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A Review on Analysis and Design of Transmission Tower

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Abstract: ***The structural planning and design process involves not just imagination and intellectual thinking, but also a thorough understanding of structural engineering science, as well as practical knowledge of modern design codes and bye laws, as well as a wealth of experience, intuition, and judgement. The goal of standards is to ensure and improve the safety of people and the environment. Tower is a steel structure developed by maintaining a delicate balance between economics and security. The transmission tower, in particular in order to establish a comfortable environment, the first thing that must be considered is safety. For the benefit of the beings in the immediate vicinity As a result, the transmission tower must be built and maintained properly. Therefore, the transmission tower has to be constructed with a proper care and maintenance. By normal designing and analysis of the tower it requires a more time so we adopt different softwares to obtain the results. So, analysis and designing of a transmission tower is done by "STAAD.Pro V8i".***

Keywords: Transmission Line Tower, Analysis, Design, Staad-pro.

I. INTRODUCTION

Transmission towers are required for the distribution of power across the country. As a result, more power stations are being built and placed in strategic locations. System interconnections are also growing in order to increase accuracy and efficiency. Any natural disaster can cause transmission lines to fail if they are not planned appropriately. As a result, it must be stable and well-designed to avoid failure in the event of a natural disaster. It must also meet all applicable national and international regulations. A transmission line's structural and electrical aspects should be considered during planning and design. Insulation and safe clearances of power carrying cables from the ground are the most critical requirements from an electrical perspective.

Transmission line towers account for almost 40% of the total cost of a transmission line. The choice of an optimal form, as well as the appropriate sort of bracing system, goes a long way toward producing a cost-effective transmission line tower design. Electricity is the primary source of power for industry, businesses, and homes. Because of infrastructure development, the demand for energy is increasing due to rapid growth in the industrial region. Electricity is now being used for rail transportation instead of fuel-powered engines due to lower costs. As a result, it is necessary to transfer the high voltage to the area in demand, which necessitates the installation of a transmission line tower to carry Extra High Voltage (EHV).

II. PROBLEM STATEMENT

A 220 kV single circuit transmission line with suspension towers which is situated in wind zone II is selected for the study. Modelling, design and analysis is carried out on STAAD Pro. Software.

III. OBJECTIVES

A. To analyse and design a steel transmission tower.
B. To study the suspension type transmission tower of capacity 220kV.
C. To optimize the tower model using STAAD Pro. Software.
D. To compare the transmission towers in different wind zones.

IV. LITERATURE REVIEW

Gopi Sudam Punse [14] (Analysis and Design of Transmission Tower) In this thesis, the analysis and design of a narrow-based Transmission Tower (using Multi Voltage Multi Circuit) is carried out in India, with the goal of maximising the use of electrical supply with limited ROW and an increasing population. Transmission Line Towers contribute to 28 to 42 percent of the total cable cost. The increased demand for power is frequently handled more cost-effectively by designing various light-weight transmission tower layouts. In this project, a battle has been waged to make the cable more cost-effective while keeping in mind the goal of providing the best possible electric supply for the defined area by identifying a unique transmission tower structure. The goal of this study is to increase the current geometry by using a 220KV and 110KV Multi Voltage Multi Circuit with narrow based Self Supporting Lattice Towers. STAAD PRO v8i was used to accomplish the analysis and design.

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Vikas Gahlawat [12] (Analysis and Design of a 25-Metre-Tall Steel Transmission Tower) The analysis and design of a steel lattice tower used for electricity transmission systems is done in this paper under various categories of gravity and lateral loads. The tower is analysed under a variety of load conditions before being designed according to IS 800:1984. In order to plan the design process most correctly, proper site research data as well as environmental impact assessment data are collected prior to the design process using appropriate electronic and paper media. During the design, relevant safety design aspects are considered, taking into account the hilly slope terrain of the location (Shimla). During the design process, non-linear imperfections in both the surroundings and the structural material are taken into account. The steel angles that were riveted together were chosen for their various purposes and load impacts. The geotechnical investigation data is used to determine the foundation details. STAAD.Pro 2008 was the software tool utilised in the process. The load calculations were performed manually, however STAAD.Pro 2008 was used to acquire the analysis and design outputs. At all times, the goal is to create the most safe design possible while keeping cost in mind.

N. Mahesh [7] (Design & Estimation of Electric Steel Tower) The main analysis and design of a convergent based Electrical Steel Tower utilising STAAD are presented in this study. This is done with the goal of giving the maximum amount of electric supply with the available ROW while keeping the expanding population in the area in mind. Electrical Steel tower lines cost roughly 30-48 percent of the overall cost of the lines to build. Due to the growth in demand, lightweight constructions will be developed, which will have lower loads on the structure due to a reduction in self-weight. In examining the tower's design and estimation, the structure chosen becomes crucial. In order to make the electrical tower more cost effective than the standard ones, a small analysis was conducted. In a single electrical steel tower, the best electric supply for the needed area is also taken into account. The construction may include 230 KV and 120 KV multi-voltage circuits, as well as self-sustaining towers that are created depending on the geometry. STAAD. Pro is used to assess and design an electric steel tower, which is also known as a steel lattice tower, for any load magnitude or orientation. It is necessary to construct three-dimensional structures of tower members. The new edition of the code is the design of steel structures based on Indian standard code IS: 800-2007 under limit state design. The foundation design of an electric steel tower is also carried using Hansen's method in this study. In addition, a total cost estimate for the construction of an electric steel tower has been completed.

Patil B.Y. [9] (Design and Analysis of Transmission Line Tower using Staad-Pro) This research compares three types of bracings and focuses on estimating a feasible transmission line tower for various wind speeds by developing transmission line towers with hot rolled sections. 220 kV twin circuit self-supporting transmission towers with square bases are employed for this purpose. STAAD PRO is used to analyse this transmission tower, which is subjected to wind loads in Zones II, III, and IV. The load calculation for the analysis is performed in accordance with IS 802:1995. Finally, wind speed is used to compare the best transmission tower design utilising hot-rolled steel.

Anshu Kumar Pal [15] (Comparative Analysis of Transmission Tower Using XX and XBX Bracing Systems in Different Wind Zones) In this work, Using STAAD Pro. V8i software, an improved steel bracing system is recommended in the construction of transmission line towers. According to IS 802 (Part-1 / Sec-I):1995, two bracing systems, XX and XBX, are being compared in all six wind zones of India, employing seven different load circumstances. STAAD Pro V8i software is used to model and analyse the structural behaviour of the tower for both bracing systems. In all wind zones of India, the XBX – bracing system was determined to be more cost-effective than the XX – bracing system.

Yasaswini [13] (Multi Voltage Multi Circuit Transmission Tower Design to Reduce Right of Way) An novel strategy for reducing the ROW width in MVMCT design is proposed in this research. A case study on MVMCT with three different voltages (400kV/220kV/33kV) was conducted, and it was shown that the proposed design is both technically superior and cost effective. When compared to traditional broad base towers, the ROW width is lowered to 40 (from 48) metres, resulting in significant cost savings when a transmission line is considered. MVMCT boosts transmission capacity as well. Within the ROW, the EMFs are also within the permitted limits. All of the stresses are within the acceptable range. When ROW is restricted, cost savings might range from 30 to 50%. As a result, MVMCT with a small basis could be a breakthrough in India, both in terms of economics and the reduction of legal concerns related to land.

V. METHODOLOGY

Steel transmission tower design is done in stages. The first stage involved gathering and compiling soil research and geotechnical data, as well as environmental data such as wind speed, topography, and terrain characteristics. The second phase involved doing design calculations to ensure that the structure could withstand a variety of stresses and loads. The tower was then designed using STAAD Pro. The tower was then tested to see if it could handle various loads. Finally, the tower design was chosen for maximum safety at the lowest possible cost.

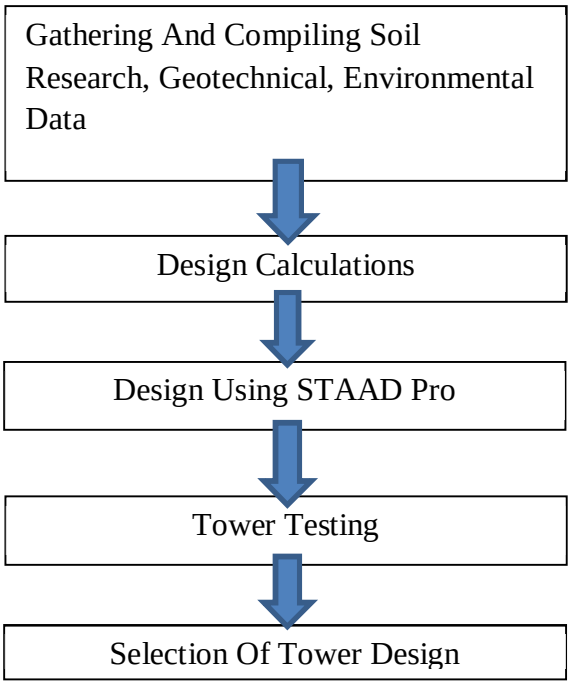


Fig. 1 Flow Chart Of Methodology

VI. CONCLUSION

The precise planning and better implementation of the project require the assimilation of field investigation data. The goal of this project was to demonstrate how to use the advanced structural tool STAAD.pro to solve complex engineering issues involving beams and nodes with ease and in a short amount of time. Following conclusions can be made:

A. Least weight of the tower implies greatest economy in the transmission line cost.
B. The wind force normal to cables was found to the worst of all. The design given by STAAD.pro has been found to be complying with IS-800: 1984 and all the members were safe.
C. XBX – bracing system is found to be optimum and economical in design of electrical transmission line towers in both strength and cost of material required in comparison to XX – bracing system.

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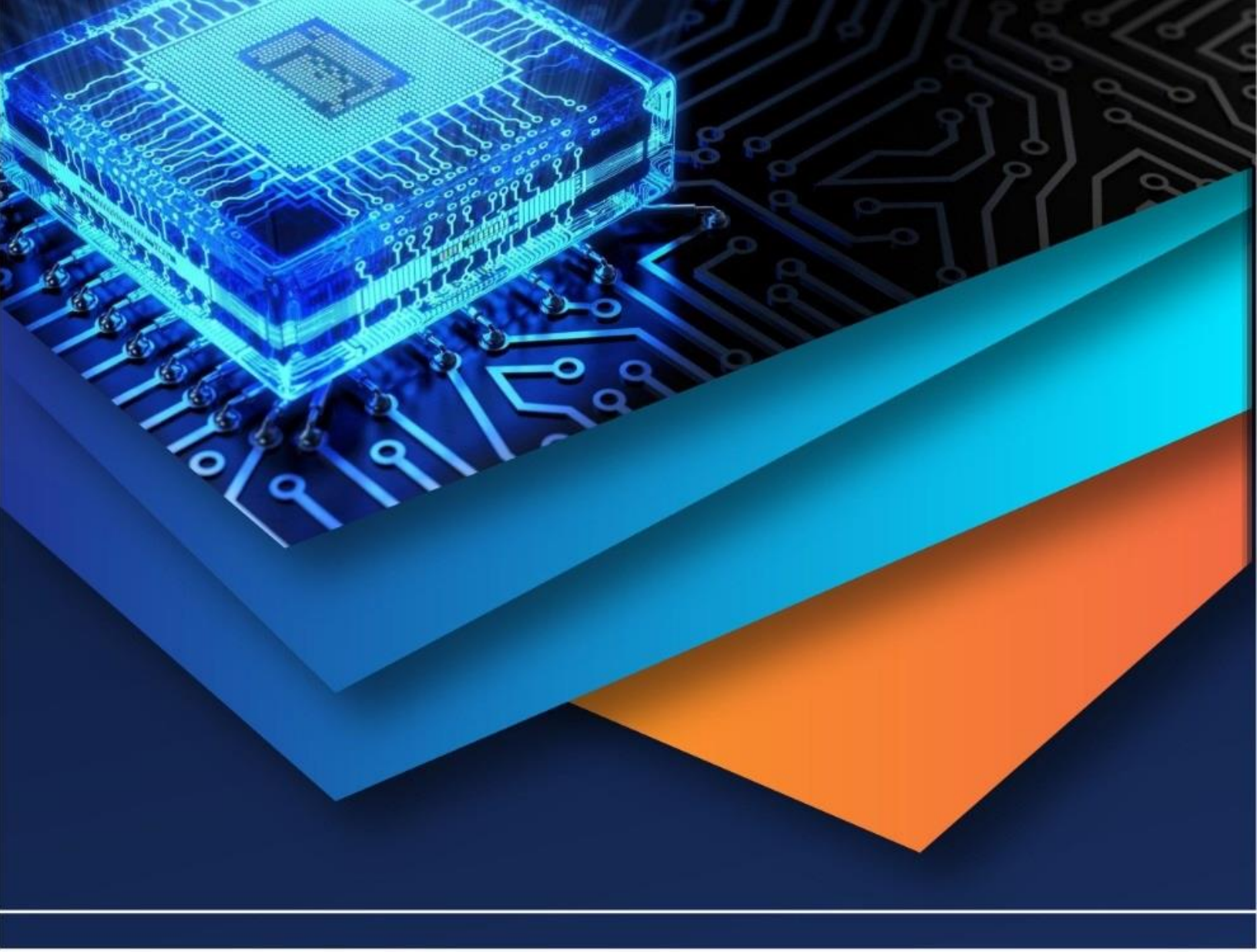
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