Design Of Transmission Tower with various Height by using Cold Form Steel

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Abstract – Transmission tower is a structure set up for the purpose of Transmitting and Receiving power, radio, telecommunication, electrical television and electromagnetic signals.

Cold form steel is structural member cold formed to shapes in rolls or are pressed breaks from carbon or low alloy steel sheets or a strips or flats generally not thiken than 12.5mm. It is also called as light gauge steel . generally most of the transmission line tower have been fabricated from hot rolled steel angle but availability of thinner hot rolled steel section is limited therefore hot rolled steel can be replaced with cold form steel.

Thus by using the cold formed steel , finding out the height of tower suitable for the tower which shows permissible deflection. For the design of transmission towers using cold form steel data is collected from various literature. The constant parameters are confirmed like load acting on the tower, purpose of tower, type of tower.

Models are prepared on staad pro and the loads applied on the tower like dead load, wind load. Seismic load on the tower is neglected. Models are run on the staad pro and the results are obtained. By using cold steel , the transmission tower can design upto 30m height.

Key Words: Transmission tower, cold form steel, Height, staad pro design.

1.INTRODUCTION

The transmission tower is a structure set up for the purpose of Transmitting and Receiving power, radio, telecommunication, electrical television and electromagnetic signals.

In this introduction part we will study the basic difference between hot rolled and cold form steel.

Table.1 Difference between hot rolled and cold form steel.

Facror	**Hot Rolled Characteristics**	**Cold Rolled Characteristics**
Layout Orientation	The material characteristics are identical in all directions.	Care must be exercised in the in layout. The grains of the material are deformed during the rolling process and stay deformed. The material will be stronger with the grain than against the grain.
Price	Less expensive	More expensive
Strength	weaker	stronger
Machinability	Experiences no wrapping when machined	The removal of 100many residue stresses, such as when a large face is fly cut, will throw the material out of the equilibrium and causes deflection and warning.
Surface Finish	Fair to poor. The surface of the material will be covered with carbon scale.	Good . Not as good as ground stock, but much better than hot roll.
Weld ability	Excellent for welding.	Weldable, but material will take on the properties of hot rolled whenever it is welded.
Dimension tolerance of stock	Fair. Deviations from the stated sizes are present due to surface scale and thermal shrinkage.	Good. It is not as accurate as ground stock, but better than hot roll.

Etc.

2. OBJECTIVES OF THIS STUDY:

1) Design of Transmission line Tower using Hot Rolled section can compare with results of existing literature.
2) To investigate the height of the tower by using single angle cold form steel.

3. METHODOLOGY

3.1 Design of Model:

- Constant parameter decided as below:

1. Loads :

a) self-weight

b) wind load

2. Support: three fixed and one partially fixed.

3. Arms: Three Arms

3.2 Load Calculations:

3.2.1 Dead Load:

a) Self Weight (weight of section selected in tower)

b) Weight of conductor = 1.5 KN

c) Weight of rope = 2.5 KN

3.2.2 Wind Load:

Wind region – Pune

Wind Velocity – 39 m/s.

Formula to calculate wind load:

- $V_z = V_b * K_1 * K_2 * K_3$

Where, K1= probability factor (risk coefficient)

K2= Terrain, Height and structure size factor.

K3= Topography factor.

The respective factors are : 1.06, x and 1 respectively.

After the calculation we get the wind load values foe 23m height tower is 1.130 N/m2.

3.2.3 Seismic Load :

Reason to neglect seismic load:

The transmission line tower is a pin jointed light structure comparatively flexible and free to vibrate and max. Wind pressure is the chief criterion for the design. Concurrence of EQ and max. wind conditions are unlikely to take place and further seismic stress are considerably diminished by the flexibility and the freedom for the vibration of the structure. This assumption also line with recommendation given in cl.no. 3.2 (b) IS: 1883-84. Seismic considerations, therefore, for tower design are ignored and have not been discussed in this study.

3.3 Modeling:

3.3.1 Tower Model with 23 meter:

Fig. 1 shows the model of 23 meter height with self weight acting on it.

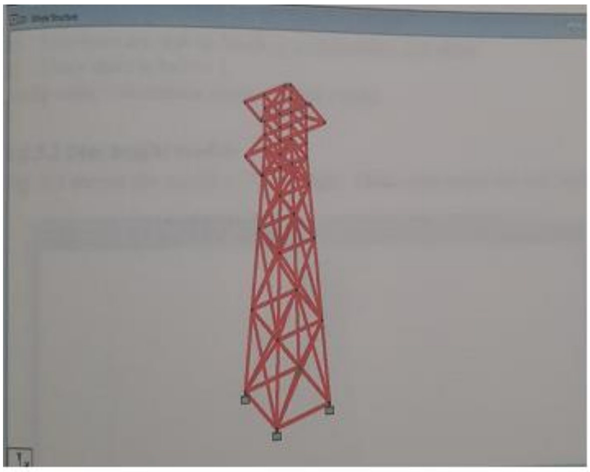

Fig.1 23m height model of tower

Fig. 2 shows the loads acting below

A) Wind load
B) Damper load
C) Rope load
D) Load combination

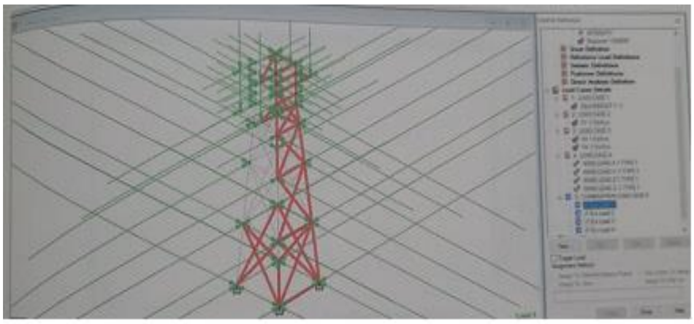

Fig.2 model with combine load

RESULTS:

The results obtained from 23m height are as follows:

a) Deflections are within permissible limit.

b) Members are safe in bending, compression and shear.

c) Unity ratio is below 1.

3.3.2 Tower Model with 27 meter:

Fig. 3 shows the model of 27 meter height with self weight acting on it.

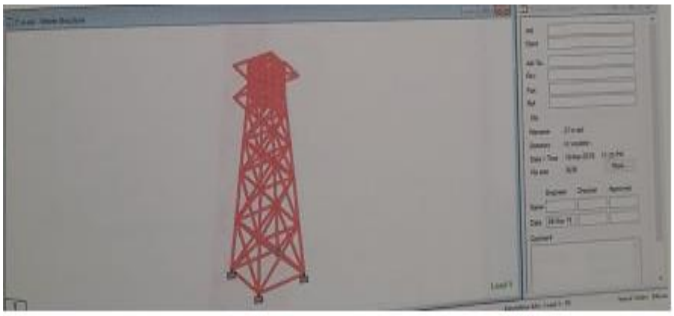

Fig.3 27m height tower model

Fig. 4 shows the loads acting below

E) Wind load

F) Damper load

G) Rope load

H) Load combination

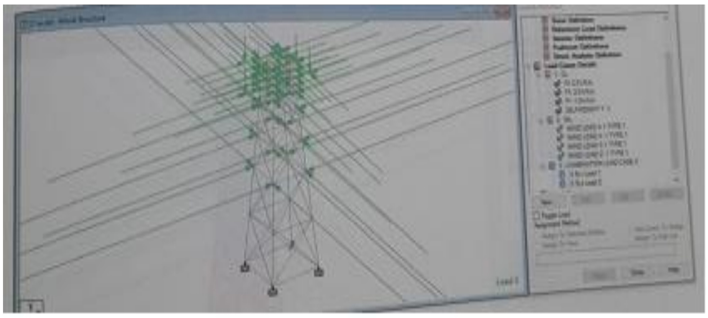

Fig.4 tower model with combination of load

RESULTS:

The results obtained from 27m height are as follows:

d) Deflections are within permissible limit.

e) Members are safe In bending, compression and shear.

f) Unity ratio is below 1.

3.3.3 Tower Model with 30 meter:

Fig. 5 shows the model of 30 meter height with self weight acting on it.

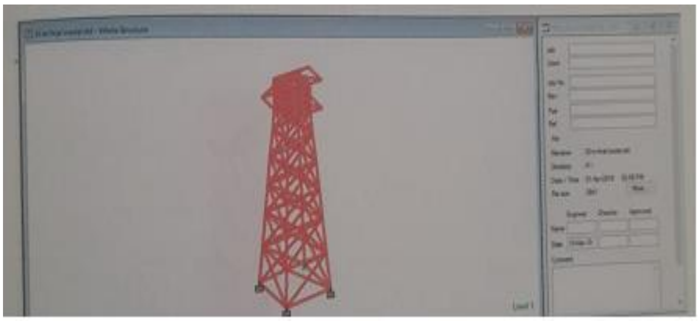

Fig.5 30m height tower model

Fig. 6 shows the loads acting below

I) Wind load

J) Damper load

K) Rope load

L) Load combination

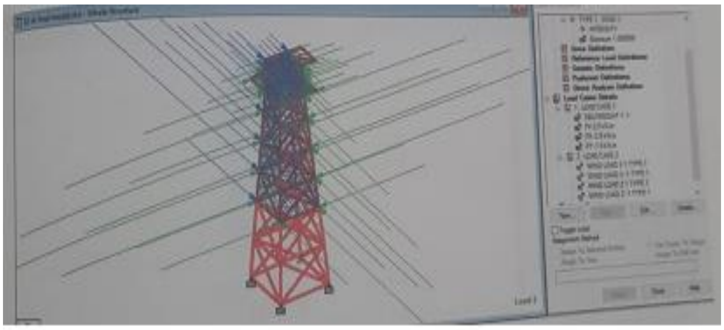

Fig.6 tower model with combination of load

The results obtained from 30 m height are as follows:

g) Deflections are within permissible limit.

h) Members are safe In bending, compression and shear.

i) Unity ratio is below 1.

3.3.4 Tower Model with 31 meter:

Fig. 7 shows the model of 31 meter height with self weight acting on it.

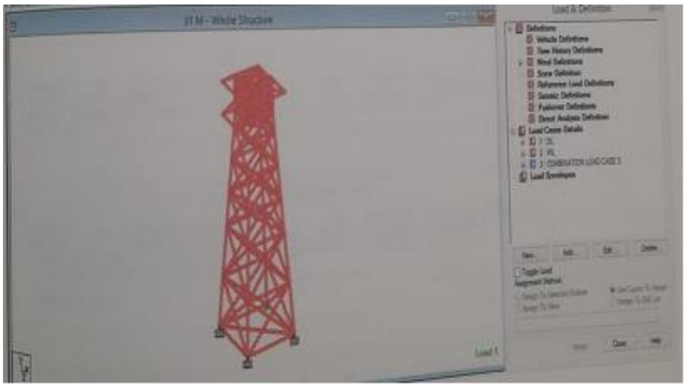

Fig.7 31m height tower model

Fig. 6 shows the loads acting below

M) Wind load

N) Damper load

O) Rope load

P) Load combination

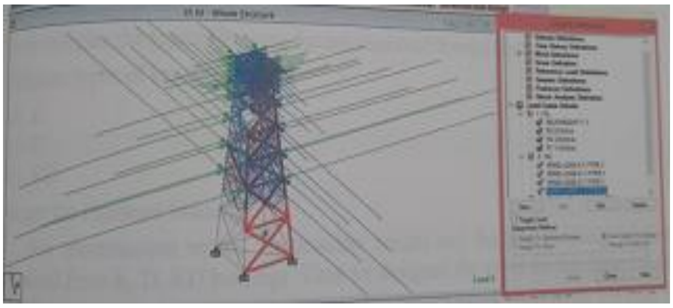

Fig.8 model with combination of load

The results obtained from 31 m height are as follows:

j) Deflections are not within permissible limit.

k) Members are not safe In bending, compression and shear.

l) Unity ratio is above 1.

4. CONCLUSIONS

- By using cold formed steel, we can construct the transmission tower upto 30 meter height.
- By using this cold form steel we can construct the transmission tower in wind zone II , in Pune District.
- The results of this study shows that the transmission tower with height 30 meter is having the deflection within the limit, the members are safe in bending, compression and shear and unity ratio is within the value 1.
- This study is mostly useful for future application in setup formation of transmission towers.

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