TO INVESTIGATE THE EFFECTS OF **CORE**-BUILDING AREA RATIO

BUILDING INFORMATION

PLAN/FORM- SEE NEXT PAGES

SLAB THICKNESS- 300mm

WALL THICKNESS- 500mm

COLUMN GEOMETRY- 1500mm DIAMETER

NO OF FLOORS- 25

FLOOR TO FLOOR HEIGHT- 3.85m

OVERALL BUILDING HEIGHT- 96.25m

PERIMETER CLADDING LOAD- 2.5kN/m

SUPER-IMPOSED DEAD LOADS- 5.0kN/Sq.m

BASIC WIND SPEED- 22m/s (10 min MEAN SPEED)

LOAD COMBINATION INVESTIGATED : DL + SDL + WL

EXERCISE ASSUMPTIONS

- NO OPENINGS WERE CONSIDERED IN CORE WALLS

- LINEAR STATIC ANALYSIS ONLY WAS CONSIDERED

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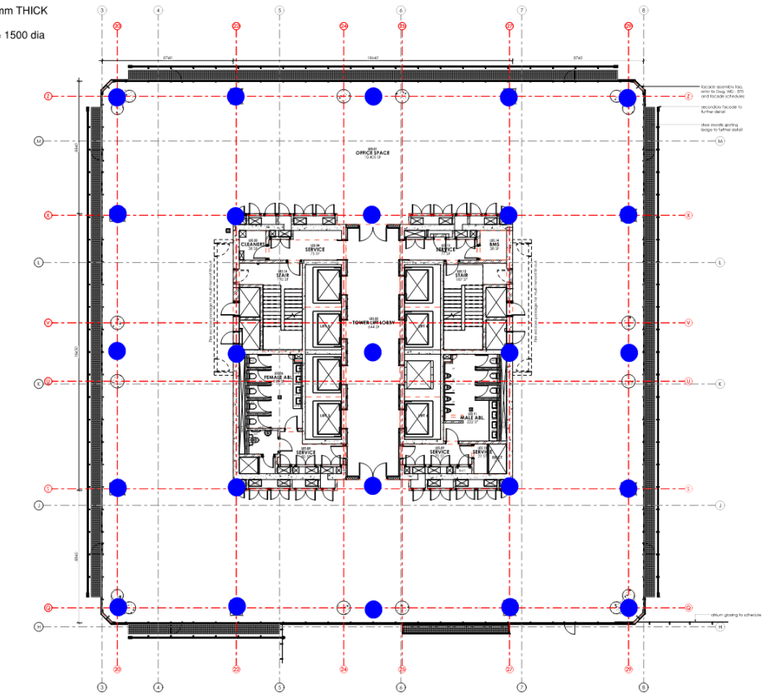
SLAB = 300mm THICK

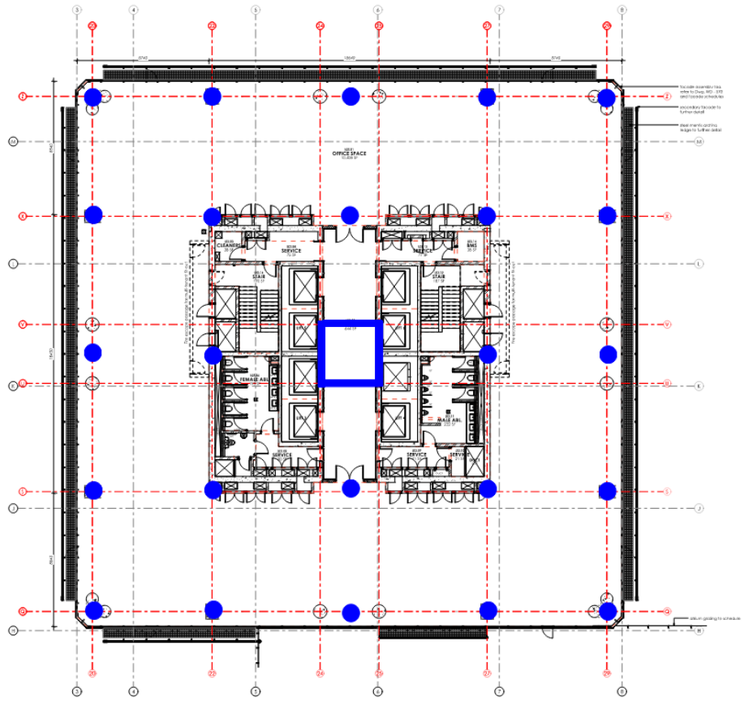
All Columns= 1500 dia

Walls= N/A

Iteration 1



Iteration 2



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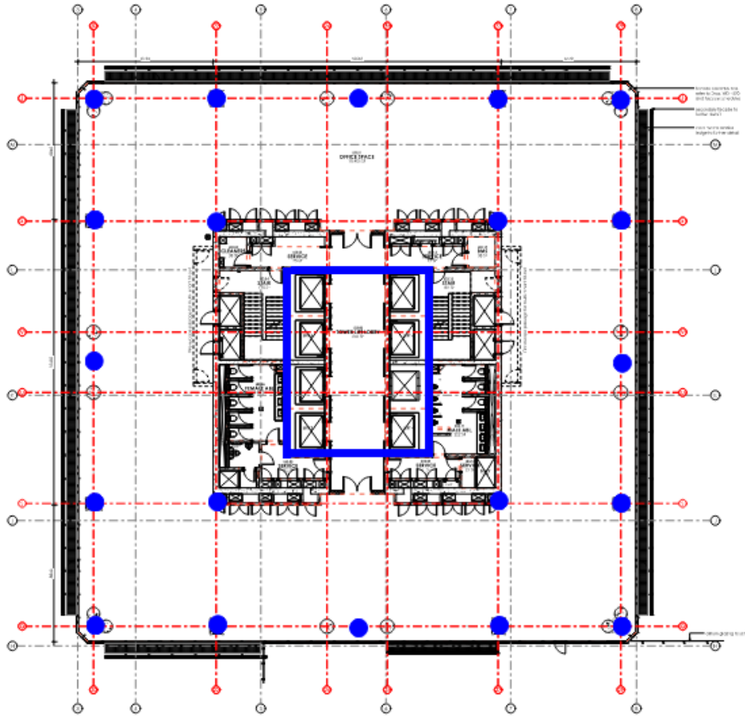

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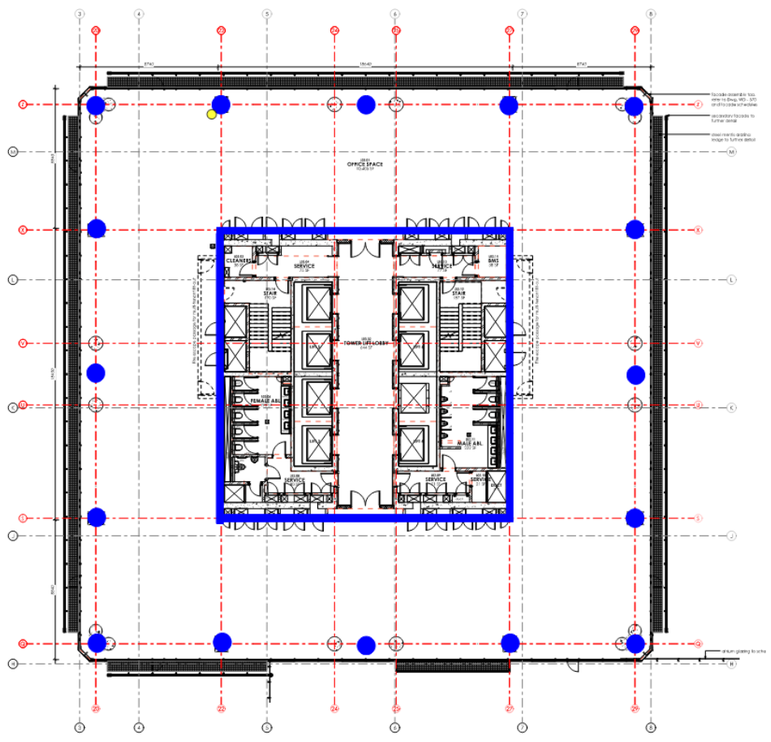
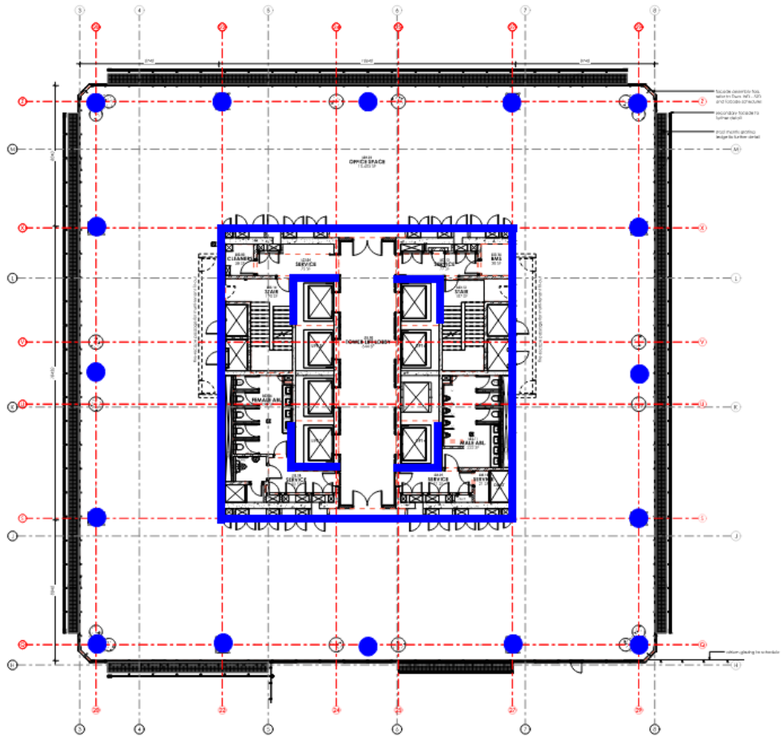


Iteration 5



Typical Floor Plan used= Britam Towers, Kenya

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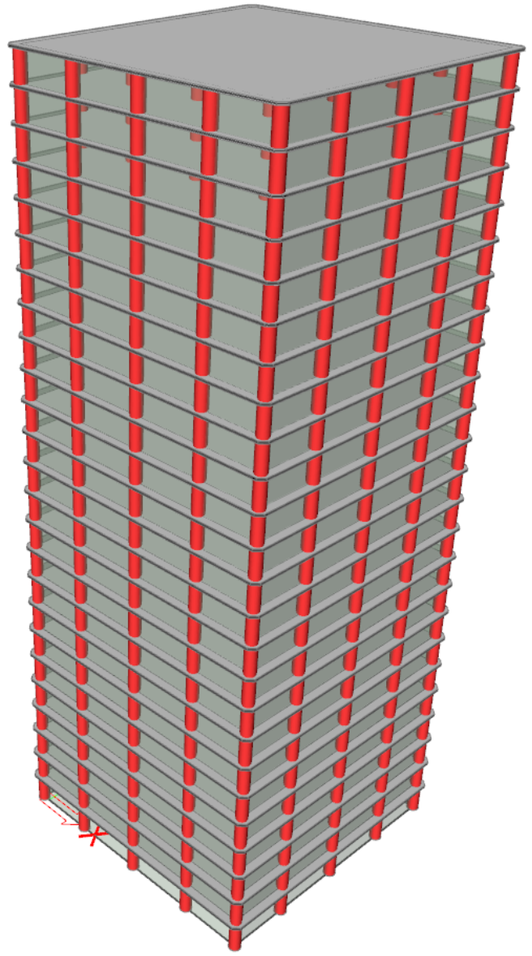
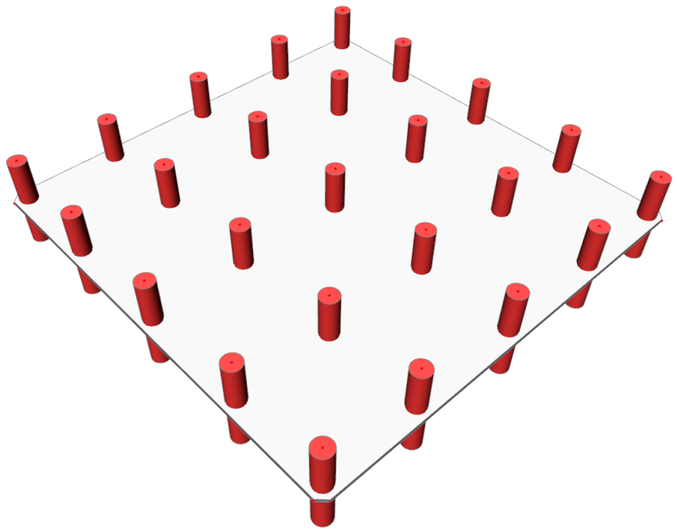
MODEL IMAGES

TYPICAL PERSPECTIVE VIEW OF ITERATION MODELS





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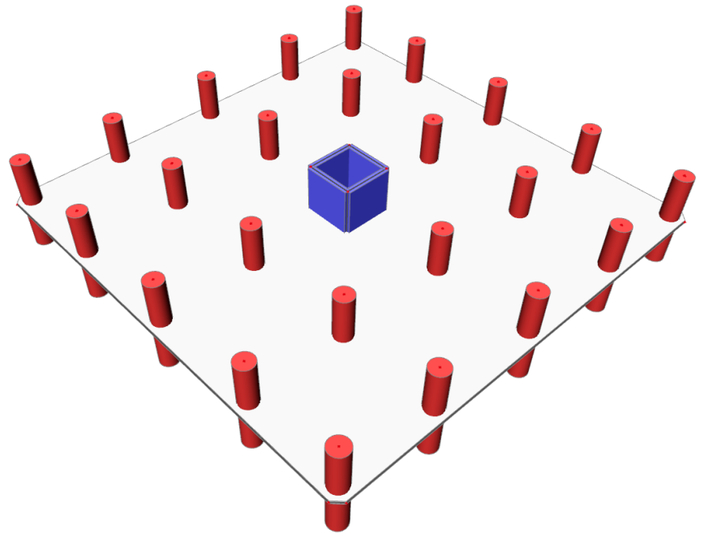
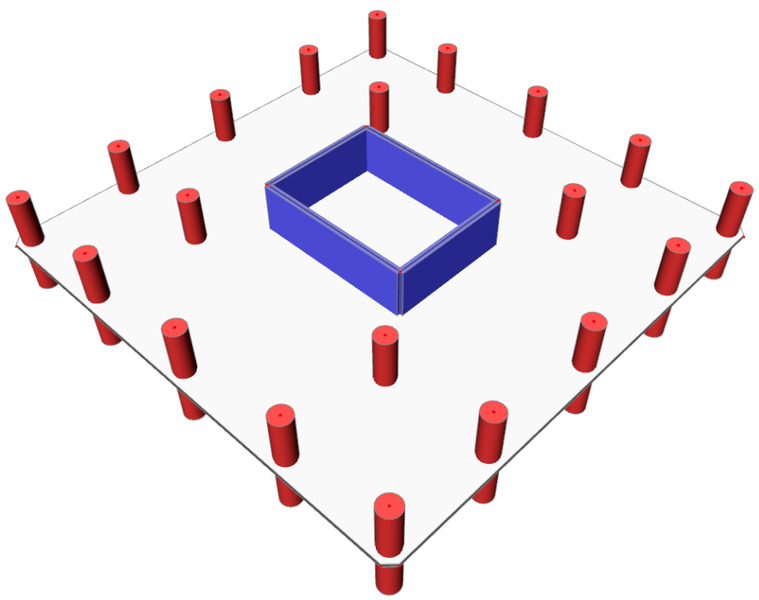


Iteration 2



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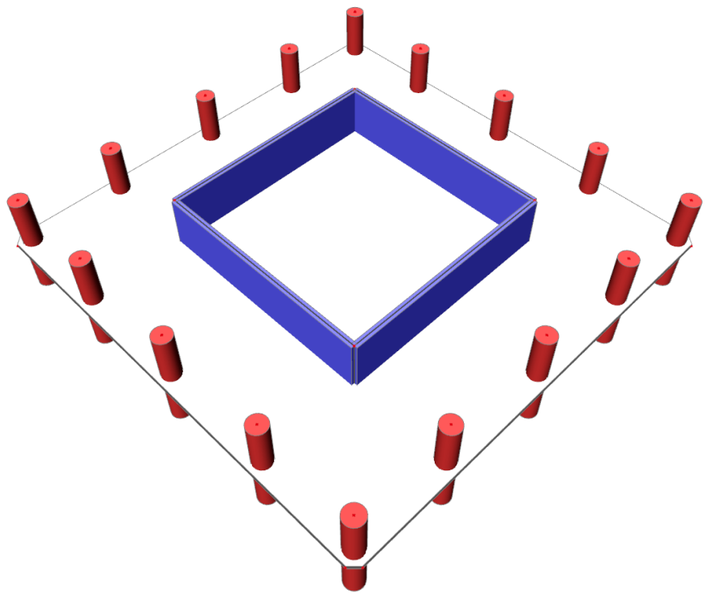
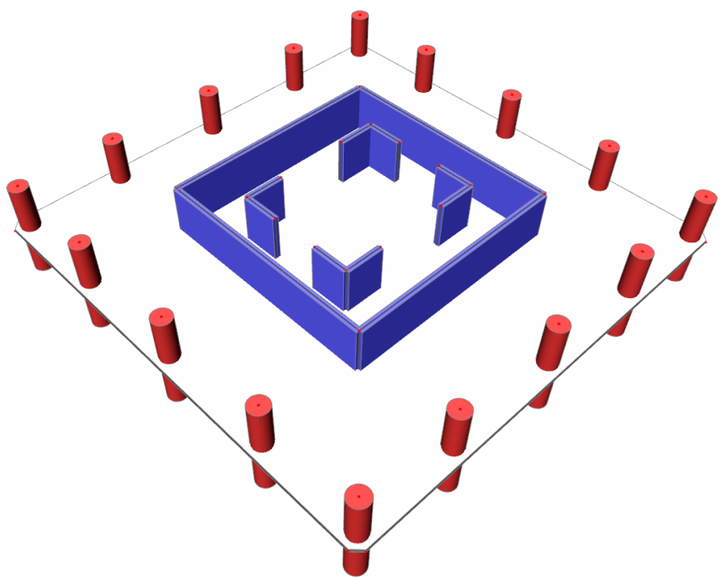


Iteration 4



Iteration 5

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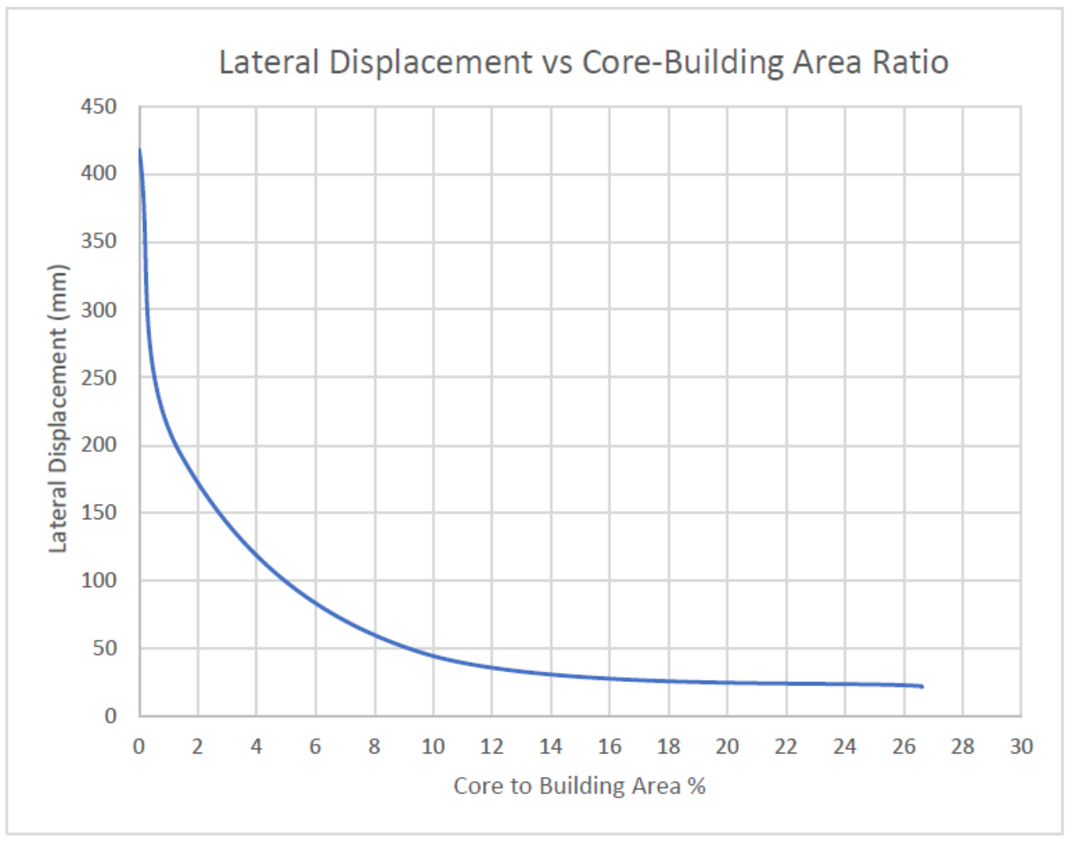
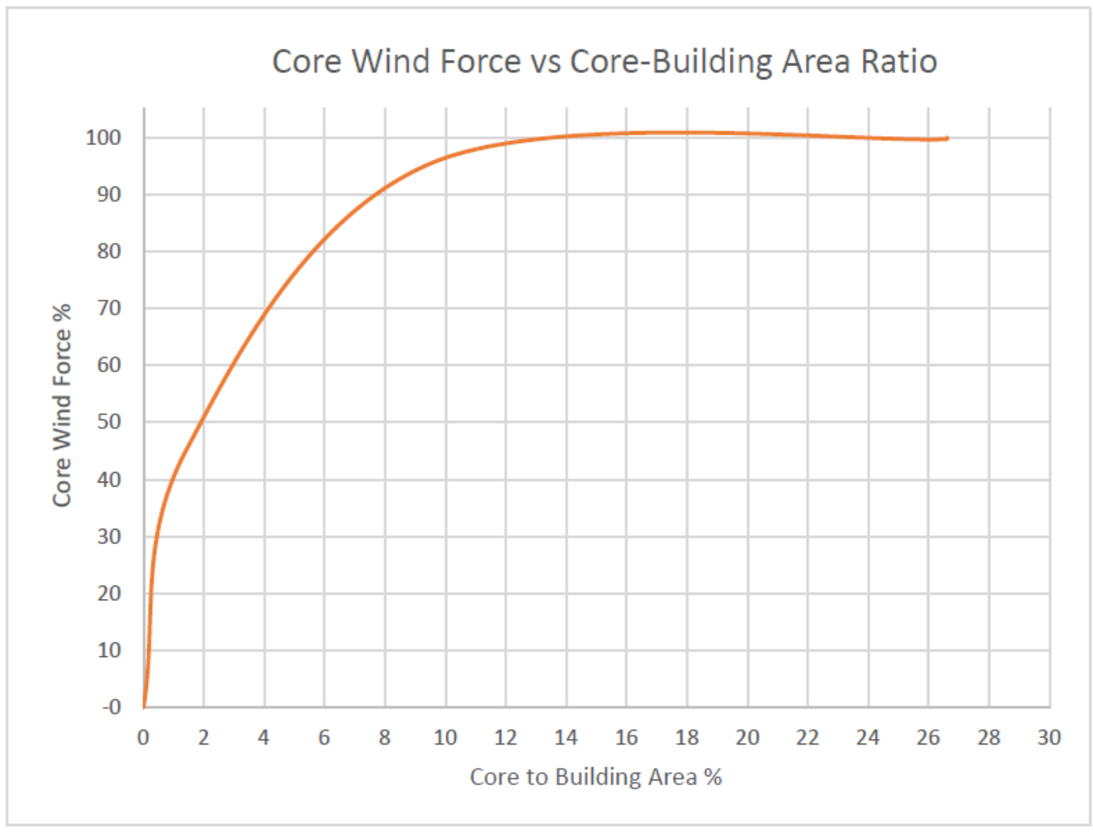
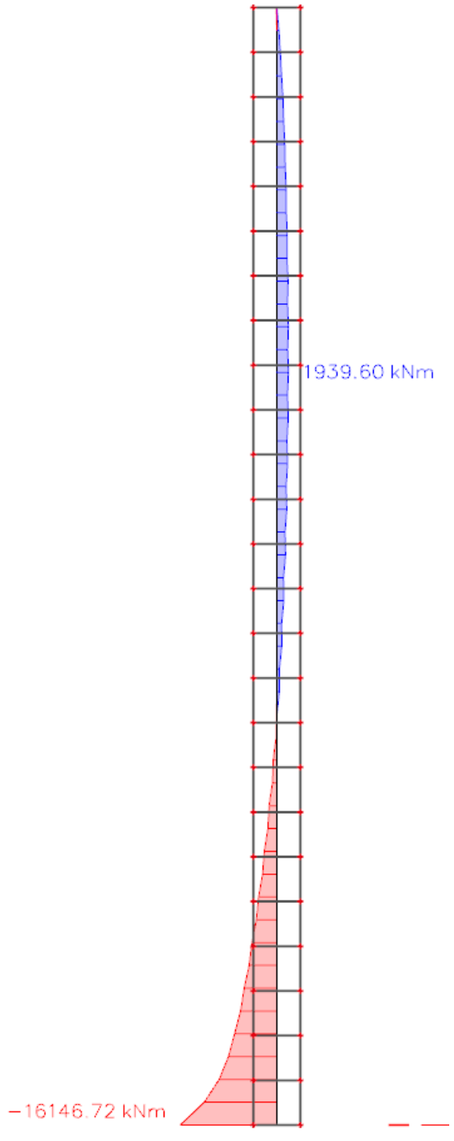
FINDINGS

ITERATION	CORE TO BUILDING AREA RATIO	CORE TO BUILDING AREA %	LATERAL DISPLACEMENT (mm)	% WIND FORCE ATTRACTED BY CORE	% WIND FORCE ATTRACTED BY COLUMNS	REMARKS
1	0	0	418	0	100	*Exceeds h/400 limiting lateral displacement, therefore column sizes need to be revised and/or frame system.*
2	1 to 69	1.4	194	45	55	*Columns resisting a larger percentage of the wind loads, 1.4% Core Area introduced reduced Lateral displacement by 53.6%*
3	1 to 10.4	9.6	47	95.6	4.4	*Core resists 95.6% wind force and the 585% increment in Core area results to a further 76% reduction in Lateral Displacement*
4	1 to 3.8	26.6	22.5	99.7	0.3	*Core resists all wind forces. Columns can be designed as gravity loads resisting only*
5	1 to 3.8	26.6	21.6	100	0	*4 Nos L-Shaped Shear Walls within Core confers additional stiffness & further reduces lateral*

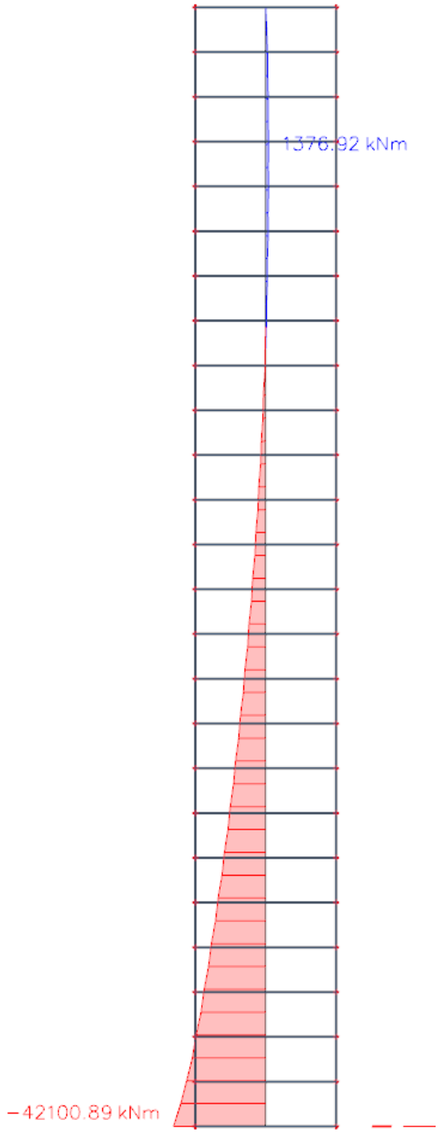




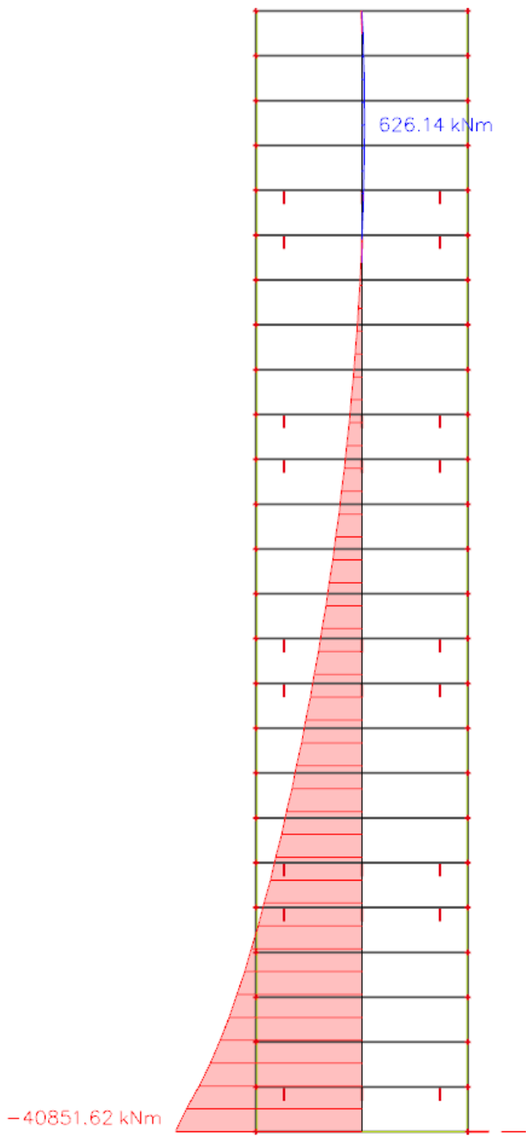
FINDINGS- BASE MOMENTS (One Wall)



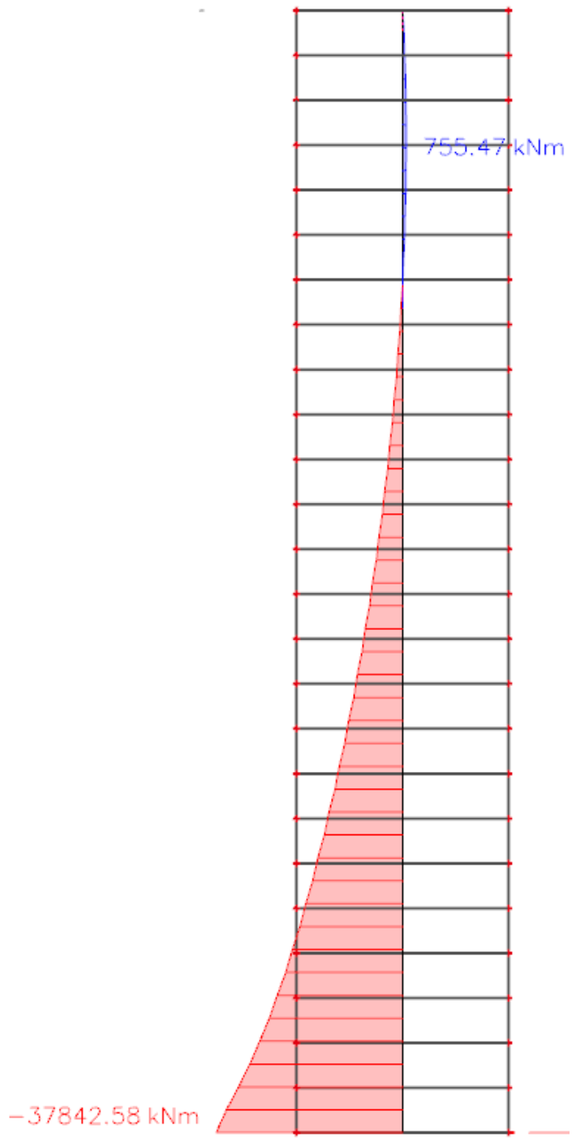
Iteration 2



Iteration 3



Iteration 4



Iteration 5

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OBSERVATIONS

1) From current observation, the core to building area percentage of a structure doesn't have a standard value in order for the core to resist wind loads as seen in Iteration 2. With an area of 1.4% the total area of the structure, the core was still able to resist a whopping 45% of the wind loads.

2) Lateral displacement is inversely proportional to the core-to-building area percentage. As the core is introduced and its size increases, lateral displacement decreases by more than 50% across most iterations. This indicates that the presence of a core in a structure significantly enhances its overall stiffness.

3) Although Iterations 4 and 5 have identical core areas, the core walls experience different moment values. This discrepancy arises from the presence of four additional L-shaped walls within the core of Iteration 5, which enhance stiffness and consequently reduce the bending moment in the wall investigated by 7%.

CONCLUSIONS

The existence of a core doesn't necessarily warrant it resisting 100% of wind loads.

The core-to-building area percentage plays an important part in overall performance of the structure as it confers greater rigidity to structure.