iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 **Issue:** IV **Month of publication:** April 2019

DOI: https://doi.org/10.22214/ijraset.2019.4316

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 7 Issue IV, Apr 2019- Available at www.ijraset.com

Effect of Wind Load on Tall Structure in Different Terrain Category

Pratik P. Ajgar[1], Vishal Gajghate[2]
[1]*Post Graduate Student,* [2]*Assistant Professor, Department Of Civil Engineering, Ghrce Nagpur, Maharashtra, India*

Abstract: ***Construction of tall building is becoming style and need of today's world. As population is being increasing and space to work and live is contracting. When it comes to tall building tall structure wind does play important role. Wind and Tall Structure are same side of a coin. More the structure is tall more will be wind load acting over it, This paper deals with effect of wind load over a structure in different terrain category. In this paper we shall also study displacement occurred at different level of building. Along with this it also shows displacement of same level of building in different terrain category. The Models were made and analyzed in ETABS-2015 package. G+10, G+15, G+20 models were taken into consideration and are studied. Terrain category consider are TC-1, TC-2, TC-3 and TC-4 according to IS 875 (Part-3):2015. This paper gives good package of information about variation of displacements occurred at different terrains and levels.***
Keywords: ETABS 2015, Displacement, Wind Load, TC-1, TC-2, TC-3, TC-4.

I. INTRODUCTION

India is Drastically Growing Country, Its ranks amongst fastest growing country economically and in Infrastructural facility. As it is growing fast and rapidly the horizontal space is being reduced. To overcome such flaws use of high rise building is been preferred over the conventional building so that Vertical Space can be brought into use. When it comes to use of horizontal space tall building comes into lead role, Tall building are those which are highly susceptible to wind pressure and force. Tall structures can be constructed in four different wind category i.e. terrain category 1, terrain category 2, terrain category 3 and terrain category 4. Terrain Category can be explained according to IS Code as follows:

1) *Category 1:* Exposed open terrain with few or no obstructions and in which the average height of any object surrounding the structure is less than 1.5m.



Fig 1: Terrain Category 01

2) *Category 2:* Open terrain with well scattered obstruction having heights generally between 1.5 to 10m



Fig 2: Terrain Category 02

©IJRASET: All Rights are Reserved

3) *Category 3:* Terrain with numerous closely spaced obstruction having the size of building structure up to 10m in height with or without a few isolated tall structures.



Fig 3: Terrain Category 03

4) *Category 4:* Terrain with numerous large high closely spaced obstructions.



Fig 4: Terrain Category 04

II. MODEL AND LOADING

As said above three models were made i.e. G+10, G+15, G+20.

A. Model 1

Table 1: G+10 Specification

No. Of Storey	G+10
Structure	RCC Frame.
Floor Height	3.5m
Grade of Concrete	M20 for Beam and Slab. M25 for Column.
Grade of Steel	Fe500
Slab Thickness	125 mm
Beam	380x450 mm
Column	750x530 mm

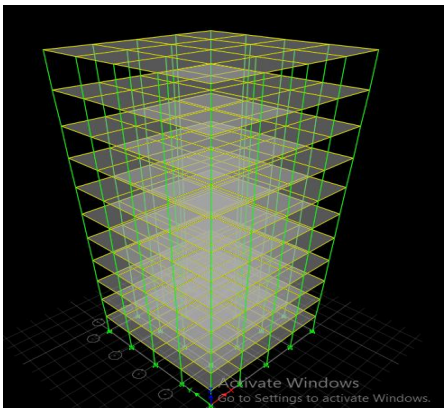


Fig 5: G+10 Model

©IJRASET: All Rights are Reserved

B. Model 2

Table 2: G+15 Specification

No. Of Storey	G+15
Structure	RCC Frame.
Floor Height	3.5m
Grade of Concrete	M20 for Beam and Slab. M25 for Column.
Grade of Steel	Fe500
Slab Thickness	125 mm
Beam	380x450 mm
Column	750x530 mm

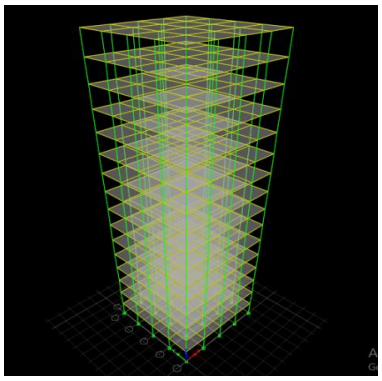


Fig 6: G+15 Model

C. Model 3

Table 3: G+20 Specification

No. Of Storey	G+20
Structure	RCC Frame.
Floor Height	3.5m
Grade of Concrete	M20 for Beam and Slab. M25 for Column.
Grade of Steel	Fe500
Slab Thickness	125 mm
Beam	380x450 mm
Column	750x530 mm

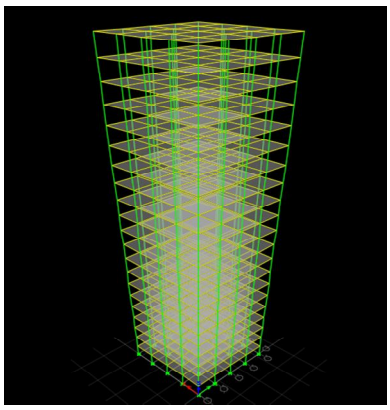


Fig 7: G+20 Model

©IJRASET: All Rights are Reserved

D. Loading

1) Dead Load: (IS 875 (Part 1) 1987): A. Self Load Of Structural Member such as Column, Beams, Slab.

2) Wall Load (200mm AAC Blocks) 0.2x1x3.5x6 = 4.2 kN/m

3) Floor Finish: Load Of Floor Finish:

= 1x1x0.05x20x1.5

= 1.5 kN/m^2

4) Live Load: (IS 875 (Part 2)-1987)

a) Live Load On Floor for Residential = 2 kN/m^2 Factored Load = 1.5x2= 3kN/m^2

b) Live Load On Roof = 1.5kN/m^2

5) Wind Load: (IS 875 (Part 3)-1987)

A. Wind Speed = 44m/s (Vb)

Vz= VbxK1xK2xK3xK4

K1= Risk Coefficient.

K2= Terrain roughness and Height Factor.

K3= Topography Factor.

K4= Importance Factor.

Pz= 0.6 Vz^2

III. RESULTS

Following tables and plots which gives the outcomes of the Study:

Table 4: Displacement of G+10 Storey

STOREY	STOREY DISPLACEMENT IN MM				TC-1 V/S TC-2	TC-1 V/S TC-3	TC-1 V/S TC-4
	TC-1	TC-2	TC-3	TC-4			
10	24.2	21.1	15.9	8.6	12.81%	34.30%	64.46%
9	23.4	20.4	15.4	8.3	12.82%	34.19%	64.53%
8	22.3	19.4	14.7	7.9	13.00%	34.08%	64.57%
7	20.8	18.1	13.6	7.3	12.98%	34.62%	64.90%
6	18.8	16.3	12.3	6.6	13.30%	34.57%	64.89%
5	16.4	14.2	10.7	5.8	13.41%	34.76%	64.63%
4	13.6	11.8	8.9	4.8	13.24%	34.56%	64.71%
3	10.5	9.1	6.8	3.7	13.33%	35.24%	64.76%
2	7.1	6.2	4.6	2.5	12.68%	35.21%	64.79%

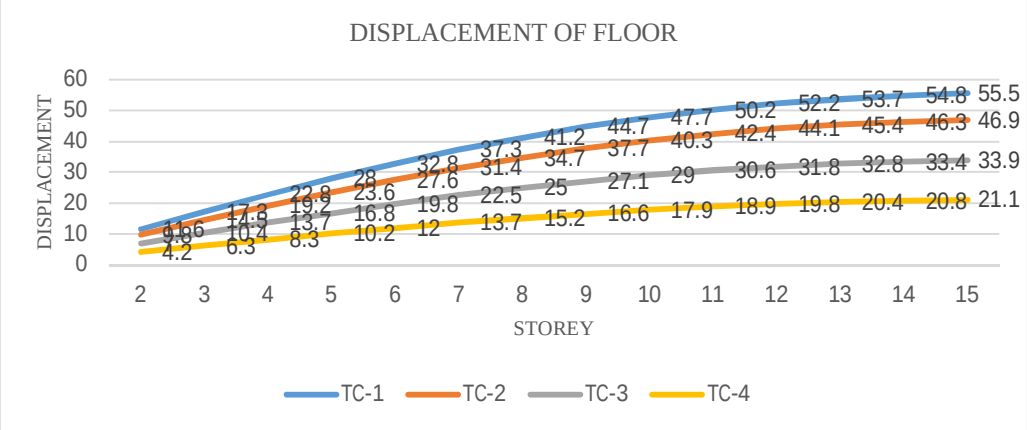


Fig 8: Displacement of G+10 Storey

©IJRASET: All Rights are Reserved

Table 5: Displacement of G+15 Storey

STOREY	STOREY DISPLACEMENT IN MM				TC-1 V/S TC-2	TC-1 V/S TC-3	TC-1 V/S TC-4
	TC-1	TC-2	TC-3	TC-4			
15	55.5	46.9	33.9	21.1	15.50%	38.92%	61.98%
14	54.8	46.3	33.4	20.8	15.51%	39.05%	62.04%
13	53.7	45.4	32.8	20.4	15.46%	38.92%	62.01%
12	52.2	44.1	31.8	19.8	15.52%	39.08%	62.07%
11	50.2	42.4	30.6	18.9	15.54%	39.04%	62.35%
10	47.7	40.3	29	17.9	15.51%	39.20%	62.47%
9	44.7	37.7	27.1	16.6	15.66%	39.37%	62.86%
8	41.2	34.7	25	15.2	15.78%	39.32%	63.11%
7	37.3	31.4	22.5	13.7	15.82%	39.68%	63.27%
6	32.8	27.6	19.8	12	15.85%	39.63%	63.41%
5	28	23.6	16.8	10.2	15.71%	40.00%	63.57%
4	22.8	19.2	13.7	8.3	15.79%	39.91%	63.60%
3	17.3	14.5	10.4	6.3	16.18%	39.88%	63.58%
2	11.6	9.8	7	4.2	15.52%	39.66%	63.79%

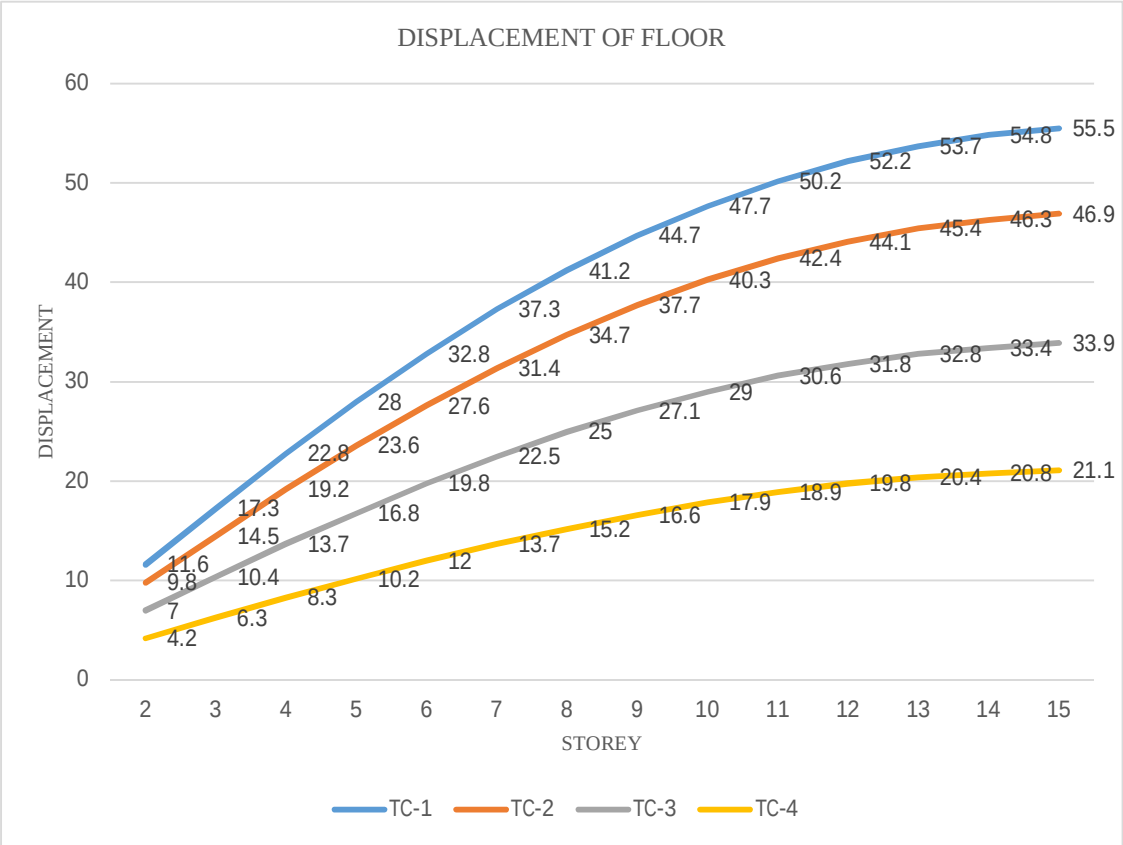


Fig 9: Displacement of G+15 Storey

©IJRASET: All Rights are Reserved

Table 6: Displacement of G+20 Storey

STOREY	STOREY DISPLACEMENT IN MM				TC-1 V/S TC-2	TC-1 V/S TC-3	TC-1 V/S TC-4
	TC-1	TC-2	TC-3	TC-4			
20	136.8	118.4	87.8	62.5	13.45%	35.82%	54.31%
19	134.6	116.5	86.4	61.5	13.45%	35.81%	54.31%
18	132	114.2	84.7	60.2	13.48%	35.83%	54.39%
17	128.8	111.4	82.6	58.6	13.51%	35.87%	54.50%
16	125	108.1	80.1	56.7	13.52%	35.92%	54.64%
15	120.7	104.3	77.3	54.6	13.59%	35.96%	54.76%
14	115.8	100	74.1	52.1	13.64%	36.01%	55.01%
13	110.3	95.2	70.5	49.4	13.69%	36.08%	55.21%
12	104.3	90	66.6	46.5	13.71%	36.15%	55.42%
11	97.8	84.3	62.3	43.3	13.80%	36.30%	55.73%
10	90.7	78.2	57.7	40	13.78%	36.38%	55.90%
9	83.2	71.6	52.8	36.4	13.94%	36.54%	56.25%
8	75.2	64.7	47.7	32.7	13.96%	36.57%	56.52%
7	66.7	57.4	42.2	28.8	13.94%	36.73%	56.82%
6	57.9	49.7	36.5	24.9	14.16%	36.96%	56.99%
5	48.6	41.8	30.6	20.8	13.99%	37.04%	57.20%
4	39.1	33.5	24.6	16.6	14.32%	37.08%	57.54%
3	29.3	25.2	18.4	12.4	13.99%	37.20%	57.68%
2	19.6	16.8	12.3	8.3	14.29%	37.24%	57.65%

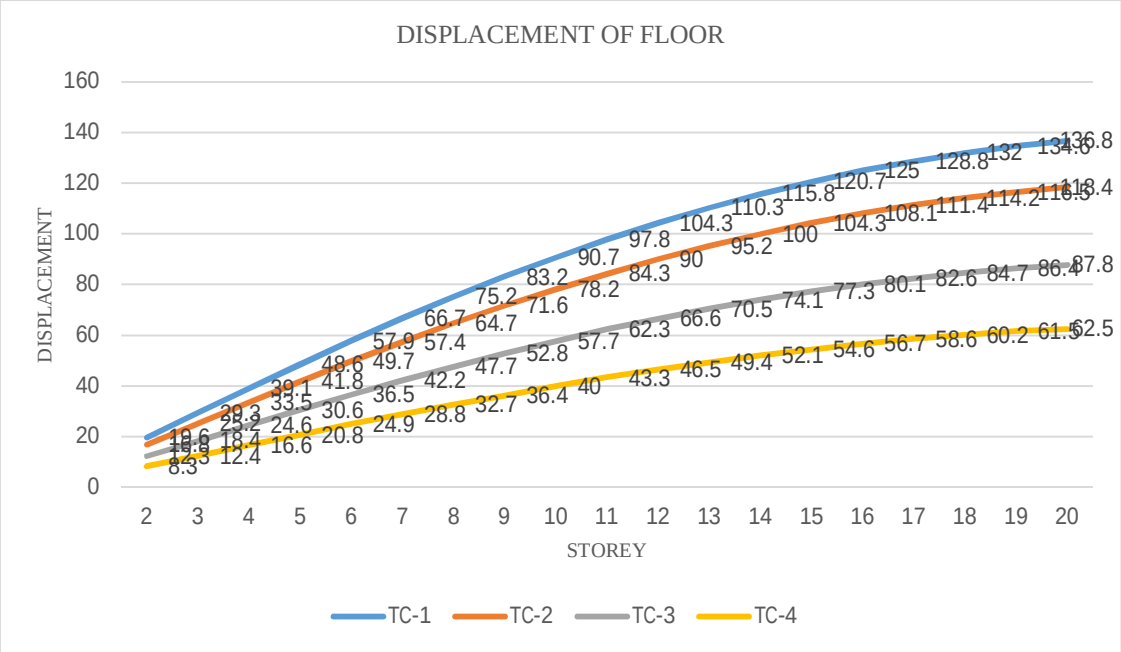


Fig 10: Displacement of G+20 Storey

©IJRASET: All Rights are Reserved

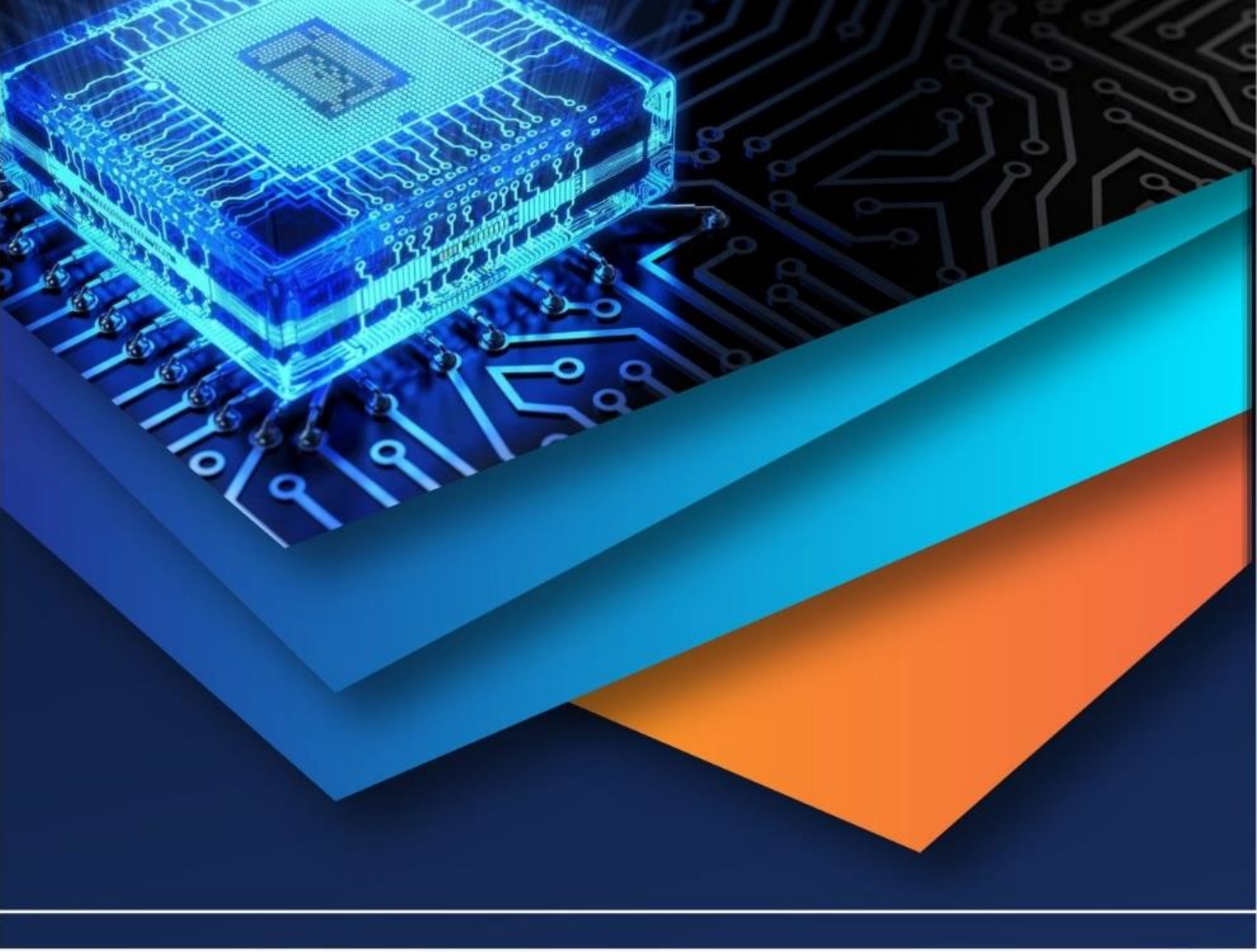
IV. CONCLUSION

A. Height of Structure or Building is directly proportional to Displacement of that structure i.e. more the height more will be displacement.
B. Displacement of Model 1 is less than Model 2, displacement of Model 2 is less that Model 3 in every terrain category.
C. Displacement of Building decreases with increase in terrain category.
D. In model 1 displacement of top storey in TC-1 is 12.81%, 34.30% and 64.46% more than TC-2, TC-3, and TC-4.
E. In model 2 displacement of top storey in TC-1 is 15.50%, 38.92% and 61.98% more than TC-2, TC-3, and TC-4.
F. In model 3 displacement of top storey in TC-1 is 13.45%, 35.82% and 54.31% more than TC-2, TC-3, and TC-4.
G. Displacement of every storey in every model is at least 50% more in TC-1 compared to TC-4

REFRENCES

[1] IS: 875:2015 (Part 1) “Indian Standard code of practice for design loads”. Bureau of Indian Standards, New Delhi.
[2] IS: 875:2015 (Part 1) “Indian Standard code of practice for design loads”. Bureau of Indian Standards, New Delhi.
[3] Mohammed Asim Ahmed, Moid Amir, Savita Komur, Vaijainath Halhalli."EFFECT OF WIND LOAD ON TALL BUILDINGS IN DIFFERENT TERRAIN CATEGORY". IJRET: International Journal of Research in Engineering and Technology eISSN: 2319-1163 | pISSN: 2321-7308
[4] K. Vishnu Haritha, I. Yamini Srivalli. "Effect of Wind on Tall Building Frames - Influence of Aspect Ratio". International Journal of Research in Civil Engineering, Architecture & Design Volume 1, Issue 1, July-September, 2013, pp. 01-06, © IASTER 2013www.iaster.com, ISSN Online: 2347-2855, Print: 2347-8284
[5] Gitadevi B. Bhaskar, Homeshwari V.Gedam. "Effect of Wind Load on High Rise Buildings Considering Aspect Ratio – A Review". International Journal for Research in Applied Science & Engineering Technology (IJRASET) ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887 Volume 5 Issue XI November 2017- Available at www.ijraset.com
[6] Chandradhara G. P, Vikram.M.B. "Effect of wind load on the aspect ratio of the building". IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684, p-ISSN: 2320-334X PP 45-49 www.iosrjournals.org

©IJRASET: All Rights are Reserved



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)