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Review on: Comparative study between Lattice Tower and Monopole

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Abstract - *Lattice Towers are the most common types of Towers adopted in construction industry. Nowadays, Monopole is also being used in place of lattice towers. This paper presents a comparative study between Monopole and Lattice type Towers with different heights. Dead loads and Wind loads are considered for analysis of the tower using STAAD Pro software which is made for analyzing different structures and towers. Designing and analysis of towers is done on STAAD Pro keeping its height and loading constant and later comparison is carried out from the results obtained. Monopole is a advance structure which requires less material and less space for installation than compared to lattice towers. In this era, as population is increasing, requirement of land and its cost is continuously increasing and hence there is need of modification in traditional lattice towers. During this paper work, past studies supporting analysis of towers has been studied well.*

Key Words: **Lattice Telecommunication Tower, Monopole, STAAD Pro, comparative study.**

1.INTRODUCTION

India is most infra developed country and the telecom industries is one of them. Cell phone technology has several advantages and has grown rapidly in the last few decades. Telecommunication towers are used for communication purposes among humans. Lattice towers are the vertical truss on ground act as cantilever beam, fixed on one end and free on the other end. These towers are used to support the antennas, at the elevated height from the ground. Telecommunication tower is used to support antennas of mobile and communication industry.

Telecommunication tower is a whole set of mechanical structures and electronic signal processing unit which is used to connect people through telecommunications. All the telephone lines and mobile phone services are connected via these towers. Different heights of towers are required in different places and purposes. The height of towers vary from 15 to 60 meters and some time more if required. Telecommunication towers are manufactured in the factory and later erected on the site. Civil Engineers are involved in the analysis and design of the towers that support the panel antennas, telecommunication equipment, and platforms. All the equipments are mounted on the tower which requires Civil engineering expertise. Telecommunication towers has became an absolutely necessary item especially in wireless telecommunication sector with the development of wireless telecommunication technologies such as CDMA (Code Division Multiple Access), GSM (Global System for Mobile),WAP (wireless Web Access), etc.

As data transmission technology is rapidly developing branch of the technical industry and the number of users are increasing day by day. Therefore, a continuous need to expand the network coverage, triggering the necessity to install many new devices. As the telecommunication network clearly requires a proper elevation of receivers, high rise supporting transmitter structures are essentially required for the technical network. In many cases, adaptation or modification of existing structures is the only solution for expanding the network, due to the cost criterion and the difficulty in construction of a new structure in the dense residential urban areas. The most important criteria to magnify the decision are the Aesthetical, Statically, and Economical considerations.

1.1 Monopole

Modern telecommunication structures are essential to the present society. The emergence of new technologies creates demand for advance facilities and introduction of new elements in our cities. Monopoles is designed and manufactured for durability, wear and corrosion resistance, and visual appeal. Monopoles are tubular polygonal sectioned and hot dip galvanized hollow steel structures. These are single self supporting or free standing pole and are most commonly used in cellular communication service applications. It requires smaller lease area, smaller price tags and reduced construction time offer speed to market as well as savings. The structures are aesthetically pleasing and require minimum space for installation. They are typically constructed of different diameter steel sections either cylindrical or multi sided in shape. The individual sections are bolted or welded together with the largest diameter sections at the base and each successive section is smaller in diameter. The joint between the different sections are either slip jointed or bolted connection. Base plates, flanges and accessories are welded to the sections. Typically, climbing accessories and antennas are the only visible additions. The need for more wireless communication infrastructure does not have to be complex. Monopoles have sleek design, simple construction and small footprint. Monopoles are ideal for local visual, zoning and climate demands. Monopole towers can support all the equipments, antennas and utilities similar to that of the conventional lattice tower.

2. LITERATURE REVIEW

A brief review of the past few literatures carried out by different researchers in field of telecommunication tower and monopole tower are discussed below :

"Effect of Wind Speed On Structural Behaviour Of Monopole and Self-Support Telecommunication Tower" (2017) M. Pavan Kumar, P. Markandeya Raju, M. Navya, G.T. Naidu

This paper presents a comparison between Monopole and Self-Support type Towers with different heights of 30m, 40m and 50m for basic wind speeds of 33m/sec, 47m/sec and 55m/sec. Dead loads and Wind loads are considered for analysis of the tower using STAAD(X) Tower software. It is concluded from this study that Self-Support Towers have lower lateral displacements compared to the Monopole Towers of same height for same amount of loading. This is because they have higher stiffness. But, the steel quantity required for Self-Support Towers is about 2 times more than the Monopole Towers for a given tower height, wind speed and loading. [1]

" Analysis of Monopole Communication Tower " (2015) Riya Joseph and Jobil Varghese

The project work deals with the analysis of monopole mobile towers. Analysis is done using ANSYS finite element software. The model provided by ANSYS is used to simulate the behaviour of monopoles when used as a communication tower. The tower height considered for the investigation are 35m and 40 m. The wind speed taken for wind load analysis is 33m/s and 39m/s. Efficiency of monopole tower is evaluated based on the finite element results. Since pole structures have smaller dimension and require lesser space for installation, they can be used as a suitable alternative for lattice towers. [2]

"Analysis of Four Legged Steel Telecommunication Tower-Equivalent Static Approach" (2018) Ravishankar P, Arun L, Sudha G.C.

The design of these steel telecommunication towers are done by the help of staad pro software. The tower height considered for the investigation are 50m, 65m and 80m. Wind load analysis is done by considering wind speed of 33m/s and 55m/s. The bracing pattern used in the designing of the towers is K-XX, XX-K, XB-XX. The results obtained from these analyses like joint displacement, natural frequency are tabulated, compared andconclusions are drawn. [3]

" Effect of Cyclonic Load Factor on Monopole Towers " (2018) Balaji K.V.G.D., Ramesh B., Santosh Kumar B., Jnanchand S., Chandan Kumar Patnaikuni

In this paper, considering the amount of tropical cyclonic related damages are disproportional to the return period in Indian coastal areas. For better safety of structures, the IS code875 (Part3)2015 presents the cyclonic importance factor (k_4 factor) according to the importance level of structure. This factor is recommended in static and dynamic analysis of wind load computations. Monopole towers, which are vulnerable to cyclonic wind speeds, are ideal for use when zoning is difficult in urban areas. The towers with heights 30, 40 and 50m are modeled in STAAD Pro (V8i) software to evaluate the k4 factor in static and dynamic analysis. The effectiveness of these factors are reviewed with the cyclonic Gust factor values (Gc). [4]

"Dynamic Analysis of 4-Legged Steel Telecommunication Tower" (2019)

Shweta shetty M.R, Anusha M, Ashwini A, Rajiv T.

The design of these steel telecommunication towers are done by the STAAD Pro Software, for this "automatic selection of members based on reanalysis procedure with fixed group select optimized section" method is adopted. The tower height considered for the investigation are 30m, 45m and 60m. Wind load analysis is done by considering wind speed of 33m/s and 55m/s. The bracing pattern used in the designing of the towers is K-XX, XX-K, K-XB, XB-K, XB-XX. The results obtained from this analysis are compared and tabulated and further conclusions are drawn. [5]

"Comparative Analysis of Telecommunication Tower" (2016) Ankush Kumar Jain, Shivanshi, Pinaki.

In this investigation, a tower of height 32m is considered for analysis. The wind has been taken as the primary force for the analysis, with wind speed 41.7m/s. Tower designing is done using STAAD Pro software. Three model are considered for the investigation having angle section X and V bracing, and tube section X bracing. The joint displacements, shear forces and bending moment and axial stress have been compared to find out the effect of the difference in the modeling strategy on the design forces acting on a telecommunication tower. [6]

"Optimal Design of the Monopole Structures Using the CBO and ECBO Algorithms" (2017) Ali Kaveh, Vahid Reza Mahdavi, Mohammad Kamalinejad

This research presents two recently developed meta-heuristic algorithms, which are called Colliding Bodies Optimization (CBO) and Enhanced Colliding Bodies Optimization (ECBO), for size optimization of monopole steel structures. The design procedure aims to obtain minimum weight of monopole structures subjected to the TIA-EIA222F specification. Two monopole structure examples are examined to verify the suitability ofthe design procedure The outcomes of the enhanced colliding bodies optimization (ECBO) are also compared to those of the standard colliding bodies optimization (CBO) to illustrate the importance of the enhancement of the CBO algorithm. [7]

3. CONCLUSION

Based on the above literature review, it has been observed that, various study has been done on different heights and loading condition of tower. Traditional lattice tower requires more land space and more material for installation than compared to monopole tower. Therefore, monopole prove to be better alternative for telecommunication towers, than conventional lattice tower.

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