



Comparative Study Of Four Legged Lattice Transmission Tower Having Angle Section And Closed Hollow Section

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Abstract — Transmission line tower is one of the most significant structures so it is necessary to perform dynamic analysis by considering both structural and electrical requirements for a safe and economical design. The economy of transmission tower can be achieved by using different configurations, type of bracing etc. In this present study, the analysis and design of a typical type of transmission line tower carrying 400kV double circuit towers having four legged tower under dynamic load like wind load, earthquake load and snow load for different configuration is done by STAAD.PRO. The type of transmission tower considered is suspension tower having 2 deviation located on a plain landscape with minimum or relatively no obstacles. The critical load combination for which maximum deflection of member occurs is one broken wire condition and anti-cascading condition. The effect of wind load is greater than earthquake load and effect of snow on the tower is negligible.

Keywords- Transmission line tower, Angle section, Closed hollow section, wind load, earthquake load, snow load

I. INTRODUCTION

In every country the need of electrical power has been continuously increasing so it is necessary to transfer electricity each and every part of the society. Transmission line tower are one of the most important life-line structures to transfer electricity. This has led to the increase in the building of power station and consequent increase in power transmission line from the generating stations to the different corners where its needed. Transmission line should be stable and carefully designed to that they do not fail during natural disaster. It should also confirm to the national and international standard. The cross section of conductors, the spacing between conductors, and the location of ground wires with respect to the conductors will decide the design of towers and foundations. Most of the time transmission lines are designed for wind and ice in the transverse direction. However, seismic load is also important because the transmission line towers and the cables may be subjected to higher force and stressed during ground motion. However, the major concern of the transmission line during high earthquake may be that the large displacements do not cause the cable to touch each other or surroundings.

II. METHODOLOGY

STAAD.PRO is a structural analysis and design computer program originally developed by Research Engineers International in Yorba Linda, CA. In late 2005, Research Engineers International was bought by Bentley Systems. In this present study, STAAD.PRO is used for modeling a four legged transmission line tower having angle section and closed hollow section. For all the dimension from tower height to different stages an elevation is made in Auto-cad. Then the wind load on tower body, conductor, ground-wire, insulator are calculated manually using IS 802 Part 1, Sec 1 and it is being applied to the model generated in STAAD.PRO. The earthquake load is applied according to IS 1893 Part 4 and similarly the snow load is also applied according to IS 875 part 4. Different load combination is developed as are mention in Indian Standard and analysis is carried out. The deflection for top node for both four legged transmission tower are calculated.



Fig.1 Four legged transmission line tower

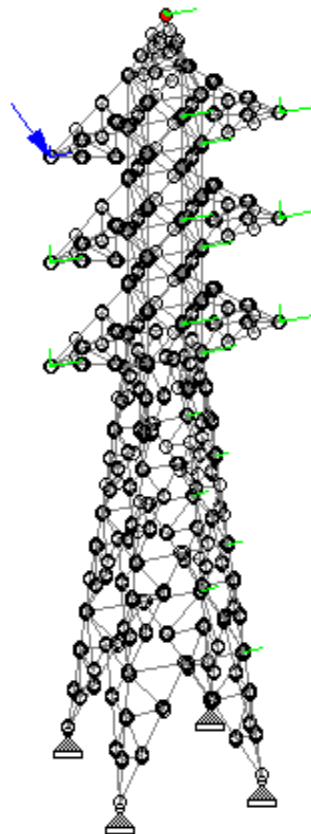


Fig.2 Loads on tower

III. RESULTS

The table and Fig. shows the deflection of top node of the transmission line tower for four legged tower. The deflection due to snow load is very small as compared to wind and earthquake load.

Table.1 Deflection of top node of tower for angle section and closed hollow section

	Deflection for top node (mm)	
	Wind load	Earthquake load
Angle section	81.293	63.023
Closed hollow section	70.072	61.106

Table.2 Cost comparison of angle section and closed hollow section

	Weight (kN)	Cost (Rs/Kg)	Total cost (Rs)
Angle section	230.32	65	1497080
Closed hollow section	190.49	65	1238185

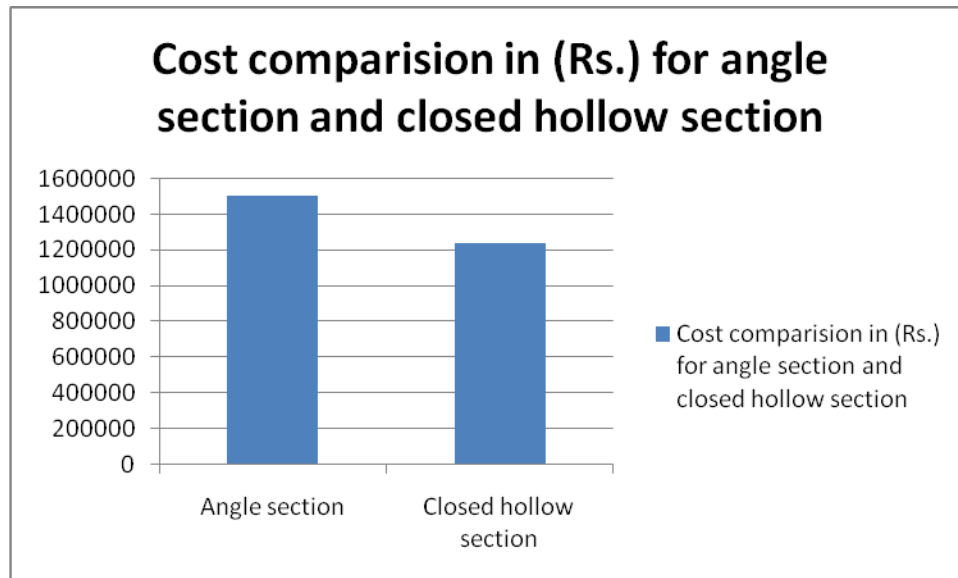


Fig.3 Graph of cost comparison in (Rs.)

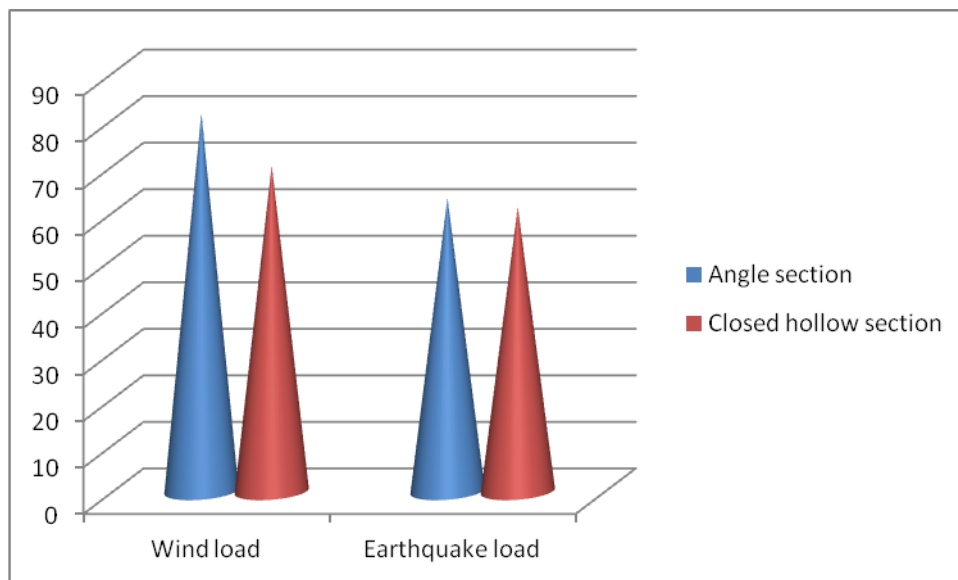


Fig. 4 Deflection (mm) graph

IV. DISCUSSION

From this present study, we can say that the deflection analysis of top node of transmission line tower for four legged has lesser value than the three legged tower. The permissible deflection for all transmission line towers for wind loading is restricted to $H/100$ or 1% of total height and for earthquake loading the maximum permissible deflection is restricted to, $D_{max} = 0.003 \times h$ Where, h = height of the tower

V. CONCLUSION

- The optimizations in terms of deflection at the top and material cost are obtained in the case of four legged closed hollow section tower as compared to the angle section transmission tower.
- The deflection for top node of the transmission tower during wind load has greater impact than that of earthquake load. So, wind load case governs more for structural design as compared to the earthquake.

- The deflection of the top most nodes comes out to be permissible limit for four legged angle section and closed hollow section but tower having closed hollow section is economical as compared to tower having angle section.
- The deflection of top node under wind load using conventional angle section for four legged transmission line tower is 22.47 % more than earthquake load and for closed hollow section is 12.79% more than earthquake load.
- The deflection of top node under earthquake load using angle section is 3.05% more than closed hollow section and for wind load using angle section is 13.85% more than closed hollow section.
- The cost of four legged transmission tower having angle section is 17.29 % more as compared to four legged tower having closed hollow section.

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