International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 5 Issue 6, September-October 2021 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Analysis & Design of Electrical Transmission Tower Using STAAD Pro V8i Software for Seismic Zone 3

Aditya Shrivastava[1], Prof. Afzal Khan[2]

[1]M Tech Scholar, [2]Professor,
[1,2]Department of Civil Engineering, Millennium Institute of Technology& Science, Bhopal, Madhya Pradesh, India

ABSTRACT

A transmission tower is a space truss and is an indeterminate structure. Increasing demand for electricity can be made more economical by developing different light weight configuration of transmission line tower. Literature survey revealed that comparative study of different types of tower. In all of the previous work Steel Transmission tower is considered but none of them defined the variation caused due to Different Type of Pylon using different Software for Seismic Zone III. Present study reports the design and analysis of steel transmission line towers performed static and dynamic assessment of transmission line tower. The investigation and displaying of tower is executed the utilization of FE based absolutely STAAD Pro software. Effect of wind and earthquake loads was studied and the results so obtained were compared for wind zones III for four legged tower.

How to cite this paper: Aditya Shrivastava | Prof. Afzal Khan "Analysis & Design of Electrical Transmission Tower Using STAAD Pro V8i Software for Seismic Zone 3" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-5 | Issue-6, October 2021, pp.148-158, URL: www.ijtsrd.com/papers/ijtsrd46386.pdf

IJTSRD46386

INTRODUCTION

Transmission line is a coordinated framework comprising of transmitter subsystem, ground wire subsystem and one subsystem for every class of help structure. Mechanical help of transmission line addresses a huge segment of the expense of the line and they assume a significant part in the solid force transmission. They are planned and developed in wide assortment of shapes, types, sizes, setup and materials. The supporting construction types utilized in transmission line by and large can be categorized as one of the three classes: cross section, shaft and guyed.

OBJECTIVES

- To Study of high tension tower with three different pylons using STAAD PRO V8i Software.

METHODOLOG

separate models are created on STAAD PRO V8i Software to check the suitability of different type of pylons for transmission towers subjected to wind & seismic loads.

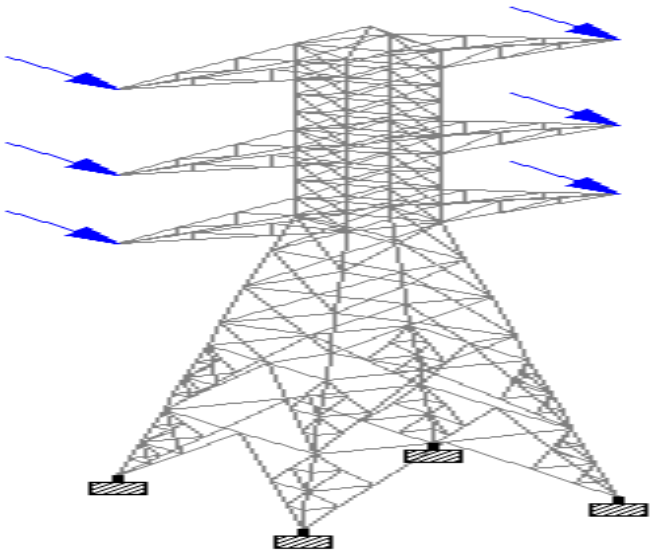


Fig. 4.1 wind Force acting on tower

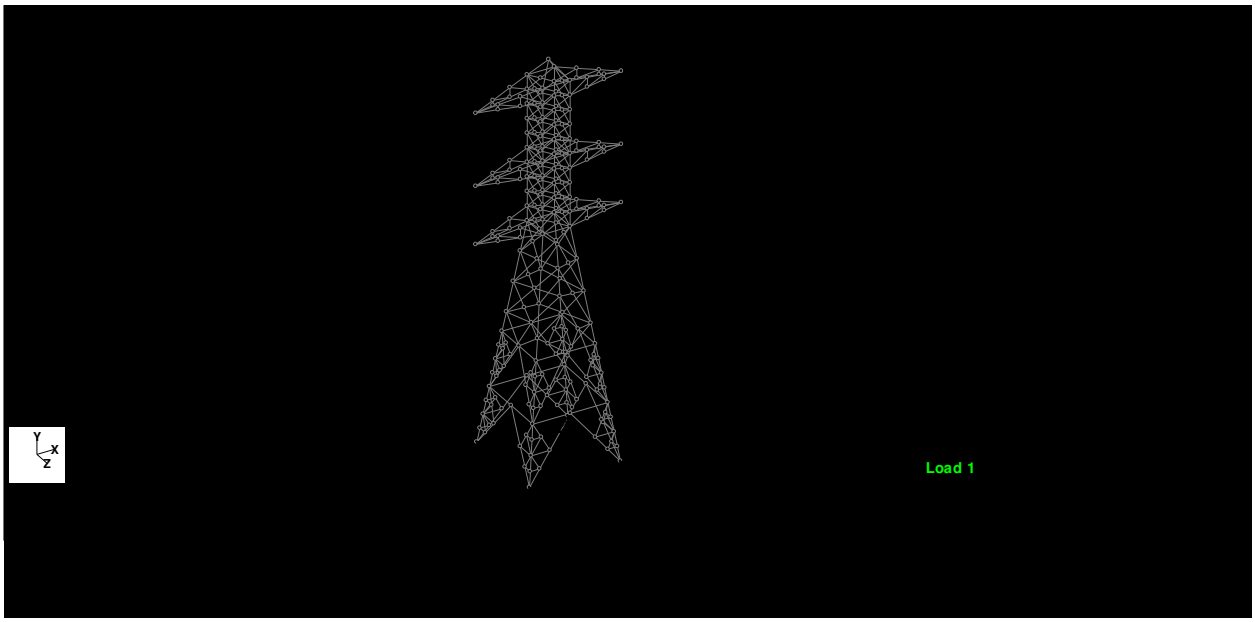


Fig. 4.2 Preparation of geometry of Model –I in STAAD PRO 3D view

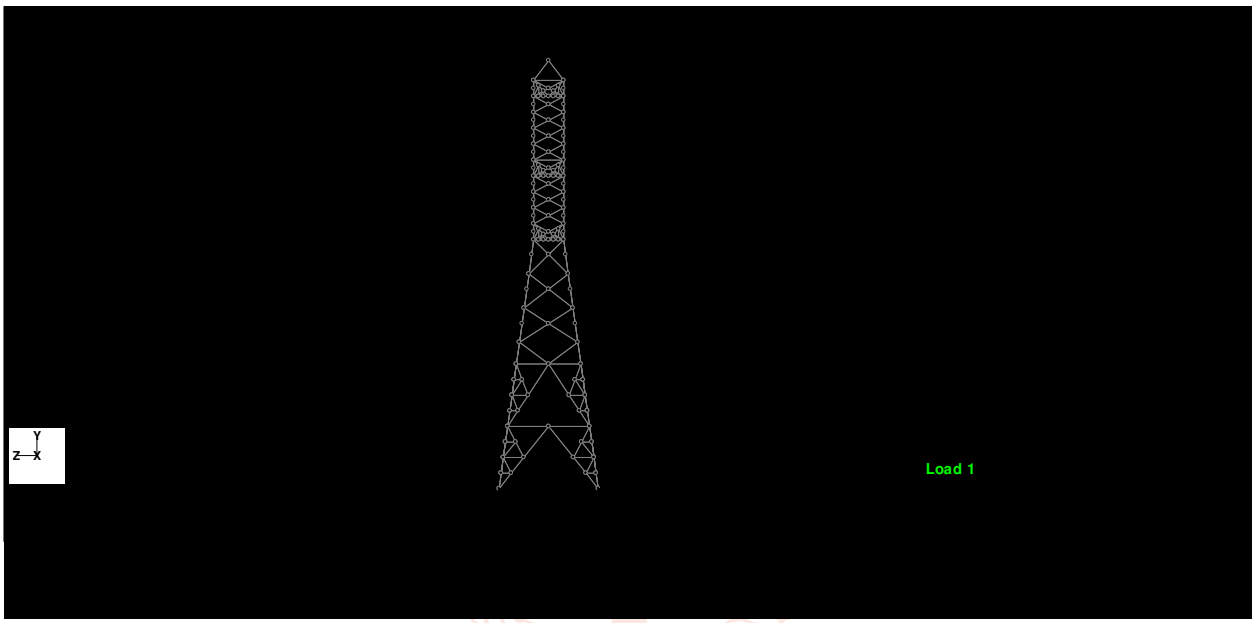


Fig. 4.3 Side View of Model –I in STAAD PRO

Fig. 4.3 Preparation of geometry of Model –I Front view in STAAD PRO

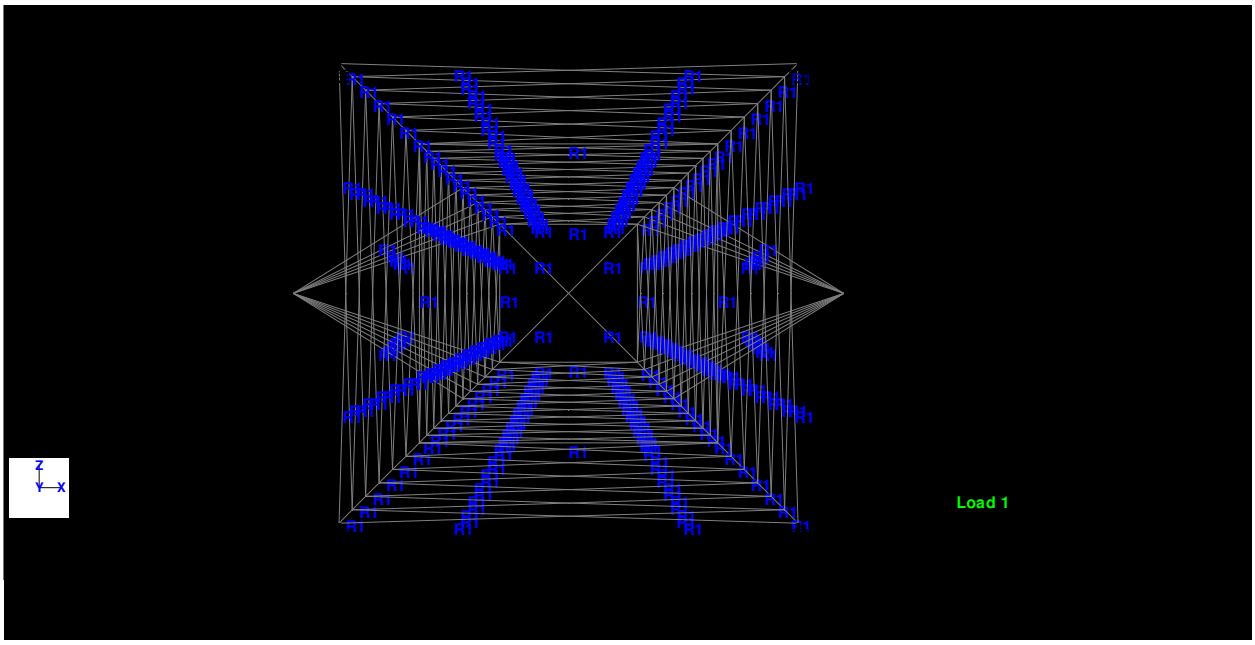


Fig. 4.4 Top View of geometry of Model –I in STAAD PRO

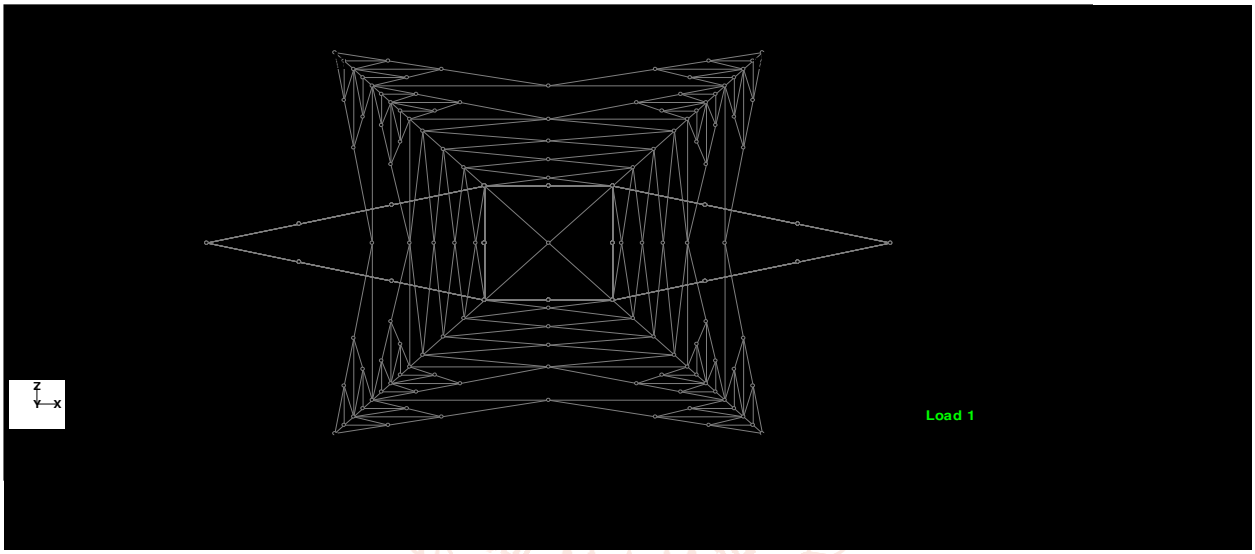


Fig. 4.5 Top View of geometry of Model –II in STAAD PRO

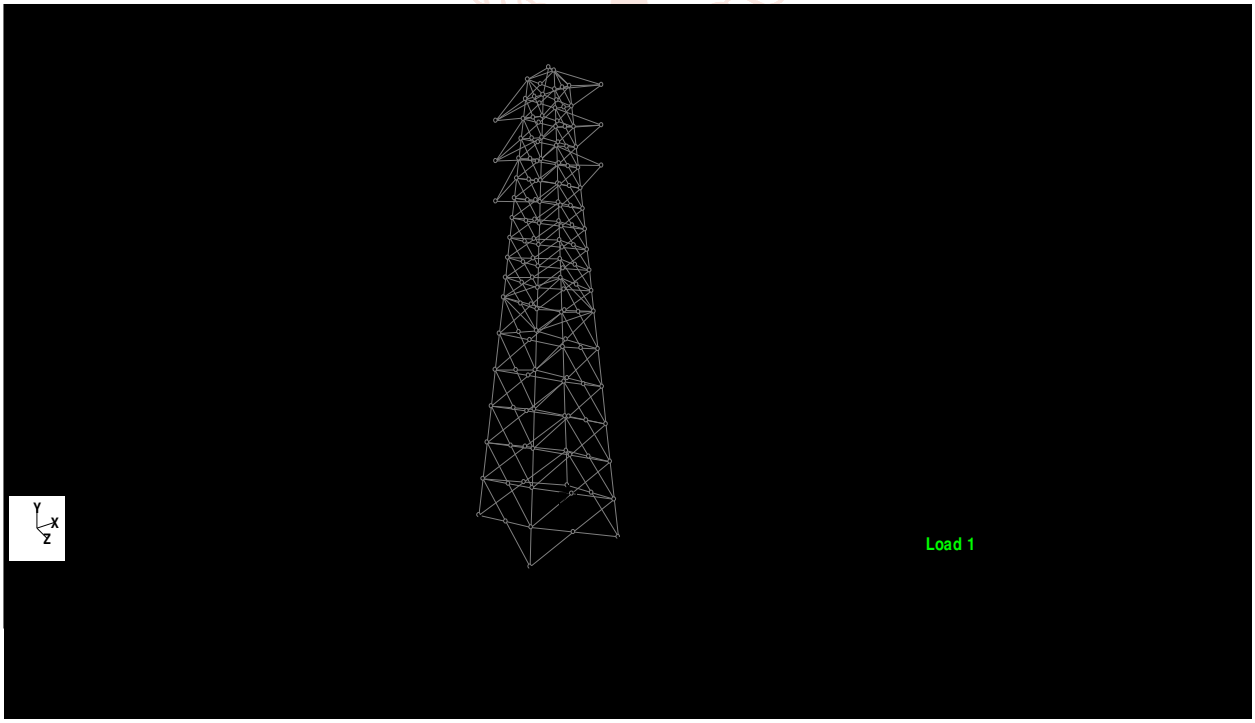


Fig. 4.6 Preparation of geometry of Model –II in STAAD PRO 3D view

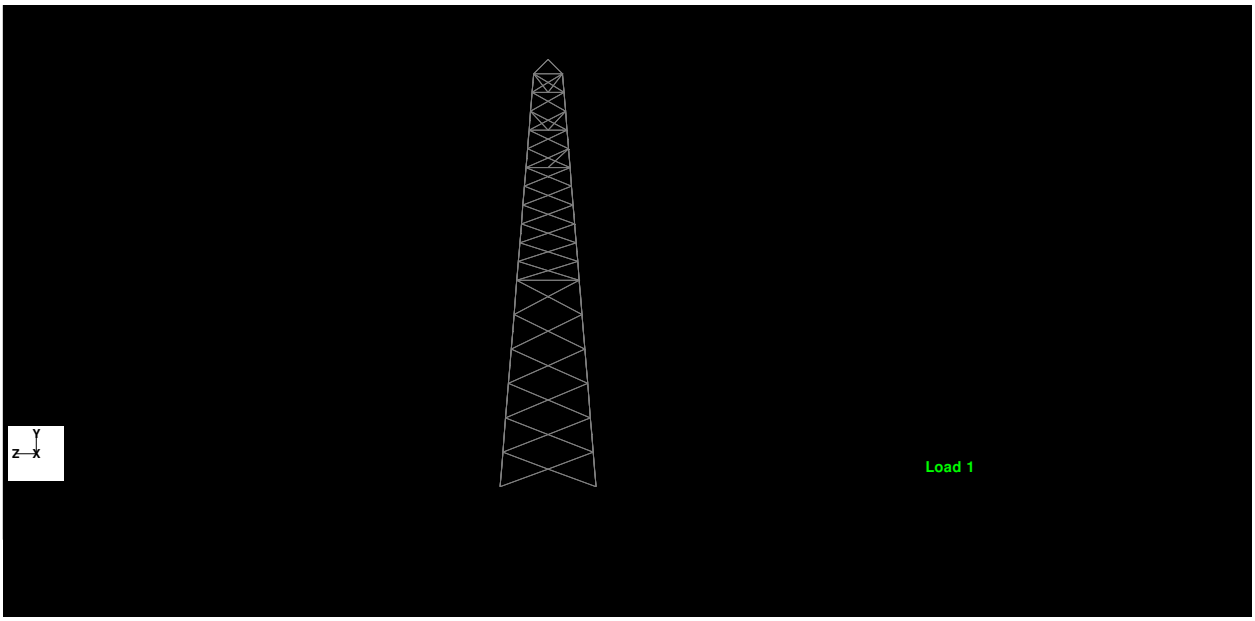


Fig. 4.7 Side View of Model –II in STAAD PRO

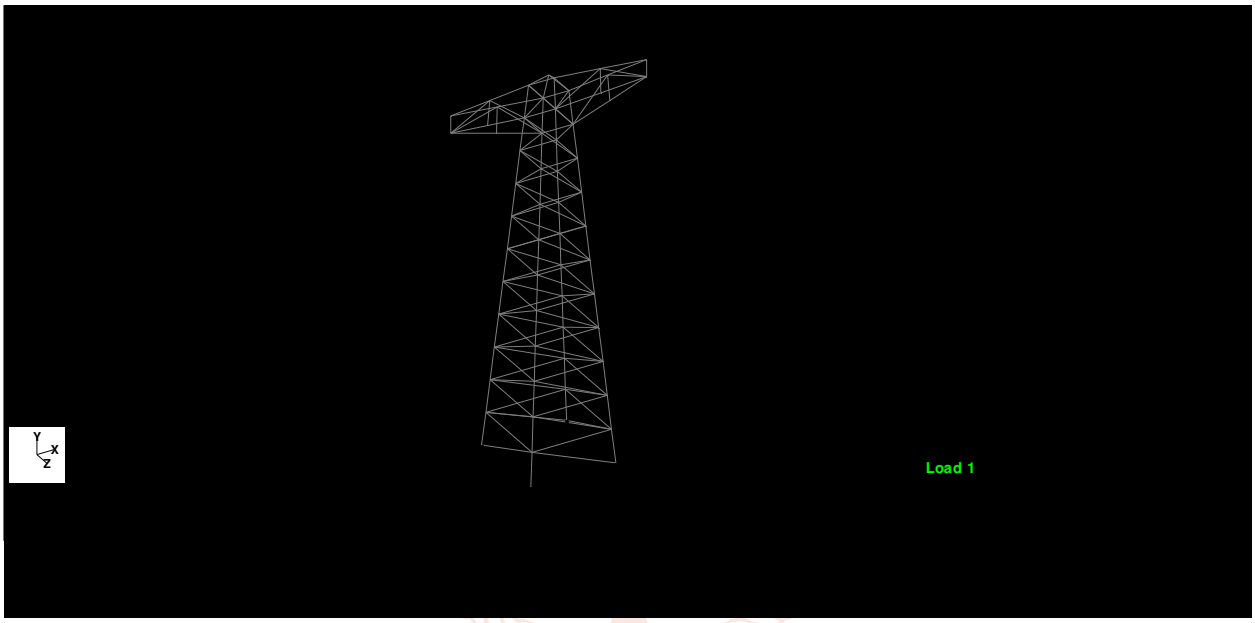


Fig. 4.8 Preparation of geometry of Model –III in STAAD PRO 3D view

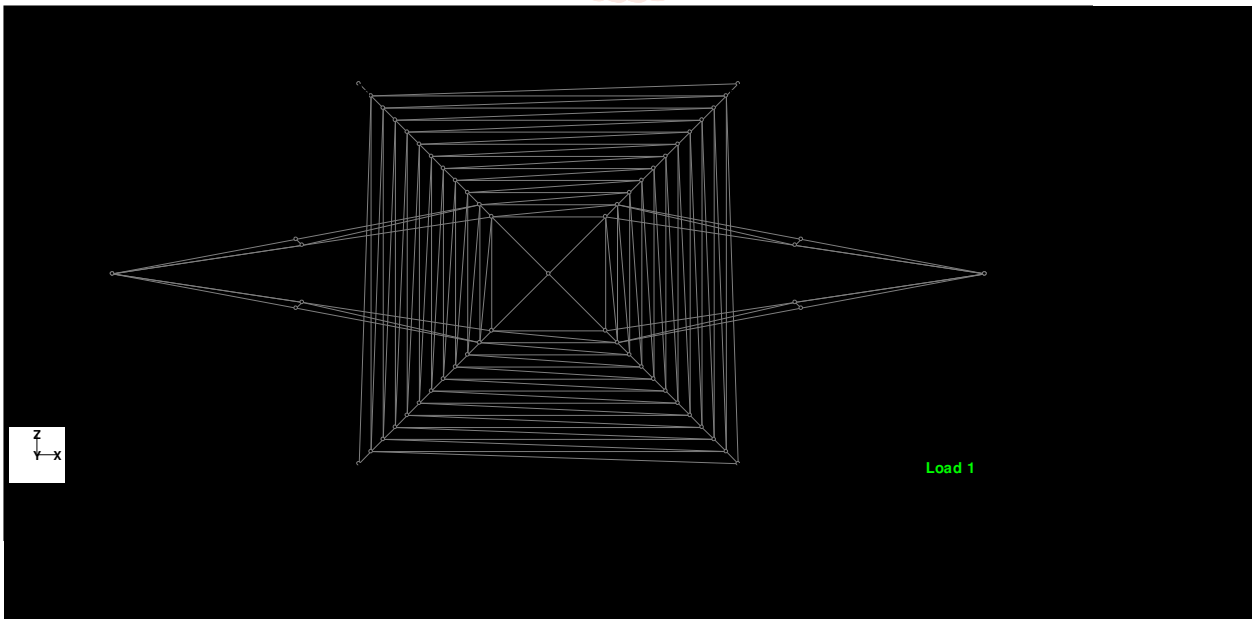


Fig. 4.9 Top View of geometry of Model –III in STAAD PRO

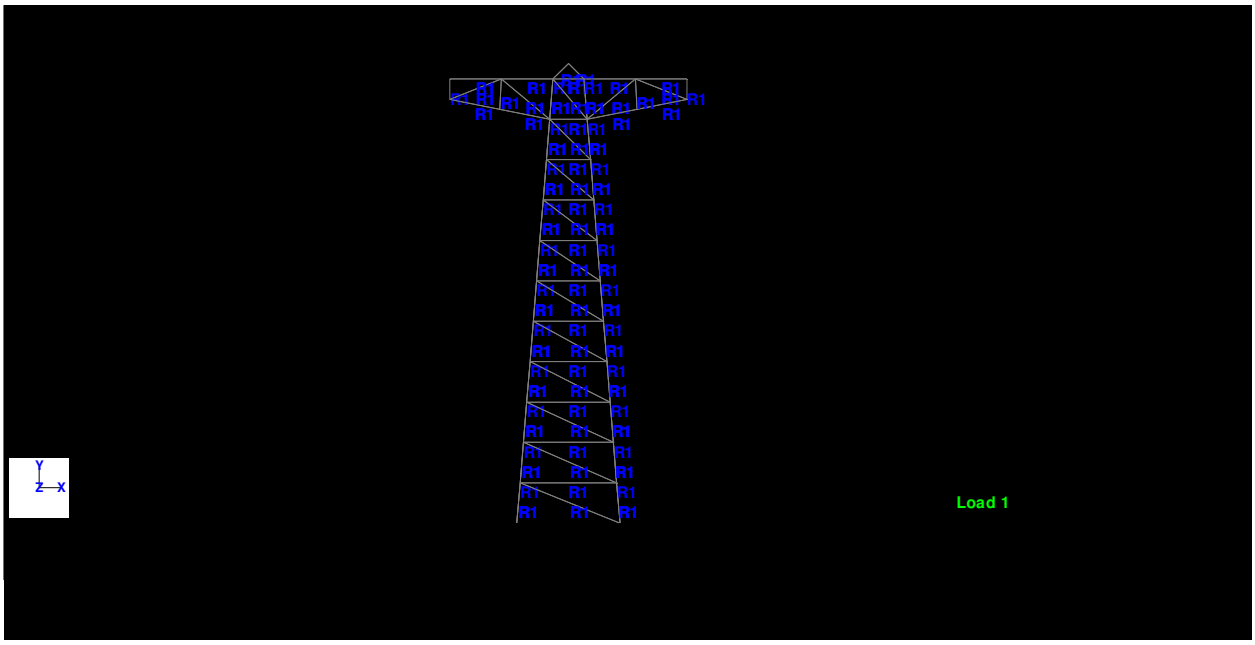
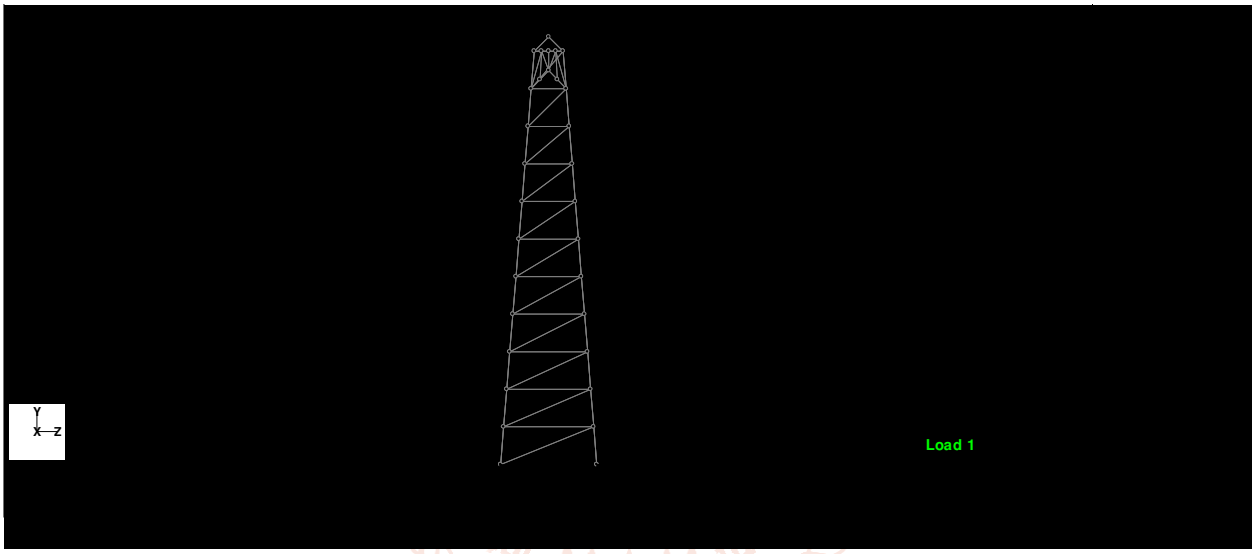


Fig. 4.10 Front View of Model –III in STAAD PRO



Model 2 Fig. 4.11 Side View of Model –III in STAAD PRO

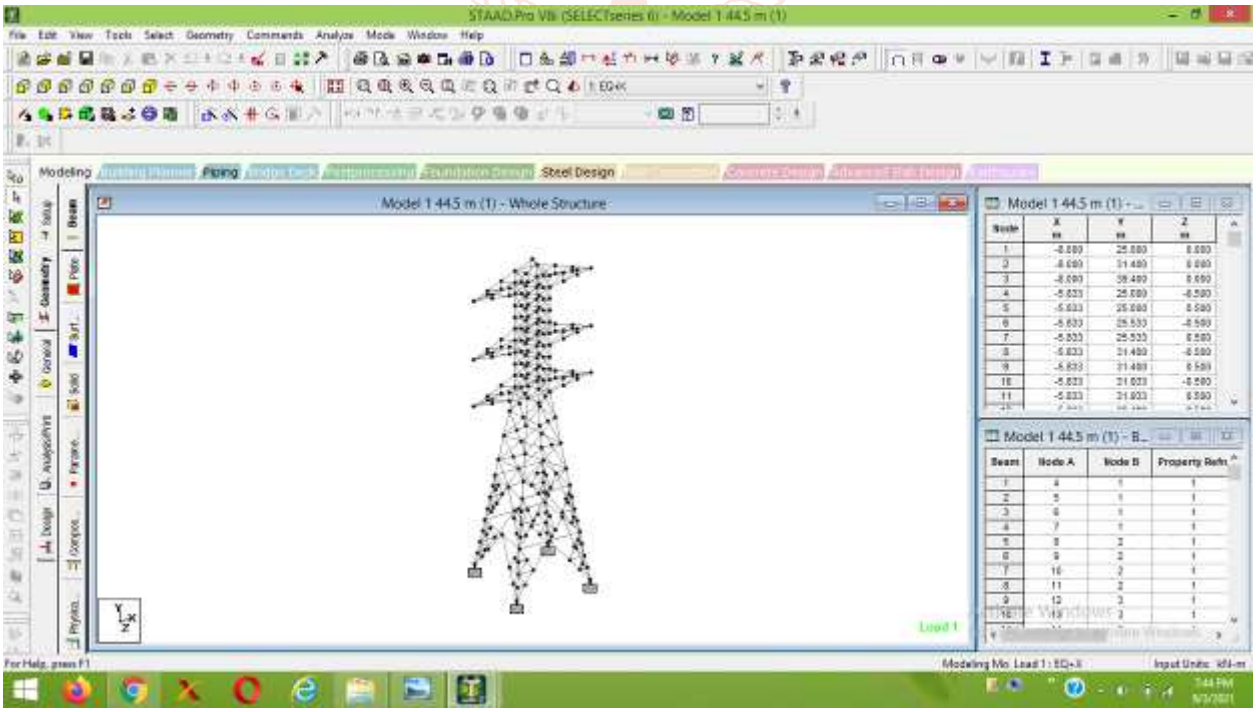


Fig. 4.12 Model –I under loading condition

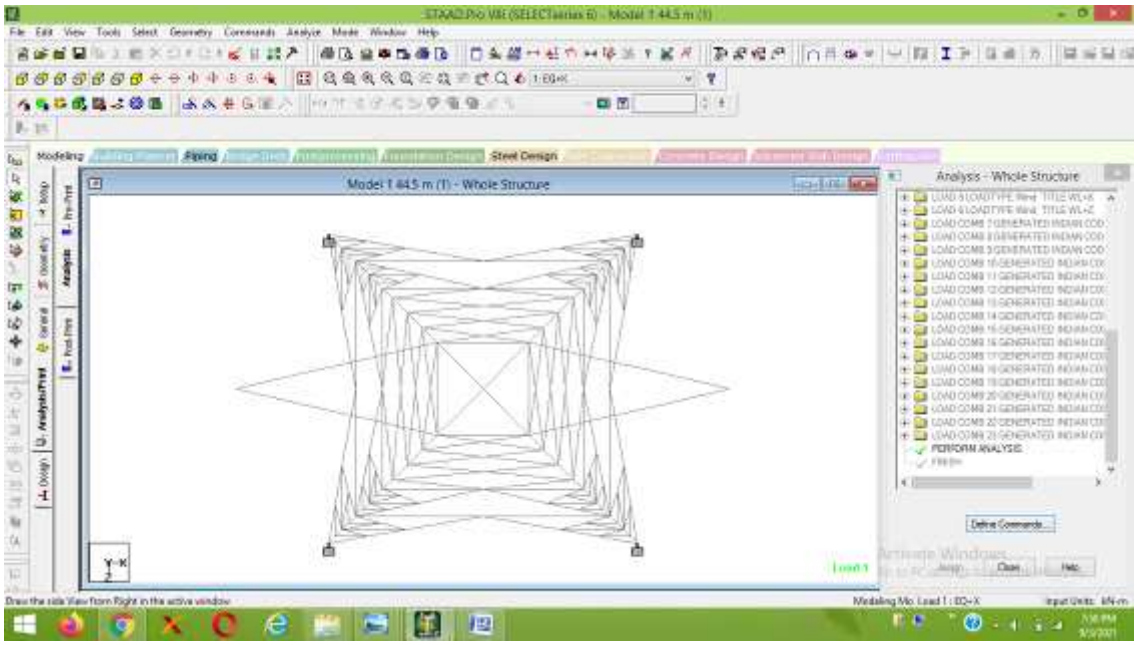


Fig. 4.13 Model –I 3 D view Under loading condition

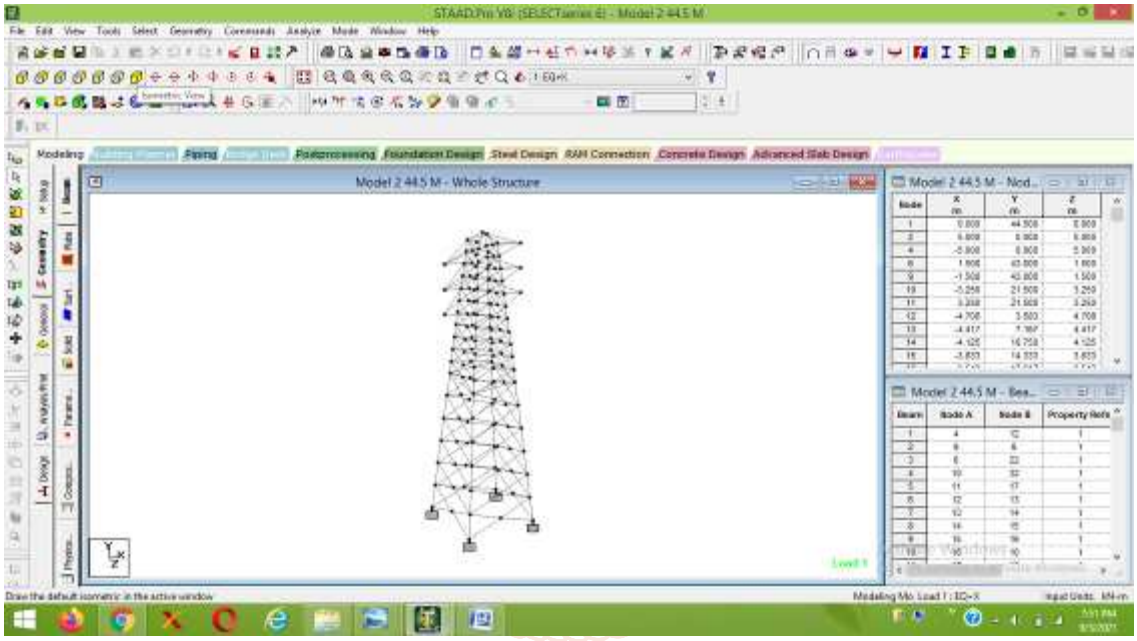


Fig. 4.14 Model –II Under loading condition

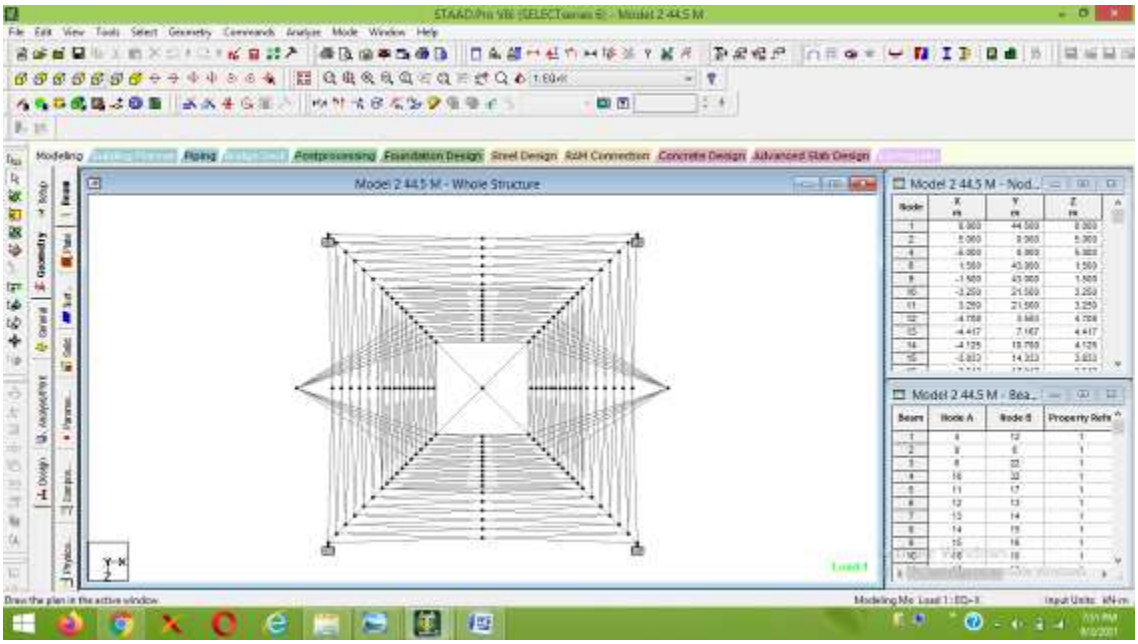


Fig. 4.15 Model –II top view Under loading condition

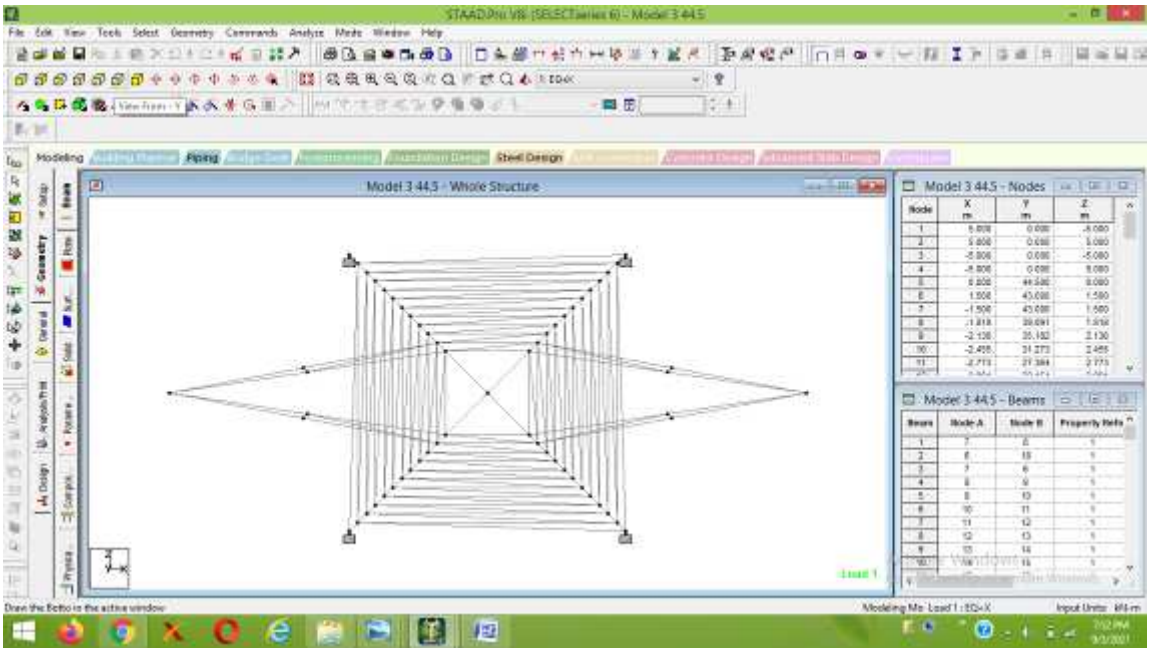


Fig. 4.16 Model –III Under loading condition

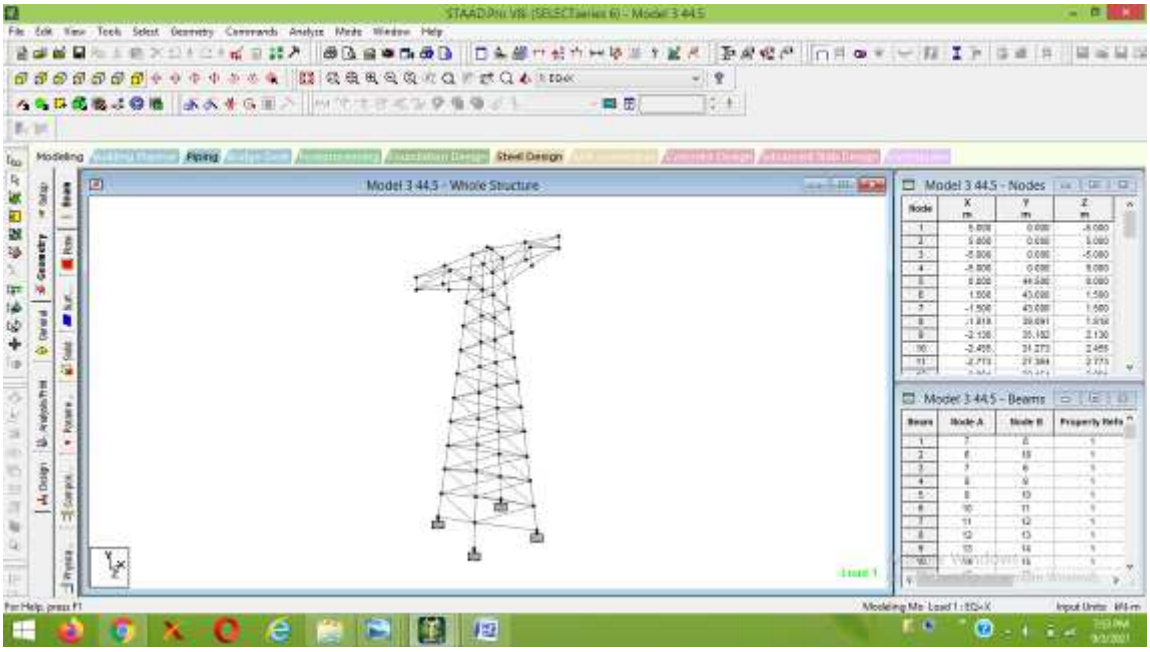


Fig. 4.17 Model –III Under loading condition

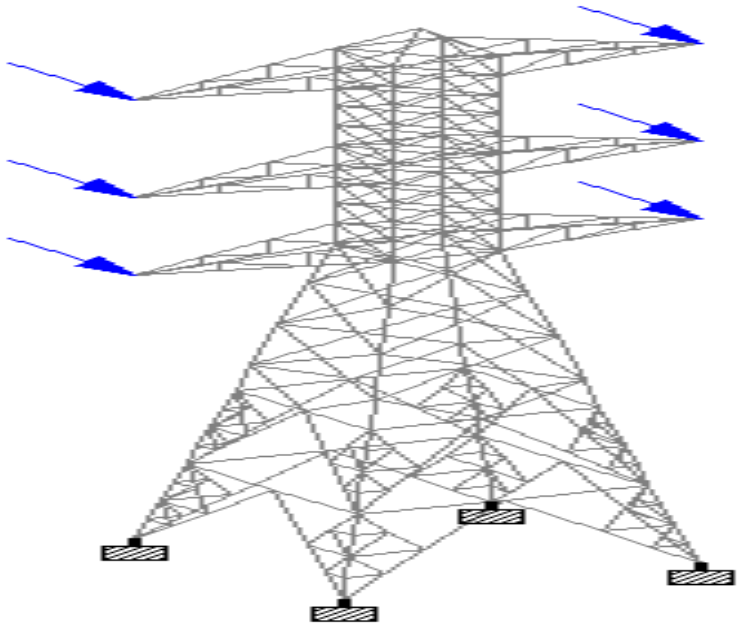


Fig. 4.18 wind Force acting on tower

RESULTS

Max Displacement Result

Graphs for Tower Height 44.5 m for Seismic Zone III

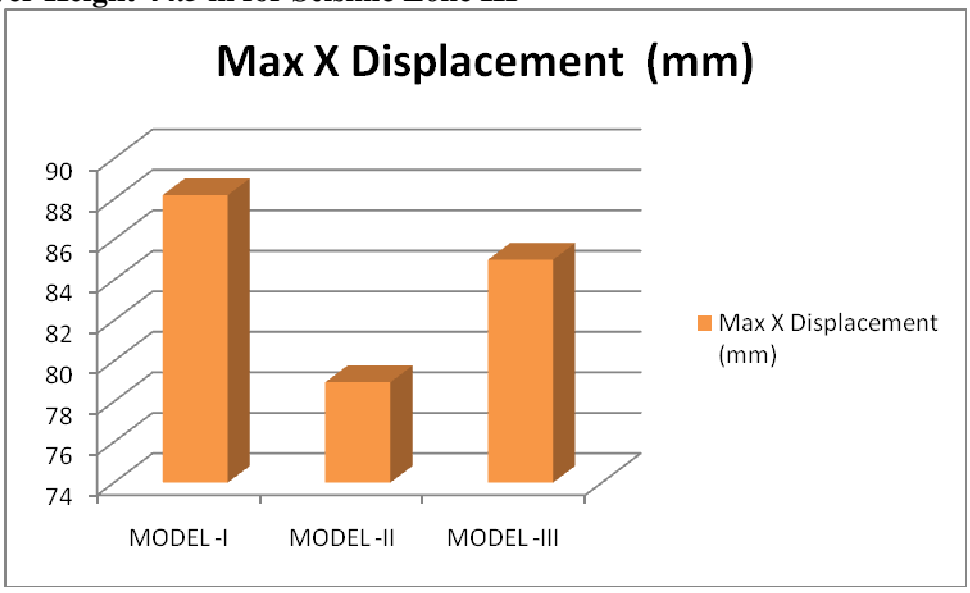


Fig 5.1 Max Displacement in X Direction

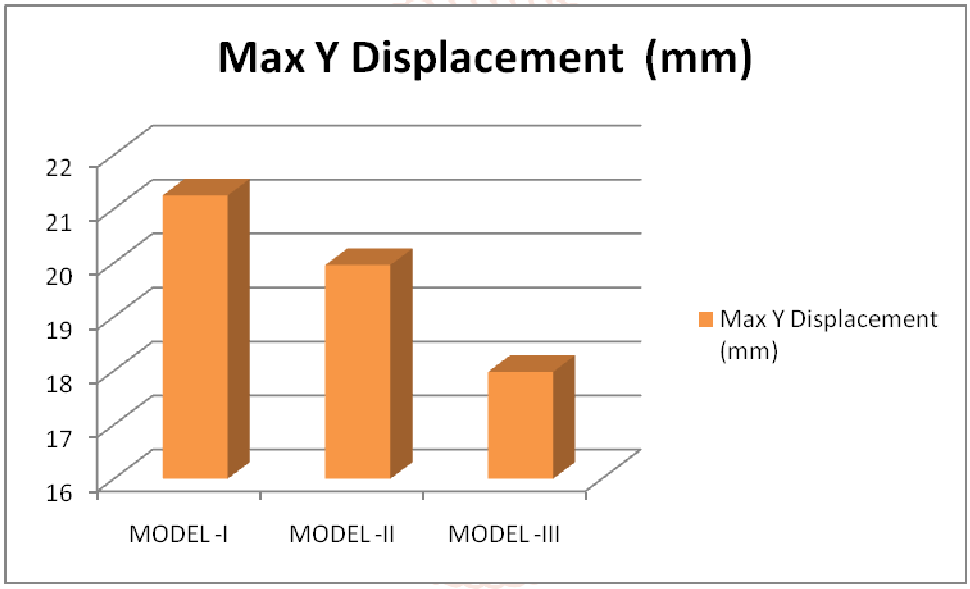


Fig 5.2 Max Displacement in Y Direction

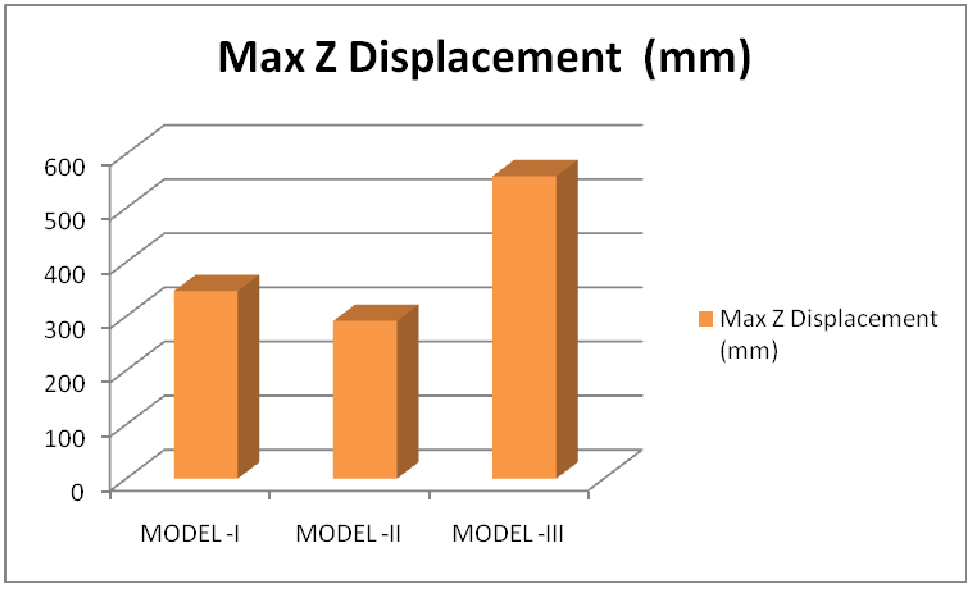


Fig 5.3 Max Displacement in Z Direction

Graphs for Tower Height 44.5 m for Seismic Zone III

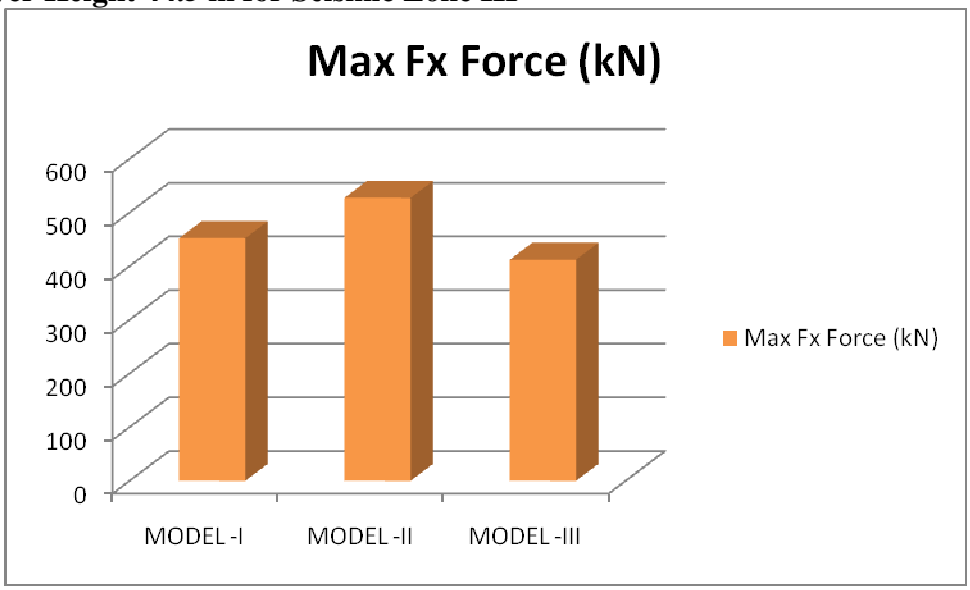


Fig 5.4 Max Force in X Direction

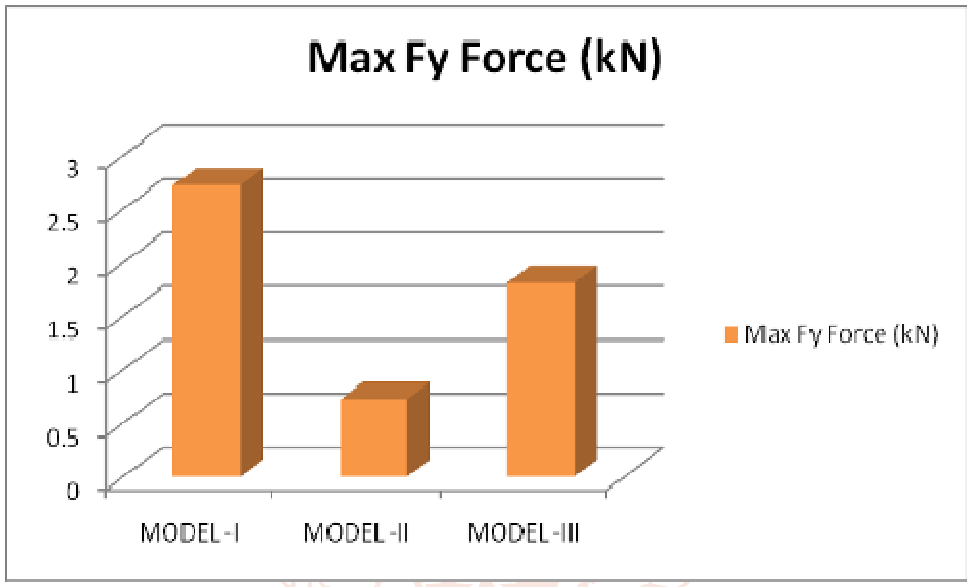


Fig 5.5 Max Force in Y Direction

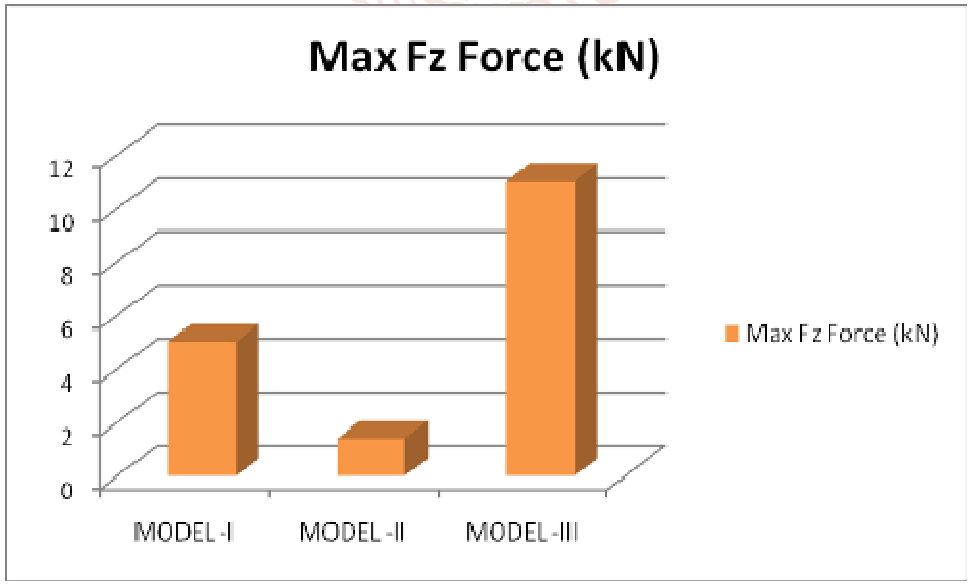


Fig 5.6 Max Force in Z Direction

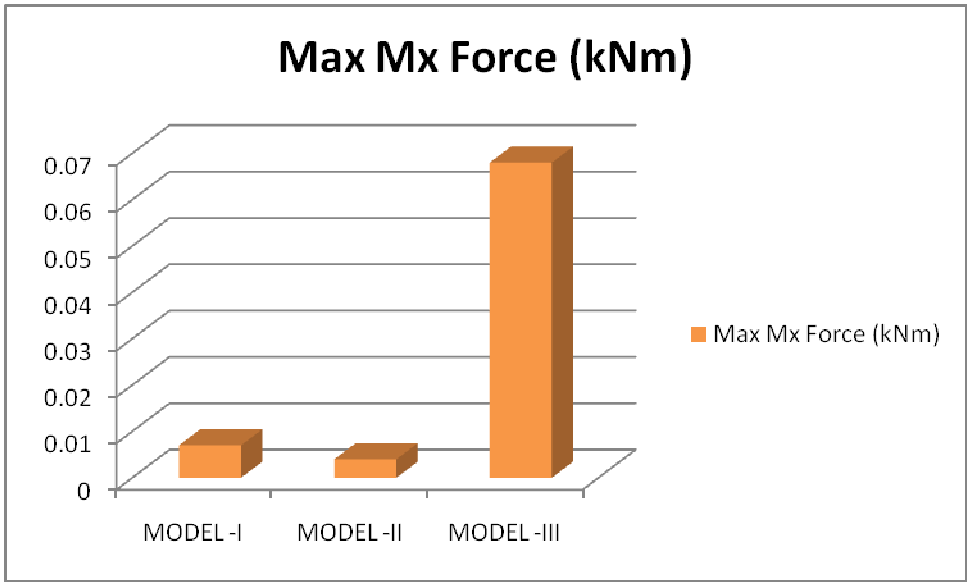


Fig 5.7 Max Bending Moment in X Direction

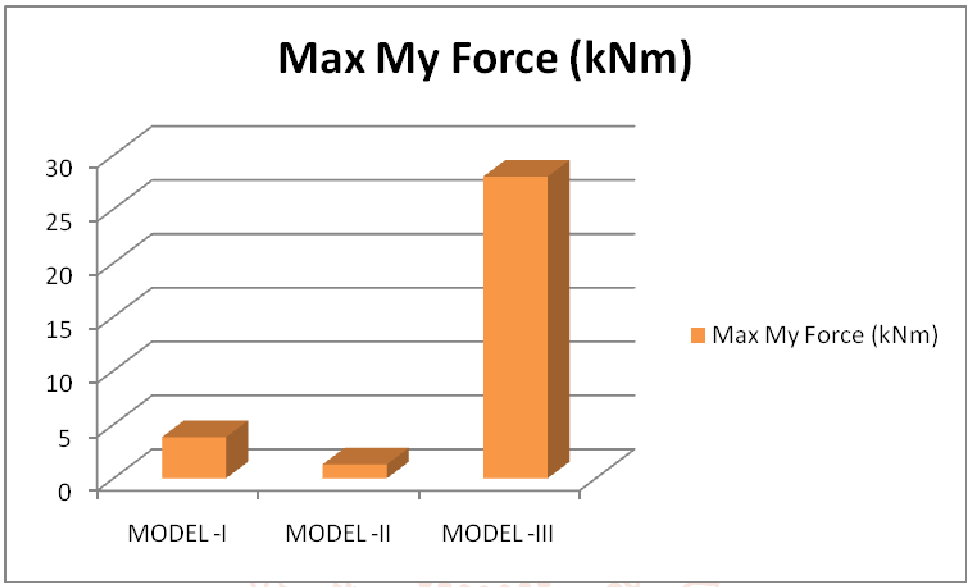


Fig 5.8 Max Bending Moment in Y Direction

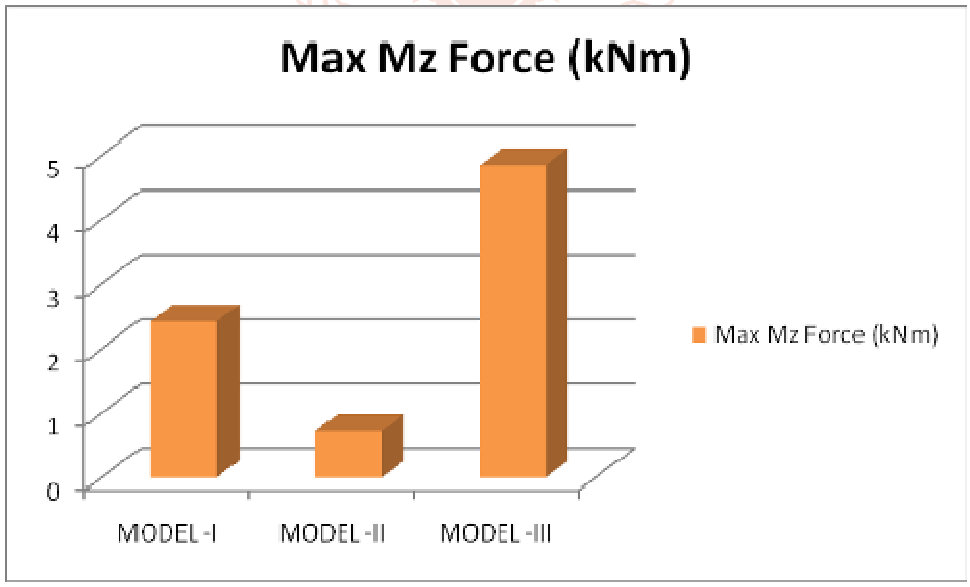


Fig 5.9 Max Bending Moment in Z Direction

CONCLUSIONS

The tower with angle section and pylons has the greater reduction in weight after optimization. Different type of pylon is economic to use in this type of steel transmission tower.

Some of the key points of conclusion:

- Model II shows least displacement i.e. 78.96mm, 19.96 mm, 291.28 mm in X, Y & Z directions as compare to Model-I and model-III.
- Model II shows shear force in all conditions i.e., 527.45 Kn, 0.728 Kn & 1.426Kn in X, Y & Z directions.
- Model II shows least bending moment in all i.e. 0.004Kn-m, 1.292Kn-m, 0.721Kn-m in X, Y & Z directions as compare to Model-I and model-III.
- Hence Model II shows better results in terms of displacement & bending moment.

REFRENCES

[1] Alshurafa S, Alhayek H and Polyzois D. Static character- istics of multicells jointed FRP tower with mass on its top. Mech Adv Mater Struct 2019; 1–8.

[2] Bhowmik C and Chakraborti P. Stability analysis of elec- tric transmission line tower made with composite mate- rial carbon fiber epoxy – an innovative approach. Rev Compos Mater Avances 2019; 29: 9–13.

[3] Bhowmik C and Chakraborti P. Study of strength and stability of a composite transmission tower. Proc Inst Civil Engineers Eng Comput Mech 2020; 173: 30–36.

[4] Bhowmik C, Chakraborti P and Das SS. Dynamic anal- ysis of typical composite electric power transmission tower structure by ANSYS. Int J Comput Intell IoT 2018; 1-6.

[5] Li HM, et al. Research on composite material towers used in 110kV overhead transmission lines. In: International conference on high voltage engineering and application, ICHVE 2010, New Orleans, LA, USA, 2010, pp. 572–575. IEEE.

[6] Loredo SAM. The behavior of transmission lines under high winds. PhD Dissertation, University of Western Ontario, Canada, 1996.

[7] M. Selvaraj, S. M. Kulkarni, R. Ramesh Babu (2012). "Behavioral Analysis of built up transmission line tower from FRP pultruded sections" ISSN 2250-2459, Volume 2, Issue 9, September 2012

[8] McClure G and Lapointe M. Modeling the structural dynamic response of overhead transmission lines. Comput Struct 2003; 81: 825–834.

[9] Momomura Y, et al. Full-scale measurements of wind-induced vibration of a transmission line system in a mountainous area. J Wind Eng Ind Aerodyn 1997; 72: 241–252.

[10] N. Prasad Rao, G. M. Samuel Knight, S. J. Mohan, N. Lakshmanan ("Studies on failure of transmission line towers in testing"

[11] Ozono S and Maeda J. In-plane dynamic interaction between a tower and conductors at lower frequencies. Eng Struct 1992; 14: 210–216.

[12] Ozono S, Maeda J and Makino M. Characteristics of in- plane free vibration of transmission line systems. Eng Struct 1988; 10: 272–280.

[13] Polyzois DJ, Raftoyiannis IG and Ochonski A.

[14] Ram Chandra, "DESIGN OF STEEL STRUCTURES", VolumeII, Standard Book House, Delhi, 110006.

[15] Ramirez VI, Herna´ ndez CR and Salgado TJE. Composite materials as an alternative to replace steel members on lattice power transmission towers. J Mater Civil Eng 2016; 28: 1–12.