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Design of Transmission Tower with Three Different Configurations on the Basis of Different Bracing Systems

Priyanka Soni, Deeksha Shirotiya, Abhay Kumar Jha

Department of Civil Engineering, Lakshmi Narain College of Technology, Bhopal, Madhya Pradesh, India

ABSTRACT
A transmission line is an integrated system made up of one subsystem for each type of support structure, a conductor subsystem, a ground wire subsystem, and a ground wire subsystem. Transfer line mechanical supports are a major component of the line's cost and are crucial for the efficient transmission of power. They are designed and constructed in wide variety of shapes, types, sizes, configurations and materials. The supporting structure types used in transmission lines generally fall into one of the three categories: lattice, pole and guyed. The supports of EHV transmission lines are normally steel lattice towers. The cost of towers constitutes about quarter to half of the cost of transmission line and hence optimum tower design will bring in substantial savings. A transmission line tower's cost-effective design is greatly influenced by the choice of the ideal form and the appropriate.

KEYWORDS: *transmission, subsystem, power, efficient, mechanical, design*

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I. INTRODUCTION
A transmission line tower's cost-effective design is greatly influenced by the choice of the ideal form and the appropriate type of bracing system. The user sets the tower's height, and the structural designer is responsible for creating the general layout, member details, and joint details. Every designer aspires to create the greatest (optimum) systems possible. But due to practical limitations, this was only possible by a successful combination of intuition, experience, and numerous failed attempts. India has a large population residing all over the country and the electricity supply need of this population creates requirement of a large transmission and distribution system. Also, the disposition of the main sources of electrical power generation, namely coal and hydro potential, are highly uneven, which raises the need for transmission once more. A transmission line is an integrated system made up of one subsystem for each type of support structure, a conductor subsystem, a ground wire subsystem, and a ground wire subsystem. Transfer line mechanical supports are a major component of the line's cost and are crucial for the efficient transmission of power

OBJECTIVES OF THE PRESENT WORK
- To design transmission tower with three different configurations (on the basis of different Bracing Systems) for a given scenario and selecting the most economical design.
- Towers in plain and hilly regions will be considered, in two separate stages.
- Parameters for comparison are:

Weight of Tower
Various Stresses
Foundation
Cost (Member cost, Joint cost, Labour cost

II. Literature review
Akbari et al. (2015) assessed seismic vulnerability of steel X-braced and chevron-braced Reinforced Concrete by developing analytical fragility curve. Investigation of various parameters like height of the frame, the p-delta effect and the fraction of base shear

for the bracing system was done. For a specific designed base shear, steel-braced RC dual systems have low damage probability and larger capacity than unbraced system. Combination of stronger bracing and weaker frame reduces the damage probability on the entire system. Irrespective of height of the frame, Chevron braces are more effective than X-type bracing. While it is preferable to distribute base shear equally between the braces and the RC frame in an X-type bracing system, a higher base shear share should be given to the braces in a Chevron braced system. The damage probability is increased by 20% for shorter dual systems and by 100% for taller dual systems when the p-delta effect is taken into account. With lower PGA levels, the p-delta impact becomes more pronounced.

Atif1 et al. (2015) The comparison of seismic analyses of G+15 buildings with bracing and shear walls is the main topic of the research. In Zones II, III, IV, and V, the building's performance is evaluated. In order to attain their suitable behaviour under future earthquakes, the study comprises identifying the primary consideration factor that causes the structure to perform poorly during earthquakes. The structure under analysis is symmetric, G+15, and an ordinary RC moment-resting frame (OMRF). The structure is modelled using the staad pro. V8i software. The programme is used to obtain the structure's time period in both directions, and seismic analysis in accordance with IS 1893(part 1):2002 has been performed. According to IS 1893(part 1): 2002, the lateral seismic forces of an RC frame are calculated using the linear static approach for various earthquake zones. The goal of the current effort is to comprehend the necessity of earthquake-resistant characteristics on structures in order for them to safely withstand the strong lateral stresses that earthquakes impose on them. Shear walls are beneficial in reducing earthquake damage to structures and in terms of building costs. Additionally, braced frames are capable of absorbing a significant amount of seismic energy. The results of the performance and analysis of the models are then represented graphically, as well as in tabular form, and are compared to determine the best arrangement of three different types of bracing with three different bracing orientations, as well as shear wall, for a building's resistance to lateral stiffness. Base shear, displacement, axial load, moments in the Y and Z directions in columns, shear forces, maximum bending moments, and maximum torsion in beams are all compared.

Kanthariya et al. (2016) In this paper from the table and chart I am conclude in a double diagonal system more effective to compare single diagonal bracing system. Both bracing systems are increase base shear in building and provide more stiffness compare to without bracing system structure. In a earthquake resistant system bracing system more effectively and provide more resistance during a earthquake. Bracing system is less costly and complex compare to damping system and other earthquake resistant techniques. When establishing a Comparison of bending moment of both bracing systems. Deflection in single and diagonal bracing systems is shown in Table 1 and Chart 1. When compared to a double diagonal bracing system, single diagonal systems exhibit greater deflection, which causes jerk. Shear force is depicted in single and diagonal bracing systems in table 1 and chart 1. The base shear is high in the top of the single diagonal bracing system and average from floor to floor, as shown quite clearly in the chart. Shear force is now increasing with respect to floor height in the double diagonal bracing system and approaching single diagonal bracing in comparison. The bending moment diagram in single and diagonal bracing systems is shown in table 1 and chart 1.

Qiu and Zhu (2016) investigated seismic-resisting, multi-story steel frames with self-centering braces (SCBs) numerically through pushover and incremental dynamic analyses. The seismic performance of self-centering braced frames (SC-BFs) is systematically compared with that of buckling-restrained braced frames (BRBFs), with emphasis on high-mode effect. The concentration of inter-story drift in the upper part of the buildings is more significant in SC-BFs than in BRBFs as a result of this effect. This high-mode effect strengthens with the increasing intensity of ground motions. Parametric studies indicate that increasing the post-yield stiffness ratio and/or energy dissipation capacity can successfully improve the seismic performance of SC-BFs, particularly in terms of limiting the high-mode effect. SC-BFs with enhanced post-yield stiffness and energy dissipation capacity exhibit relatively uniform inter-story drift ratios and reduced record-to-record variability in seismic performance.

Pathak et al. (2016),considered and examined G+9 steel mounts with a diverse variety of bracing configuration and altered combination of soft-story by means of software STAAD Pro. In contrast to limitations like column shift, defined deflection, story drift, maximum bending moment, maximum axial force, and maximum shear force, the effect of these modified bracings on the soft story is planned for.

Bhojkar and Bagade (2015), elevated-rise development was evaluated for seismic risk using a steel bracing method. Use of steel is recommended for seismically deficient reinforced concrete mounts Vol-7 Issue-5 2021 www.ijariie.com IJARIIE-ISSN (O)-2395-4396 15245 There are 92 bracing systems that are ready to solidify. The investigation makes use of a variety of bracing structures and completes a seismic assessment for seismic area III in accordance with IS1893:2002. The main restrictions that are taken into consideration are adjacent movement, story drift, axial force, and base shearIt was believed that the X kind of steel bracing supplemented the mechanical toughness and that excessive inter-story drift of the casings also grows condensed. The bracing system produces the best results in terms of lateral rigidity, power aptitude, and movement capacity. They discover that the adoption of X type of bracing arrangement results in a drop in lateral movement of the assembly that is up to 65%. In X kind of bracing mechanism, narrative wander decreases. Axial force for the X bracing system increased by up to 22%.

Srivardhan et al. (2016) Four distinct plan shapes, including a square, rectangle, plus, and a T shape, are taken into consideration for typical 20 and 30 story structures with an area of 40 m x 40 m and a span of 4 m. Using the load combinations listed in the IS code book, each building is examined for its vulnerability to wind and earthquake loads. For the bottom and upper halves of the structure, three types of bracing are used: a steel X-bracing system, a concrete shear wall system, and a combination of the three. Rectangular buildings deflect less than square buildings along shorter base dimensions, but more strongly along longer base sides.

Pate et al. (2017) The need of making the structure safe against lateral load is increased for high-rise buildings made of RCC frames. The causes of these loads include earthquakes, wind, and others. Various steel or RCC bracing solutions are offered to resist lateral loads occurring on buildings. RCC bracing may offer advantages over other bracing, such as greater stiffness and stability. The goal of this study was to compare various RCC bracing systems under seismic activity in tall buildings. Moment Resisting Frames (MRFs), X-Braced Frames (XBFs), and V-Braced Frames (VBFs) are three additional structural configurations employed in this paper for an 11-story (G+10) building. The bracing systems that are available around the column's perimeter. Software is used to examine the frame models in accordance with IS: 1893-2000. The parameters which are considered in this paper for comparing seismic effect of buildings are base shear and storey displacement. The results showed that X-braced frames are more efficient and safe at time of earthquake when compared with moment resisting frames and V-braced frames.

III. Analysis in Staad pro

The process of analysis and design of structure performed on STAAD–Pro V8i is shown through Flow Chart in figure 1.

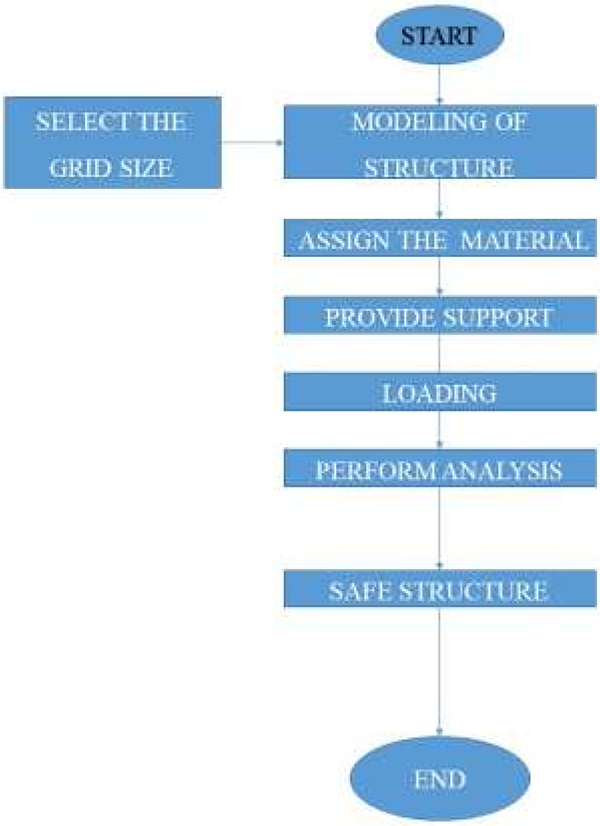

Fig 1 Flow Chart Model analysis of Staad Pro

IV. Conclusion

Based on the above study following conclusions can be made:

- The cost of the tower is directly proportional to the number of joints required because of increased number of bolts, gusset plates, and man-hours.
- Difference in the foundation parameters is not substantial, therefore this does not affect the total cost to a large extent.

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