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ANALYTICAL STUDY ON VARIOUS BRACING SYSTEM FOR TRANSMISSION TOWER

Ms. Monisha R[1], Mrs. Usha K N[2]

[1]Student, Master of technology, Department of Civil Engineering, East West Institute of Technology, Bangalore.
[2]Assistant Professor, Department of Civil Engineering, East West Institute of Technology, Bangalore.

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Abstract- Transmission line towers and monopoles. Transmission line towers and monopoles are often used for high steel structures used for electric transmission. The transmission line tower or monopole should be carefully planned so that they won't fail over their whole lifespan and should be followed both nationally and internationally. This paper describes the transmission tower for different spans, such as 3m, 5m, 7m, and 9m, and with 3 types of bracing systems (K, X, and K & X). Comparing each brace with each other and observing the displacement of each tower to bring out the best self-supporting and most economical transmission tower based on the displacement values. The results show that displacement was observed to be high in K-bracing and low in K & X bracing combined.
Keywords. Transmission tower, K-bracing, X-bracing, K & X bracing.

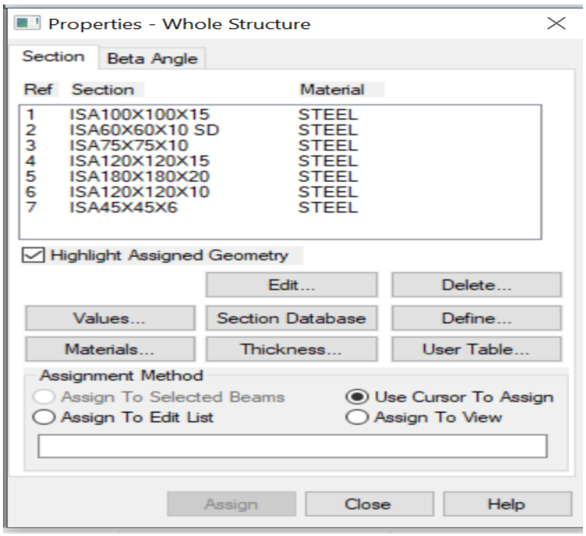
1. INTRODUCTION:

Electric force utilization has become more and more necessary in every country, with developing countries showing a greater pace of interest. Transmission tower lines are one of the most significant life-line infrastructure projects. Transmission towers are necessary for flexible power distribution across the nation's many regions. Due to this, the organization of intensity stations has changed, and as a result, there are now more power transmission lines connecting the various producing stations with the many regions where it is needed. Interconnections between frameworks are also growing in order to increase consistency and economy. Transmission line should be steady and painstakingly structured with the goal that they don't fall flat during catastrophic event. It ought to likewise comply with the national and worldwide norm. In the arranging and plan of a transmission line, various prerequisites must be met from both auxiliary and electrical perspective.

From the electrical perspective, the most significant necessity is protection and safe clearances of the force conveying conveyors from the ground. The cross-section of the transmitters, the spacing between conduits, and the location of the ground wires in relation to the channels will all influence the design of the towers and installations. Transmission line components such as conduits, ground wires, protection, towers, and institutions are crucial. Transmission lines are frequently built for wind. One proceeds with a research of the powers in various people with the aim of mending their sizes once the external burdens following the peak are resolved. Because the major power source for a bracket component is the hub, the part should be designed for either pressure or strain. Certain persons may be subjected to both compressive and tractable powers under diverse stacking configurations when there are many heap conditions. Inversion of burdens may likewise actuate exchange nature of powers; thus these individuals are to be intended for both pressure and tension. The complete power following up on any individual part under typical condition is duplicated by the comparing element of wellbeing, and it is guaranteed that the qualities are inside the passable extreme quality of the steel is used.

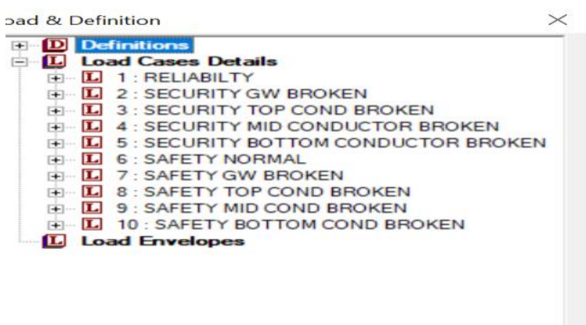
2. MODELLING & ANALYSIS:

In the present study, 12 models (A, 1A, 2A, B, 1B, 2B, C, 1C, 2C, D, 1D & 2D) are considered which are created using STADD Pro software, where in each models have different bracing systems Model A- (K Bracing with 3m base width), Model 1A- (X Bracing with 3m base width), Model 2A- (Combination of X&K Bracings with 3m base width), Model B- (K bracing with 5m width), Model 1B- (X bracing with 5m base width), Model 2B- (Combination of X&K with 5m base width), similarly Model C&D with 7&9 base with respectively. Height of each model is 34m.



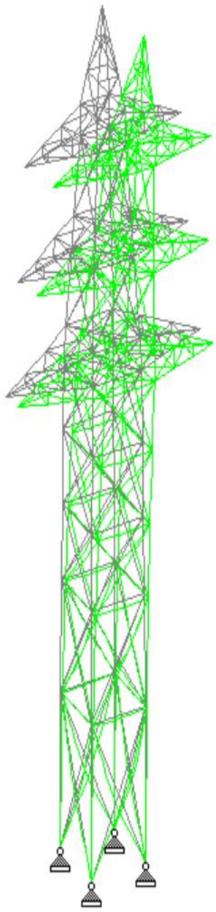
Material Properties

Loads Applied

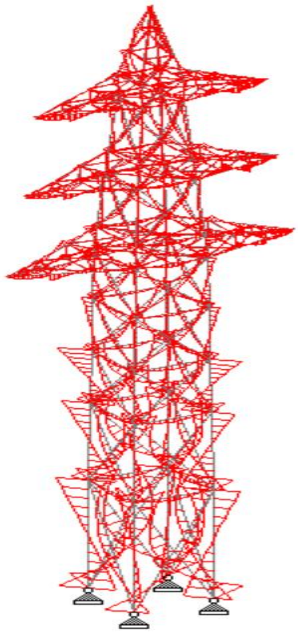


Step by Step Procedure for Analysis of Transmission Tower

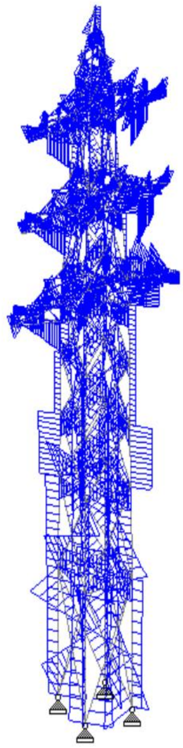
1. Steel Structure (Transmission Tower) is Modelled in STAAD Pro.
2. Material Properties & Loads are assigned to the models.
3. Models are analysed and 3 different zones i.e zone 2, 3, 4 & 5.
4. Results are extracted from each model (i.e Displacement, Base Shear & Bending moment).



Displacement



Bending Moment



Shear Force

3. RESULTS:

Maximum Displacement in the X Direction.

Type of bracing	Displacement in X- direction			
	3m	5m	7m	9m
K- type bracing	68.852	48.585	31.122	26.04
X- type bracing	64.934	37.733	30.304	24.901
K & X type bracing	65.32	37.582	30.375	25.181

Table 1 Displacement in X-direction

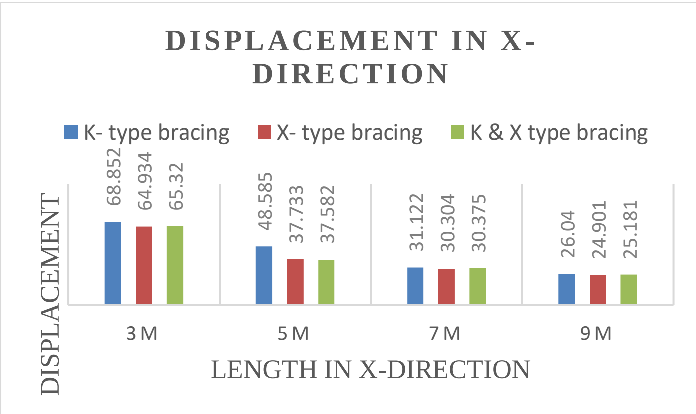


Figure: Displacement in X-direction

The results for 3m span displacement in X-direction were obtained comparing K-bracing with K & X bracing. They were observed to be reduced by 5% compared to that of K-bracing, and comparing X-bracing with K & X bracing, there was an increase of 1% compared to X-bracing.

Maximum Displacement in the Z Direction.

Type of bracing	Displacement in Z- direction			
	3m	5m	7m	9m
K- type bracing	27.937	10.441	17.106	14.982
X- type bracing	23.48	16.277	14.335	12.87
K & X type bracing	24.499	17.573	16.066	14.956

Table 2 Displacement Z-direction

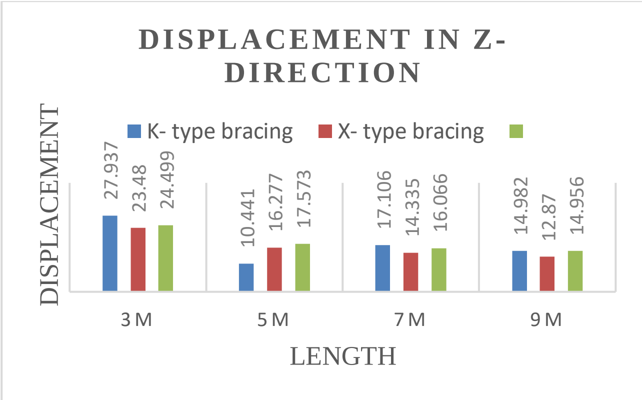


Figure: Displacement in Z-direction

The results for 3m span displacement in Z-direction were obtained comparing K-bracing with K & X bracing. They were observed to be reduced by 14% compared to that of K-bracing, and comparing X-bracing with K & X bracing, there was an increase of 4.2% compared to X-bracing.

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Maximum Base shear in the X Direction.

Type of bracing	Base-shear in X- direction			
	3m	5m	7m	9m
K- type bracing	78.231	112.872	78.232	78.233
X- type bracing	78.232	78.232	78.232	78.231
K & X type bracing	78.232	78.231	78.232	78.232

Table 3 Base shear in X-direction

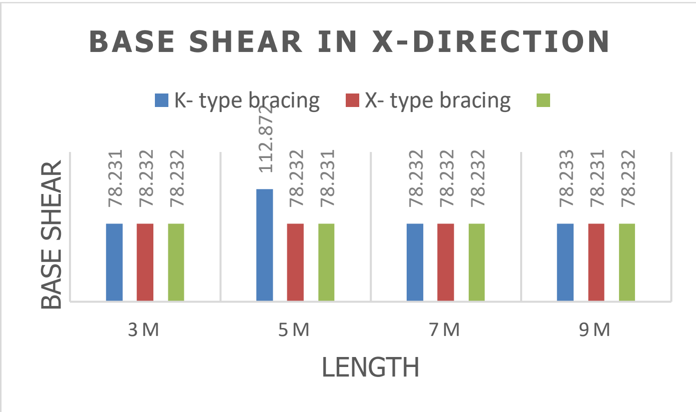

Figure Base shear in X-direction

Maximum Base shear in the Z Direction.

Type of bracing	Base-shear in Z- direction			
	3m	5m	7m	9m
K- type bracing	11.9	11.9	11.9	11.9
X- type bracing	11.9	11.9	11.9	11.9
K & X type bracing	11.9	11.9	11.9	11.9

Table 4 Base shear in Z-direction

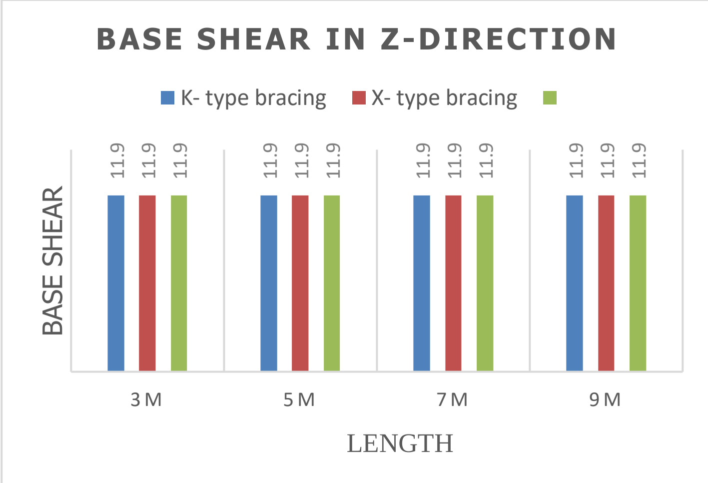

Figure *Base shear in Z-direction*

The base shear in both X and Z directions was observed to have no variations in terms of X-bracing, K-bracing, and X & K bracing combined.

4. CONCLUSION:

1. The displacement results for 3m, 5m, 7m & 9m span bracings were compared in such a way that K-bracing was compared with K & X bracing. Similarly, X-bracing was compared with X & K bracing. Similarly, even for base share, the results are compared.

2. The results for 5m span displacement in x-direction were obtained comparing K-bracing with K & X bracing. It was observed to be reduced by 23% compared to that of K-bracing, and comparing X-bracing with K & X bracing, it was further reduced by 0.4% compared to X-bracing. The results for 5m span displacement in Z-direction were obtained comparing K-bracing with K & X bracing. They were observed to be reduced by 40% compared to that of K-bracing, and comparing X-bracing with K & X bracing, it was further increased by 7.4% compared to X-bracing.

3. The results for 7m span displacement in X-direction were obtained comparing K-bracing with K & X bracing. They were observed to be reduced by in 2.4% compared to that of K-bracing, and comparing X-bracing with K & X bracing, there was an increase of 0.2% compared to X-

bracing. The results for 7m span displacement in X-direction was obtained comparing K-bracing with K & X bracing were observed to be reduced by 6.5% compared to that of K-bracing, and comparing X-bracing with K & X bracing, there was an increase by 10% compared to X-bracing.

4. The results for 9m span displacement in X-direction were obtained comparing K-bracing with K & X bracing. They were observed to be reduced by 3.3% compared to that of K-bracing, and comparing X-bracing with K & X bracing, there was an increase of 1.1% compared to X-bracing. The results for 9m span displacement in Z-direction were obtained comparing K-bracing with K & X bracing. They were observed to be reduced by 0.2% compared to that of K-bracing, and comparing X-bracing with K & X bracing, there was an increase of 14% compared to X-bracing.

5. The base shear in both X and Z directions was observed to have no variations in terms of X-bracing, K-bracing, and X & K bracing combined.

6. By comparing the above obtained results displacement in X-direction is less for larger width when compared to smaller widths and the displacement in Z- Direction approximately same for considered widths.

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