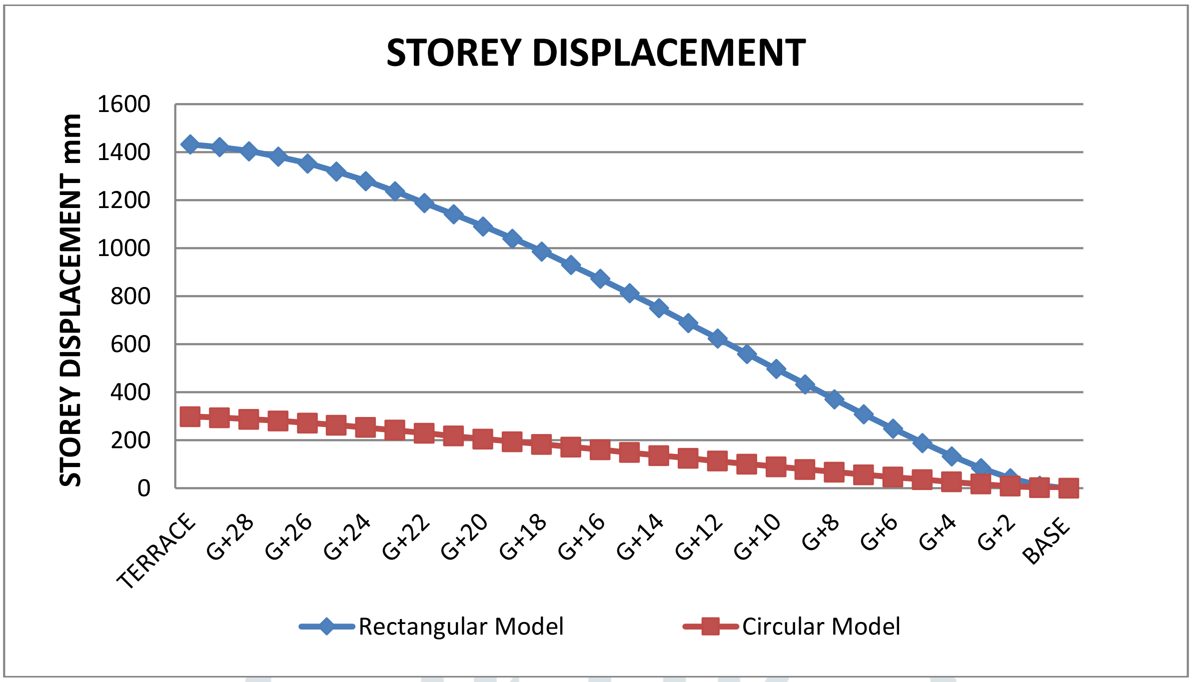
Total Load	=		4.95	kN/m^2	






Axial Force
Axial Force kN
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
Circular Model
Rectangular Model
Axial Force
11089.62
17859.72


BASE SHEAR kN
BASE SHEAR KN
14000
12000
10000
8000
6000
4000
2000
0
Circular Model
Rectangular Model
BASE SHEAR
13264
4801



FUTURE SCOPE

(a) In this present study rectangular & circular geometry is considered thus in future the study can be stretched out to different geometrical shapes.

(b) In the present dissertation study, G + 30 symmetrical structures have been considered. The study can be done on the taller structures.

(c) This study performed for seismic load analysis and it can also further be analyzed for wind load

(d) Present study is done for seismic zone V which is further extended to the other seismic zones.

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