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Determination of Efficient Height Combination of Twin Tower under Seismic Loading

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Abstract**—** *Now a days multistoried building design and the architectural vision has wants a new innovation. A number of competitors enclosed by them used to create the structure with their individual option and also the requirement of market and the multistoried building perform as tremendously critical work in pioneering and fresh fields. It should enlighten the complexity of manufacture area all along with the architectural and structural point of view. By combined and miscellaneous floor arrangement on similar ground wants the consistency on the structural approach. This types of structure are Twin tower structure used in this modern world. In this examine, the parameter of evaluation of result such as displacement and storey drift are obtained in requisites of the twin tower multistoried structure located in earthquake Zone-III, earthquake effects are performing on the construction under 11 different height combination and analyze with the assistant of design software.*

Keywords**— Twins Tower, Efficient Height, Lateral Loading, Response spectrum analysis, Seismic Effects.**

I. INTRODUCTION

With the help of multistory structure guide the structural engineer to analyze and design as per harmful earthquake effects. Current days, Twin towers are very much in demand due to its good architectural and structural design, individual plan along with additional space with similar base support. For that, we should know the well-organized point parameters when these types of structures are in the get in touch with of earthquake loads.

II. OBJECTIVE

This study analyses the different parameters like base shear, shear force, bending moment displacements in longitudinal and transverse direction. After this, storey drift is calculated in both X as well as Z direction. The most efficient twins' tower height combination will be analyzed after all parameters. There is total 11 height combination of twin tower multistoried building at medium soil condition under seismic forces for earthquake zone III exist.

III. STRUCTURE MODELING

The twins tower modeling done in design software. The twin tower building detail of the multi storey construction are shown in Table 1 and Table 2 and shown graphically with the help of graphs. Top view and front view of various Shapes of G+12 building shown by the help of figures. Various height combination used in this paper up to 12 floor twin with 11 different height combination. After than efficient height combination for each parameter along with its remarks has drawn below each parameters.

Table.1: Details of building

Building configuration	G+12
No. of bays in X direction	9
No. of bays in Z direction	9
Height of building	51.580m
Dimensions of building	45M X 45M
Size of beam	750mmX650mm
Size of column	550mmX450mm
Concrete and Steel Grade	M 30 & FE415

Table. 2: Detail of loading

Earthquake parameters	Zone III with RF 4 & 5% damping ratio
Period in X & Z direction	0.692 & 0.692 for both direction
Dead load for floor	2KN/m^2 & 0.5 KN/m^2

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and waterproofing	
Live load for floor and roof	3.8KN/M^2 & 1.2u KN/M^2

IV. RESULT AND DISCUSSION

These result is observed by the following cases-

Table 3: Maximum Displacement in X direction in Zone III

HEIGHT CASE	Maximum Displacement (mm)
	For X Direction
A	131.980
B	122.788
C	130.483
D	137.960
E	144.911
F	151.011
G	155.951
H	159.481
I	161.450
J	161.825
K	160.701

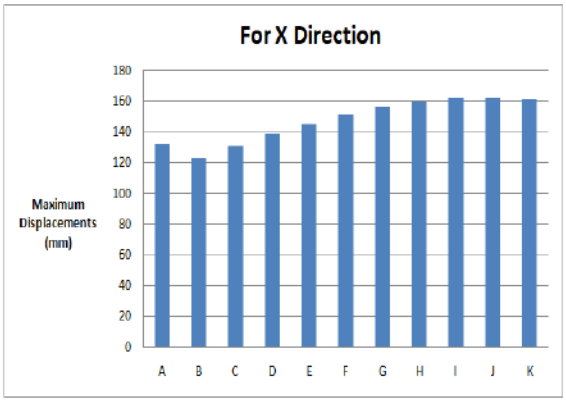

Fig. 1: Maximum Displacement shown in X direction Zone III

Table 4: Maximum Displacement shown in Z direction in Zone III

HEIGHT CASE	Maximum Displacement (mm)
	For Z Direction
A	168.458
B	178.957
C	191.855
D	204.35
E	215.912
F	226.077
G	234.347
H	240.337
I	243.814
J	244.738
K	243.263

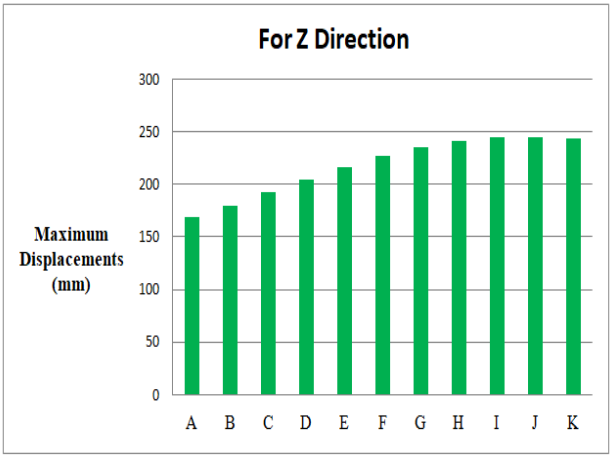

Fig. 2: Maximum Displacement shown in Z direction in Zone III

Table 5: Base Shear shown in X and Z direction in zone III

HEIGHT CASE	Base Shear (KN)	
	X direction	Z direction
A	18079.26	14962.41
B	16797.29	13996.19
C	15203.78	13193.95
D	15102.46	14176.83
E	16083.18	14067.64

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F	18463.25	14410.82
G	23552.23	15221.03
H	10012.44	14707.36
I	9804.96	14383.24
J	30472.28	8112.48
K	26285.39	8015.43

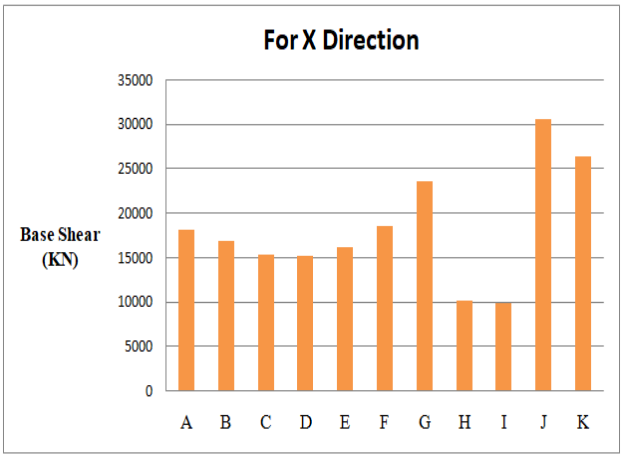

Fig. 3: Base Shear shown in X direction in zone III

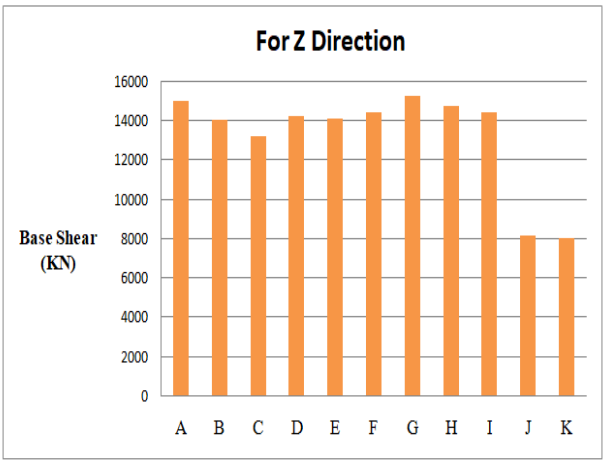

Fig. 4: Base Shear shown in Z direction in zone III

Table 6: Maximum Axial Forces shown in Column at ground level in zone III

HEIGHT CASE	Column Axial Force (KN)
A	8502.388
B	8698.226
C	8938.696
D	9171.270
E	9387.021
F	9576.525
G	9730.927
H	9843.141
I	9908.945
J	9927.641
K	9902.112

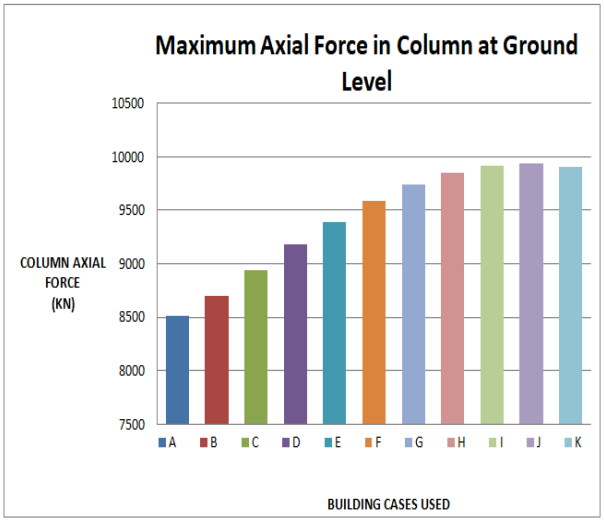

Fig. 5: Maximum Axial Forces shown in Column at ground level in zone III

Table 7: Maximum Shear Forces shown in Columns in zone III

HEIGHT CASE	Column Shear Force (KN)	
	Shear along Y	Shear along Z
A	294.635	374.260
B	306.869	397.620
C	321.973	426.315
D	336.671	454.078
E	350.341	479.839
F	362.323	502.463
G	371.990	520.886
H	378.839	534.253
I	382.566	542.051
J	383.115	544.191
K	380.689	541.011

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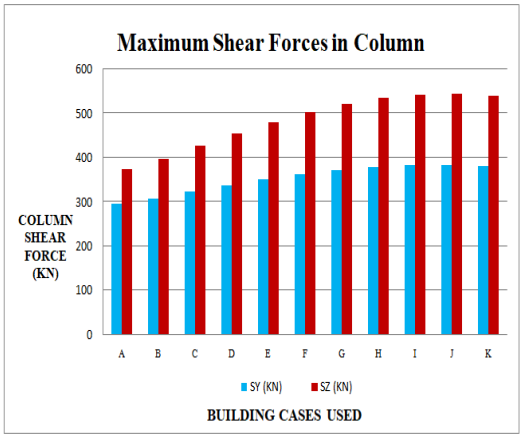

Fig. 6: Maximum Shear Forces shown in Columns in zone III

Table 8: Maximum Bending Moment shown in Columns in zone III

HEIGHT CASE	Column Bending Moment (KNm)	
	Moment along Y	Moment along Z
A	737.827	668.461
B	783.494	695.994
C	839.973	729.958
D	898.882	762.978
E	944.257	793.672
F	988.496	820.573
G	1024.505	842.288
H	1056.606	857.702
I	1065.789	866.142
J	1069.873	867.488
K	1063.524	862.186

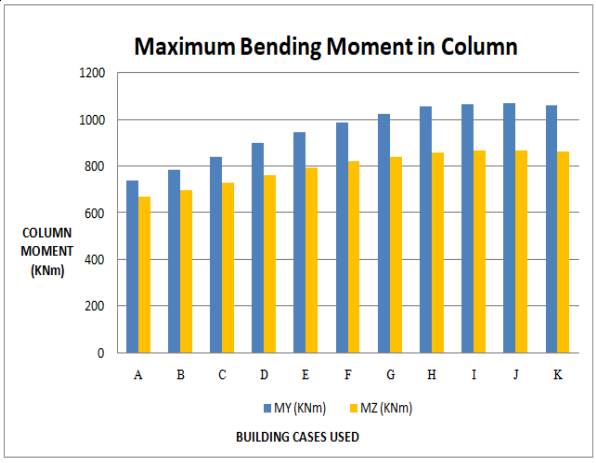

Fig. 7: Maximum Bending Moment shown in Columns in zone III

Table 9: Maximum Shear Forces shown in beams parallel to X direction in zone III

HEIGHT CASE	Beam Shear Force (parallel to X direction) (KN)
A	158.162
B	162.153
C	167.055
D	171.798
E	176.199
F	180.066
G	183.232
H	185.529
I	189.871
J	187.242
K	186.701

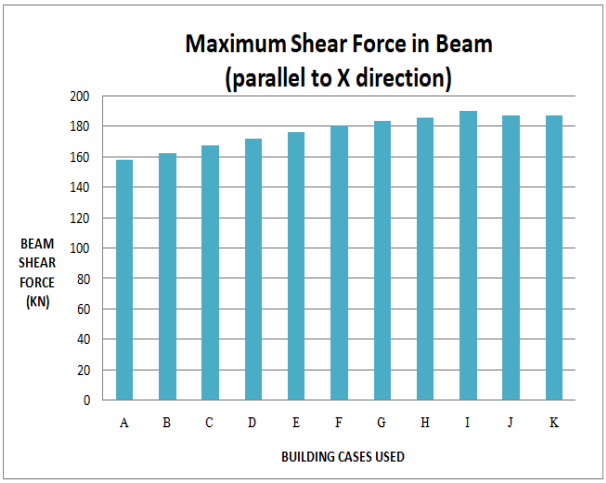

Fig. 8: Maximum Shear Force shown in Beam for X in zone III

Table 10: Maximum Shear Forces shown in beams parallel to Z direction in zone III

HEIGHT CASE	Beam Shear Force (parallel to Z direction) (KN)
A	2.681
B	3.124
C	3.271
D	3.590
E	3.738

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F	4.064
G	4.552
H	4.879
I	4.237
J	3.998
K	3.881

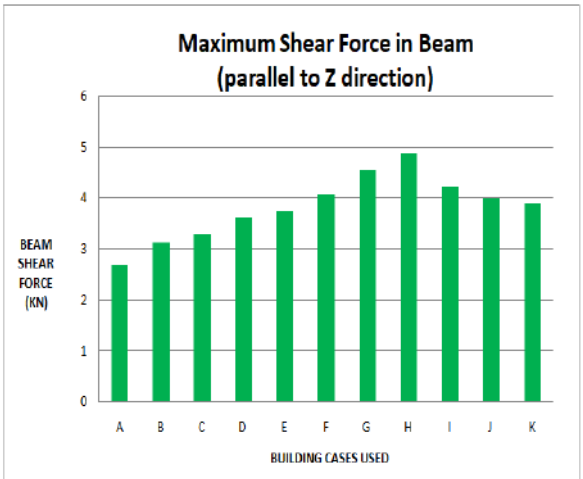

Fig. 9: Maximum Shear Force shown in Beam for Z direction in zone III

Table 11: Maximum Bending Moment shown in beams parallel to X direction in zone III

HEIGHT CASE	Beam Bending Moment (along X direction) (KNm)
A	6.701
B	7.810
C	8.336
D	8.975
E	9.347
F	10.161
G	11.381
H	12.199
I	10.673
J	9.995
K	9.838

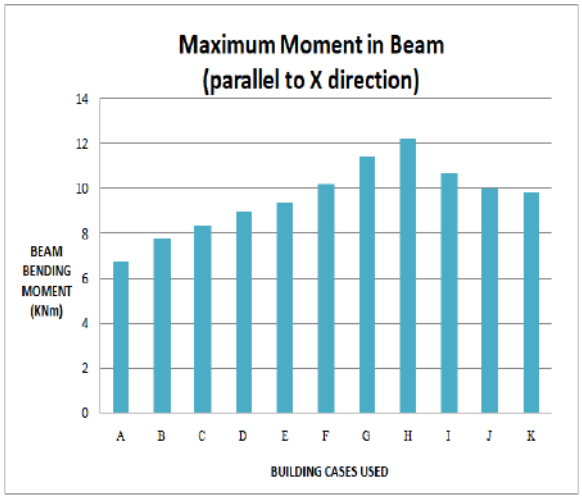

Fig. 10: Maximum Bending Moment shown in beams parallel to X direction in zone III

Table 12: Maximum Bending Moment shown in beams parallel to Z direction in zone III

HEIGHT CASE	Beam Bending Moment (along Z direction) (KNm)
A	253.577
B	264.028
C	276.940
D	289.433
E	301.023
F	311.203
G	319.493
H	325.510
I	329.024
J	329.994
K	328.574

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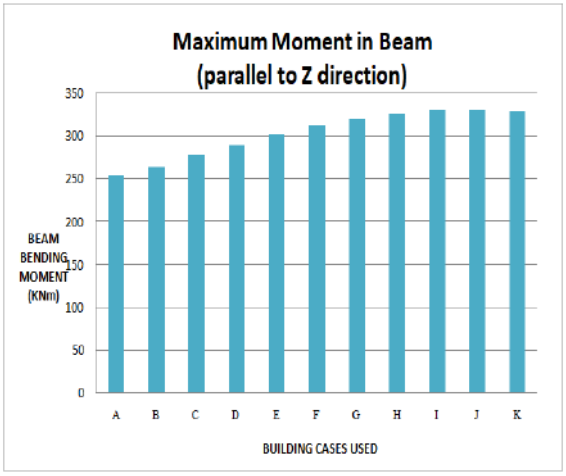

Fig. 12: Maximum Bending Moment shown in beams parallel to Z direction in zone III

Table 13: Maximum Torsional Moment shown in beams parallel to X and Z direction in zone III

HEIGHT CASE	Beam Torsional Moment (along X direction) (KNm)	Beam Torsional Moment (along Z direction) (KNm)
A	29.201	28.670
B	29.266	28.428
C	29.291	28.869
D	30.821	28.880
E	32.392	28.499
F	33.772	29.262
G	34.895	30.961
H	35.711	32.736
I	36.184	31.091
J	36.762	35.148
K	36.119	34.342

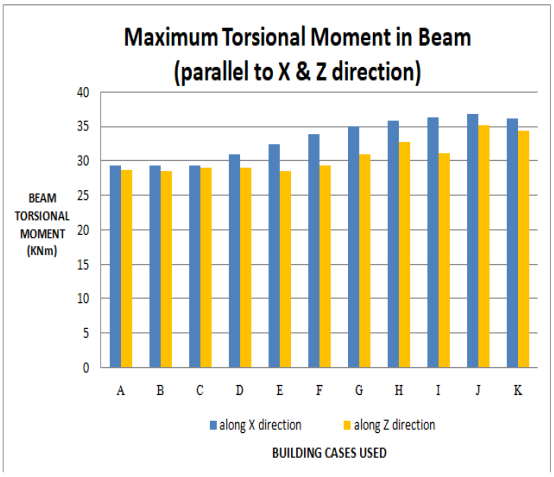

Fig. 13: Maximum Torsional Moment in beams parallel to X and Z direction in zone III

V. CONCLUSION

The design of twin towers height combination of building subjected to seismic effects the analytical results obtained from 11 combination of twins tower multistoried structure. As seen in results the minimum displacement in X direction height case B and Z direction height case B, minimum base shear in height case I and K in respectively X and Z direction, minimum axial force in height case B, minimum column shear force in height case B in both direction, minimum column bending moment height case B in both direction, beam shear force height case B is optimum as well result same for torsional force. That means height case B is very efficient cases for twins tower in height case.

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