

## STRUCTURAL WEIGHT OPTIMIZATION OF 132kV TRANSMISSION LINE TOWER

**Sandesh B. Bhilawe <sup>\*1</sup>, P.D. Ramteke <sup>\*2</sup>**

<sup>\*1</sup>Student, M.tech Structural Engineering, KITS Ramtek, Ramtek, Maharashtra, India.

<sup>\*2</sup>Assistant Professor, M.tech Structural Engineering, KITS Ramtek, Ramtek, Maharashtra, India.

### ABSTRACT

Transmission Line Towers represent approximately 28 to 42 percent of the cost of the transmission line. The growing demand for electrical energy can be met more economically through developing exceptional mild weight configurations of transmission line towers. In this paper an attempt has been made to make the transmission line more cost effective with three different types of configurations and analysed and designed as a three dimensional structure in stadd pro software. In addition to the configuration system the tower is analysed for various trial angle section and the section which gives optimum result is selected.

**Keywords:** Base width, Pattern geometry, section sizes, slenderness ratio, weight optimization.

### 1. INTRODUCTION

India is a hugely populated country and the electric power supply need of the population creates requirement of a huge transmission and distribution system. Also, the disposition of the primary resources for electrical generation viz., coal, hydro capacity, is quite uneven, thus, again adding to the transmission requirements. Transmission line is an integrated system which includes conductor subsystem, ground wire subsystem and one subsystem for every category of support structure.

The efficient design of the transmission line towers is based on both electrical and structural considerations. The general shape and height of the tower is based on the electrical aspects and so the optimization can be performed to reduce the weight and to arrive at the best geometry shaping. Optimization is the process of finding the best solutions from which a designed can derive maximum benefit from available resources. It also enables the construction of efficient structures and also maintains safety and reliability.

### 2. METHODOLOGY

Total six number of towers are modelled for different configuration and different height and configuration with optimum weight is selected.

### 3. MODELING AND ANALYSIS

Modelling and analysis is done in stadd pro software. Dead load, wind load and load combinations are applied. The following procedure to any analysis the tower using STAAD Pro software are:

- Basic structure of the tower is prepared using simple beam method.
- Nodes and beams are created.
- Section property is applied to various members of the tower.
- Various joint loads that we have calculated in manual method are applied on nodes of corresponding points.
- After applying loads analysis is done and result is obtained.

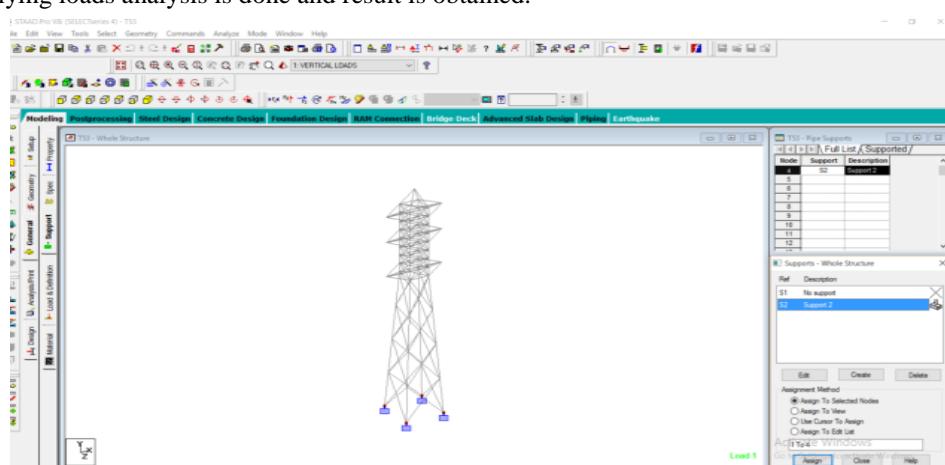
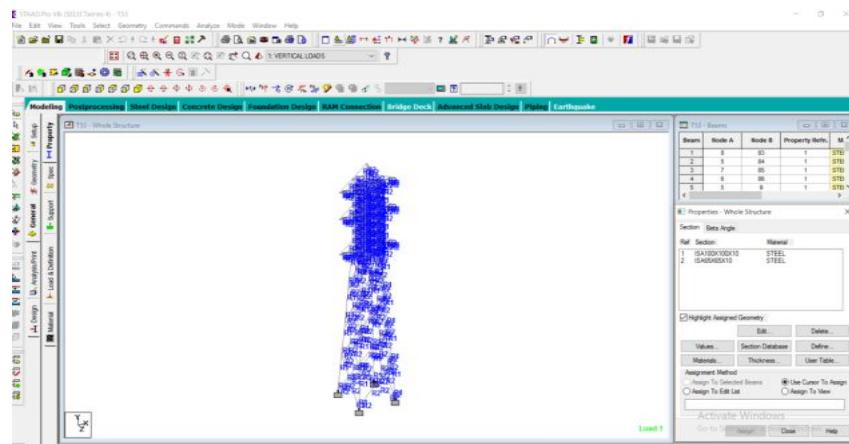
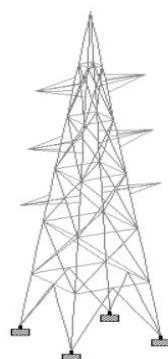


Figure 1. Assign support

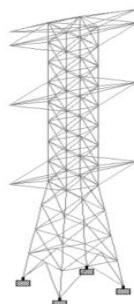




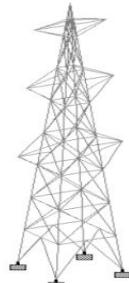
**Figure 5. Configuration I**  
(Height= 26m)



**Figure 6. Configuration II**  
(Height = 26m)



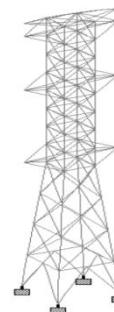
**Figure 7. Configuration III**  
(Height =26m)



**Figure 8. Configuration IV**  
(Height = 30m)



**Figure 9. Configuration V**  
(Height =30m)



**Figure 10. Configuration VI**  
(Height =30m)

#### 4. RESULTS AND DISCUSSION

Height of tower	Configuration	Weight (kN)
26	I	41.941
	II	64.727
	III	63.145
30	IV	41.941
	V	64.727
	VI	63.145

#### 5. CONCLUSIONS

Optimization of Transmission Line Tower is aimed at achieving low cost, high performance, better and more reliable design strength. It is observed from the analytical work that the weight of tower with Optimized base width, Pattern Geometry, Base Configuration and section size optimization shows an economical construction. This work attempts to optimize the transmission line tower structure for a 132 KV double circuit quad conductor, regarding base configuration, section size and pattern geometry as variable parameters. Due to multiple loading conditions, each member subjected to maximum stress under any of the loading conditions is assigned an angle size considering the strength factor of 1.08 to 1.1. This work has focused on economic analysis and design of transmission line tower structure.

1. Effect of wind is predominant at greater height. Hence, when height of tower increases deflection of tower is observed at cross arms due to swinging effect of conductor wires.
2. Width of the tower is generally kept as one sixth of the height of tower.
3. It is also found that for height of tower 26 m and 30m configuration I gives optimum weight.
4. In the region where wind effects are severe and also when towers are constructed in the proximity of traffic, diaphragm can be provided either partial or throughout the height of tower to cope up with lateral earth pressure.

## 6. REFERENCES

- [1] I.S. 802: Part 1: Sec: 1:1995: Code of Practice for Use of Structural Steel in Over Head Transmission Line Towers-Materials and Loads.
- [2] I.S. 802: Part 2: Sec: 1:1995: Code of Practice for Use of Structural Steel in Over Head Transmission Line Towers-Permissible Stresses.
- [3] I.S. 875: Part 3: 1987: Code of Practice for Design Loads (other than Earthquake) for Buildings and Structures: Wind loads.
- [4] I.S.280: 1978: Specification for Mild Steel Wire for General Engineering Purposes.
- [5] Transmission Line Manual: No. 268, C.B.I.P.
- [6] Glossary of Terms Relating to Transmission Line Towers: No. 47 (1985): C.B.I.P.
- [7] F. Albermani, M. Mahendran and S. Kitipornchai, Upgrading of Transmission Towers Using a Diaphragm Bracing System, *Engineering Structures*, 26, pp. 735-744.
- [8] M.P.Saka, (1990) "Optimum Design of pin-jointed steel structures with practical applications", *J.StructuralEngg*, Vol. 116, pp.2599-2620.
- [9] Visweswara Rao, (1995) "Optimum Design for Transmission Line Towers", *Computers and Structures*, Vol 57, No.1, pp.81-92.
- [10] Y.M.Ghugal and U.S.Salunke (2011), "Analysis and Design of three and four legged 400kV steel transmission line towers: Comparative study".