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ANALYSIS AND DESIGN OF TRANSMISSION TOWER USING STAAD. PRO V8I

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ABSTRACT

Transmission towers are critical components of electrical power distribution systems, providing support for high-voltage power lines. The structural integrity and reliability of these towers are of paramount importance to ensure uninterrupted power transmission. This abstract provides an overview of the analysis and design of an X-bracing transmission tower using STAAD Pro V8i, a powerful structural analysis and design software.

Keywords: Transmission Tower, Geometry Of Tower, STAAD Pro V8i, X-Bracing, Wind Load.

I. INTRODUCTION

One of the most essential lifeline structures is the transmission line tower. Transmission Tower are required to provide power to different parts of the country. This project's goal is to demonstrate the most economical bracing for a transmission tower when it is subjected to varying loads. Bracings join the legs together to provide stability and evenly transfer the load between the legs and the ground. The height of the tower is fixed by the user. When planning and designing a transmission tower, many requirements must be investigated. A wide variety of shapes, types, sizes, configurations, and materials are used in their design and construction. In this study, transmission towers with square bases that are self-supporting are taken into account and also the tower are designed for wind zone with constant base width. A Displacement, moment, and steel take-off are all the subject of a research. The software STAAD Pro V8i has been used for modeling.

II. METHODOLOGY

The design and construction of a transmission tower involve a well-defined methodology to ensure the structural integrity and reliability of the tower. Here is a typical methodology for the design and construction of a transmission tower. STAAD Pro V8i software important role play on the transmission tower for modeling. The tower are modeled by using x- bracing. Bracing by using Indian angle section with the properties in the tower element. The total height of tower is 40m.

III. MODELING AND ANALYSIS

A. Transmission Tower configuration

Table 1. Tower Configuration

Total height of the tower	40m
Length of the cross arms	6.10m
Base width of the tower	10.97m
The geometry of the tower	Square base

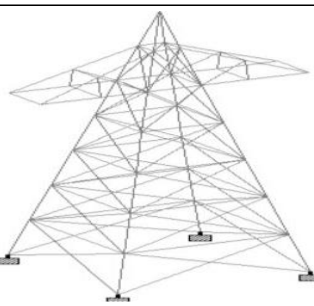

Figure 1: Transmission Tower

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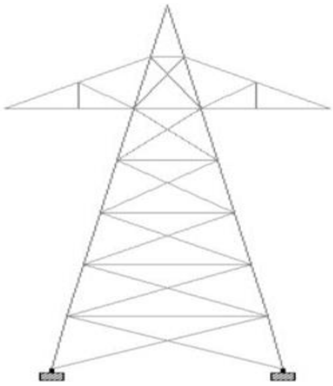

Figure 2: Elevation of the tower

B. ASSIGNING SUPPORT

At the transmission tower's four legs, which are firmly fastened to the base, fixed supports are offered.

C. ASSIGINING LOADS

The load acting on the tower are:

1. Dead load -Self- weight of the tower. Figure 3 show the assigning of dead load.

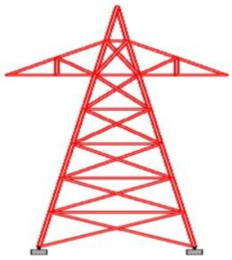

Figure 3: Assigning dead load

2. Live load -Nodal load of the tower.
3. Wind load calculate as per ASCE-7

Intensity VS Height

Table 1. Wind table

SN.	Int(KN/m2)	Height(m)
1	0.059	0
2	0.289	10
3	0.469	30
4	0.58	40

4. Combination of load

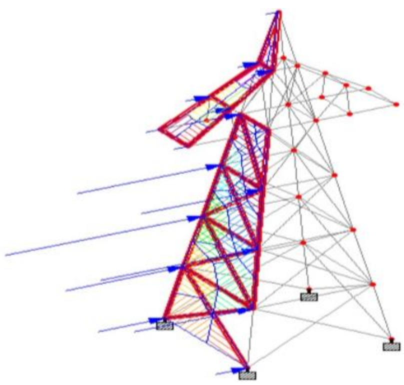

Figure 4: Assigning Wind load in X-Direction

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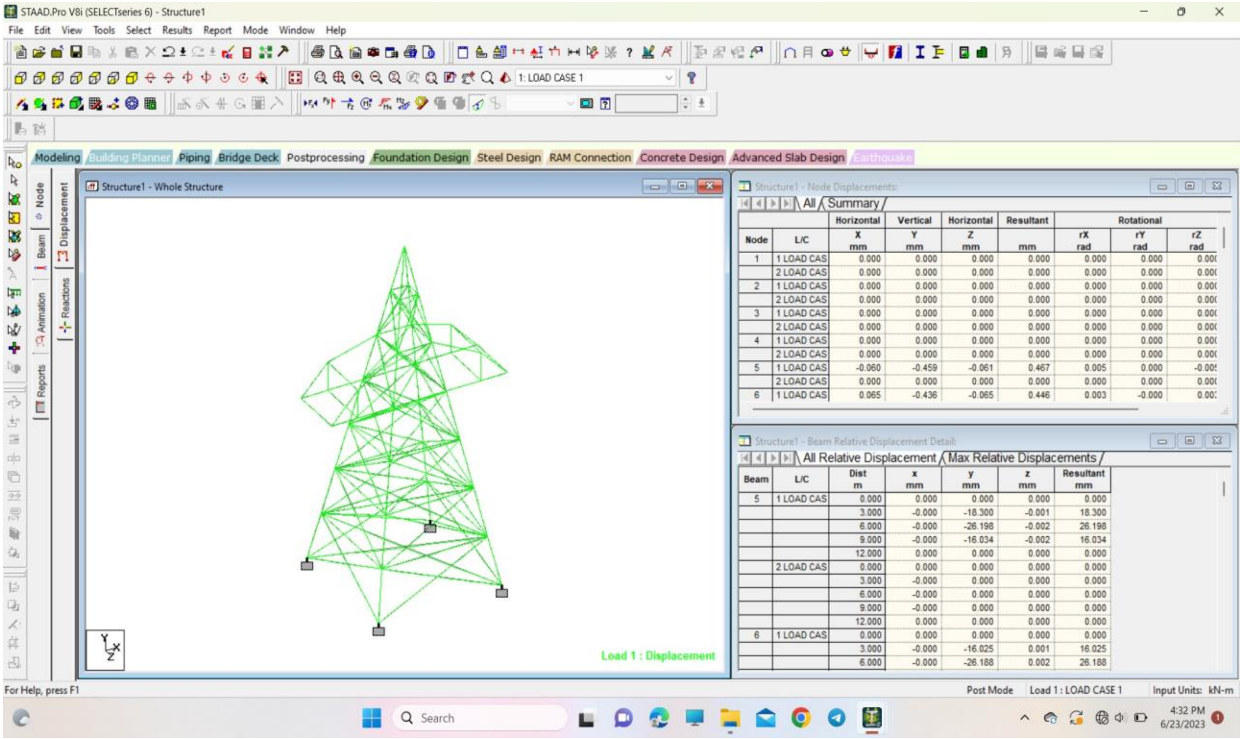
ANALYSIS OF TOWER

Once the loads have been assigned to the structure, analysis is carried out to measure the displacement, moment, and steel takeoff to ascertain the economic section. STAAD Pro software can produce design after analysis.

IV. RESULTS AND DISCUSSION

Different value of displacement from STAAD Pro V8i.



LOADING 1:

- X = -5.35218E-03 cm at node 12
- Y = -1.00034E-01 cm at node 39
- Z = 1.37158E-01 cm at node 6
- RX = -7.79453E-04 radians at node 12
- RY = 1.24088E-05 radians at node 33
- RZ = -8.10977E-04 radians at node 12

In Loading 1, the maximum displacements include significant vertical (Y) and upward (Z) displacements, indicating the structure's response to the applied load.

LOADING 2:

- X = -2.26501E-03 cm at node 34
- Y = -9.16978E-03 cm at node 39
- Z = 4.38774E-03 cm at node 6
- RX = 2.51449E-06 radians at node 39
- RY = 6.86302E-07 radians at node 33
- RZ = 1.94776E-05 radians at node 39

In Loading 2, the displacements are relatively smaller than in Loading 1, indicating a less severe response to the load.

LOADING 3:

- X = 7.49257E-02 cm at node 6

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- Y = 1.92847E-02 cm at node 40
- Z = -1.46673E-03 cm at node 9
- RX = -2.50112E-06 radians at node 34
- RY = -2.48384E-06 radians at node 6
- RZ = -2.66830E-05 radians at node 6

Loading 3 results in relatively large displacements in the X and Y directions, suggesting significant horizontal movements.

LOADING 4:

- X = -6.36634E-02 cm at node 6
- Y = 1.81015E-02 cm at node 34
- Z = -6.64826E-03 cm at node 39
- RX = -1.01171E-05 radians at node 40
- RY = -1.64514E-05 radians at node 34
- RZ = 2.35160E-05 radians at node 6

In Loading 4, the X and Y displacements are significant, indicating horizontal and vertical movements. The angular displacements are relatively small.

LOADING 5:

- X = 1.52440E-03 cm at node 16
- Y = -1.29753E-02 cm at node 9
- Z = 1.09093E-01 cm at node 6
- RX = 5.12709E-05 radians at node 8
- RY = 3.34717E-05 radians at node 44
- RZ = 7.62477E-06 radians at node 38

Loading 5 results in significant vertical (Z) displacement, and relatively small displacements in other directions.

LOADING 6:

- X = -6.36634E-02 cm at node 6
- Y = 1.81015E-02 cm at node 34
- Z = -6.64826E-03 cm at node 39
- RX = -1.01171E-05 radians at node 40
- RY = -1.64514E-05 radians at node 34
- RZ = 2.35160E-05 radians at node 6

Loading 6 is identical to Loading 4, so the results are the same.

V. CONCLUSION

The goal of the current project was to demonstrate how the sophisticated structural tool STAAD.pro might be used to quickly and easily solve challenging engineering problems involving beams and nodes. It has been discovered that, out of all combinations, the load combinations including wind-forces were the most important. The maximum displacements at different nodes and loadings indicate how the structure responds to various applied loads. Engineers use this data to assess whether the displacements are within acceptable limits and if the structure can safely support the loads without structural failure or excessive deformation.

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