International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075 (Online), Volume-9 Issue-5, March 2020

Analysis of Transmission Tower using Stadd Pro

Priya Dhillon, Raghvendra Singh

Abstract*: Present days there are a lot of interest for power in the private and open parts in India has been expanded and to full fill, the interest of power a few activities is being taken by the legislature of India. From the source power to the customer the transmission tower is utilized as a transport framework. Right now, endeavor has been made to investigation a 36 m high transmission tower 3D model with the assistance of STAAD Pro (V8i) programming utilizing the codal arrangements of IS 800:2007 and furthermore the manual count of every part are determined for the examination as per codal arrangements.As per IS 875 (part III) code, the wind zone 3 height 36 m, landscape classification 2 and fundamental wind speed 39 m/sec are considered for the analysis. The damping ratio is 0.05 is also considered in the analysis. The results are concluded in terms of stability against wind force, structural, statically stable of all steel components.

Keywords: Manual calculation, Stadd pro, Transmission tower, Wind analysis

I. INTRODUCTION

Transmission tower line a significant part as far as electric inventory to the city. Transmission steel towers are expected to supply the power from fundamental station to sub stations in different spots. At present, there is a multi-day increment in electrical cables and transmission towers in different all around. The usage of electric force has transformed into a relentlessly critical bit of the economy of mechanical countries. The progression of warm delivering stations, remote hydro-electric force plants and the interconnection of once in the past self-sufficient electric systems have offered rise to the necessity for extra high voltage (EHV) electric transmission lines. Toward the beginning of World War I, 115KV was seen as high voltage. Since that time, load improvement and transmission detachments have extended to where workplaces for 500KV and 800KV transmissions are being assembled. Transmission steel tower is a medium to pass on power loads beginning with one station then onto the following station. The presentation and arrangement of transmission tower are easier than the others steel structures, it is to a lesser extent a visual effect. The summit some portion of transmission tower gives a long-extend view to individuals at or close to the top-level. Transmission lines are the partner join between making stations and passed on structure. From the electrical procedure, the most critical need is assurance and safe .

The analysis of transmission steel tower includes the plain terrain type, wind zone 3, basic wind speed 39 m/sec, self supporting type and square and regular geometry in the analysis.

A. Parts of transmission tower

A complete transmission steel structure which is a combination of various steel members is listed below and depending upon the function these are described:

Pinnacle of steel tower is a steel member of tower over the vertex cross arm is called pinnacle of transmission tower.

Cross arm provided cross arm of steel transmission tower handle the transmission conductor. The cross arm depends upon the level of transmission voltage, configuration and min make plot for weight distribution (support conductor and ground wire).

Enclosure of transmission tower is a part between tower body and vertex is known as enclosure of transmission tower. This part of the pinnacle holds the cross arm between pinnacle and tower body.

Boom of transmission steel tower is used to support power conductor which is placed in horizontal direction.

Bracing is used to resist lateral loads which is comes from mainly from wind load..

B. Types of transmission tower

All Transmission tower body consists from the part from base of cross arm to ground level. A vertical view of transmission steel tower is presented in Figure 1.1.

Depending upon the point of deviation, the transmission of tower is categories from A to D depending upon the inclination and its classifications are discussed below:

Category A: Tangent tower which has point of deviation from 0^o to 2^o .

Category B: Small angle tower with a point of deviation from $2o^o$ to 15^o .

Category C: Medium angle tower with a point of deviation from 15^o to 30^o .

Category D: Large angle tower with a point of deviation from 30^o to 60^o .

The transmission tower is being classified in four ways and descriptions of these classifications are given below:

Class 1: Self supporting type in which members are rigid in both longitudinal as well as in transverse direction.

Class 2: Self supported wide base in which member are horizontal configured

Class 3: Flexible type in which the members are not rigid in transmission cable direction

Revised Manuscript Received on March 30, 2020.

* Correspondence Author

Priya Dhillon*, civil department, Ujjain Engineering college ujjain, Madhyapradesh, India. Email: priudhillon@gmail.com

Raghvendra Singh, civil department, Ujjain Engineering college Ujjain, Madhyapradesh, India. Email: raghvendr@uecu.ac.in.

Class 4 Based on number of circuits by a transmission tower; it might be classified as single, double and multiple circuit towers.

C. Transmission line component

The accompanying parameter of the transmission line and its segment are accepted from IS 802: part 1: IS 5613 section 2: sec: 1:1989:

- Transmission line tower
  1. Terrain type consider – plain
  2. Wind zone – 3
  3. Basic Wind speed – 39m/s
  4. Tower type – self supported
- Conductor
- Earthwire
- Insulating string

D. Objective

The main objective is to build a tower in a short time which can be done using Stadd Pro in a structure. Following objectives such as:

- I Have studied the geometry of the tower.
- The structure is studied on a stadd pro.
- It has been studied that structure can be design using analysis, software, and also manually calculation.
- I have studied designing a member of the tower.
- The software has been studied and analysis we have applied various loads on the structure (self wt, wind load).

II. METHODOLOGY

- Modelling:
  - Transmission tower
- Loads:
  - 1.5(Dead Load +Wind Load
- Analysis:
  - Analysis of steel-framed structure.
  - Shear Force and Bending Moment calculation.
- Design:
  - Design of member
- Geometry of parameter
  - Wind pressure detail
  - Essential breeze speed v_b = 39m/s
  - Wind zone = 3
  - Unwavering quality level = 2
  - Landscape class = 2
  - Reference wind speed = VR = V_b/k_0

A. Manually analytical procedure

Tower according to IS 875 code particular are as per the following**:**

As indicated by the arrangement size 14 m X 14 m, 40 m high of steel transmission tower and wind load in zone III case thought according to IS code, the heaps (1.5 occasions of dead burden and wind load) in the all edge area in vertical individuals and x-type supporting individuals are determined. As per the strain or pressure power in the edge areas proposed in the pinnacle utilizing the strategy for joints technique, the heaps are determined.

The protected area for the individuals which takes pressure in steel structure acquired according to IS 875 code arrangements.

The protected segment for the individuals which takes pressure in steel structure got according to IS 875 code arrangements.

As a rule following are size of steel individuals are utilized for the plan of steel transmission tower:

Principle leg: ISA 200×200×25 single point came back to returned area, inclining and cross arm propping: ISA 100×100×6 single point and even supporting: ISA 130×130×8 single edge thus, such individuals are to be intended to oppose both malleable and compressive powers

III. MODELLING AND ANALYSIS

step1 :Before Create a nodal point based on the frame positioning of the plan.

step2 : Representation of pressure and strain by using add beam we had drawn the beam between the corresponding node point.

step3 : 3D view of the structure.

step4 :Supports and property assigning. After the creation of the structure, the support at the base of the structure is specified as fixed also, the material and section are assigned.

step5 : After assigning the property the 3d rendering view of the structure can be shown.

step6 : Self-weight load of the structure can be created by stadd pro itself with oneself weight direction in the heap case segment.

step7 : Assigning a wind load it is defined as per IS 875it is based on intensity and exposure are calculated.

step8 : Adding of load combinations After assigning all the load.

step9 : Analysis after completion of all steps we have to perform the analysis,

step10:After analysis, we have designed a member of the structure and also a restrained member.

step11: Finally steel to design is performed on the structure and Finally also performed an analysis and checked.

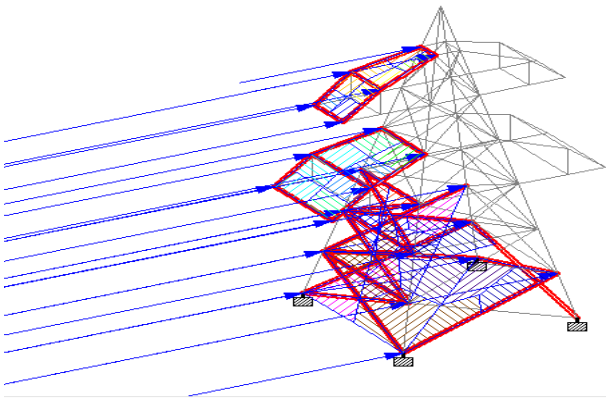

Figure1: When wind to load is applied

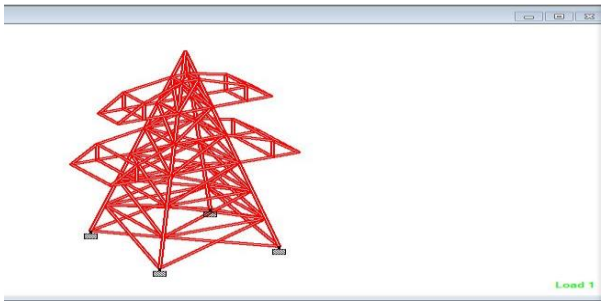

Figure2: When a dead load is applied

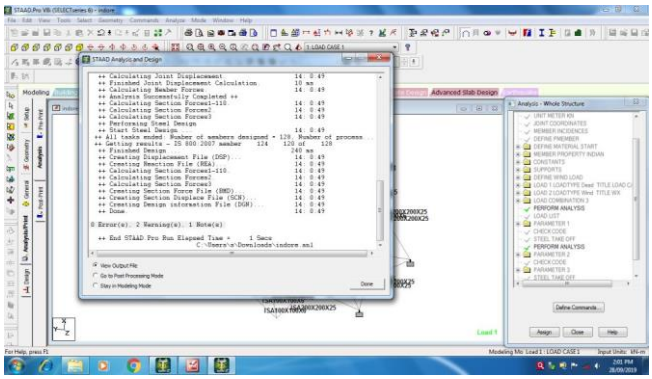

Figure3: Pictorial veiw of complete analysis

IV. RESULT AND DISCUSSION

We are analysis of the tower using stadd pro and also shown an all the result of the tower in different load case and different section of the structure.

A. Geometry and material property

A presentation of steel member sectional geometry and design properties of angle ISA 130 X 130 X 8 is shown in pictorial view in Figure. For an example, the results indicated that, safe and critical section of steel sectional member number 109 in the size of ISA 130 X 130 X 8 size 3 m in length and 0.13 m width with a density of 7833.0 kg/m^3 and elastic modulus 205.0 kN/mm^2.

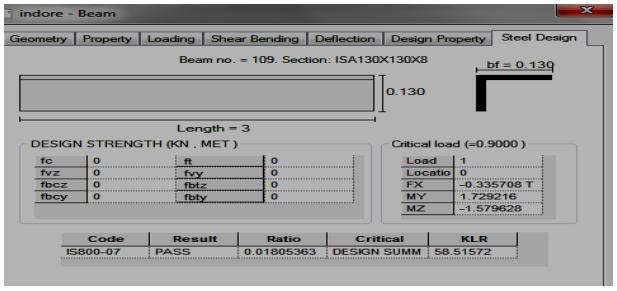

Figure1: .pictorial veiw of design of compression steel angle member

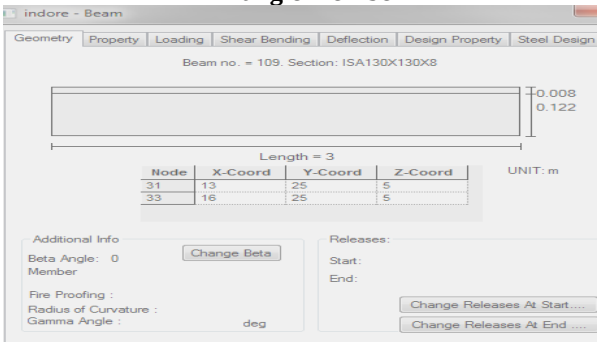

Figure2: .Pictorial view of angle sectional geometry

The displacement within the each member of the steel sections of transmission tower in pictorial view and in plots or graph is discussed in the following sections. The safe design sections of the tower are also discussed in the following sections.

B. Displacement of steel section

According to the 3D model outcomes from STAAD Pro, the evaluated removals at different areas of the each steel individuals from tower under safe condition or non disappointment condition are spoken to by green shading and relocation esteems in the Figure

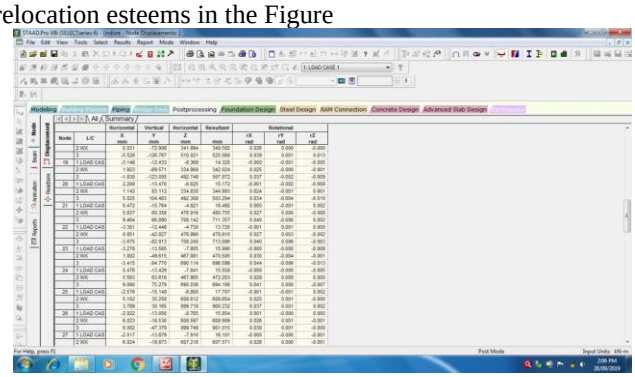

Figure3: Representation view of nodal displacement of members

From the analysis of model in STAAD Pro, the results indicated that, the maximum displacement of 0.9 mm is observed in the direction on wind is find out due to the load combination of load (1) and 1.5x load (2).

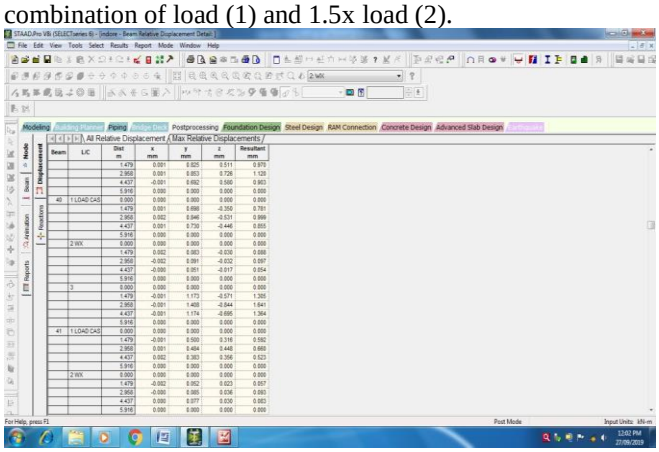

Figure4: Relative displacement of members

C.Axial shear force and bending moment

The outcomes got from the STAAD Pro model of transmission tower, the hub powers, shear powers and twisting minutes in the various individuals from the pinnacle is exhibited in the Figure

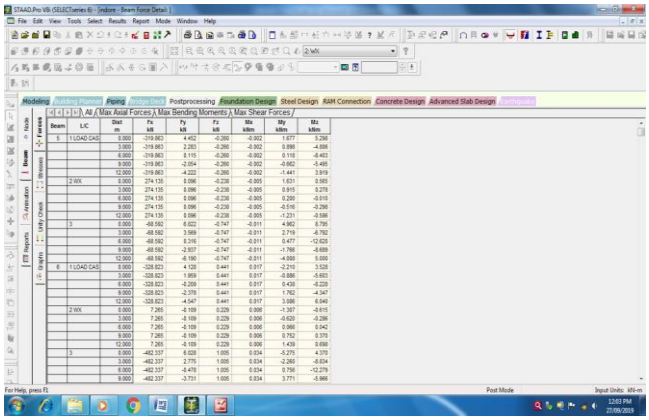

Figure5: Pictorial view of axial forces in the members

The shear powers in the different individuals from the transmission tower acquired from the consequences of model created in the STAAD Pro is displayed in the Figure

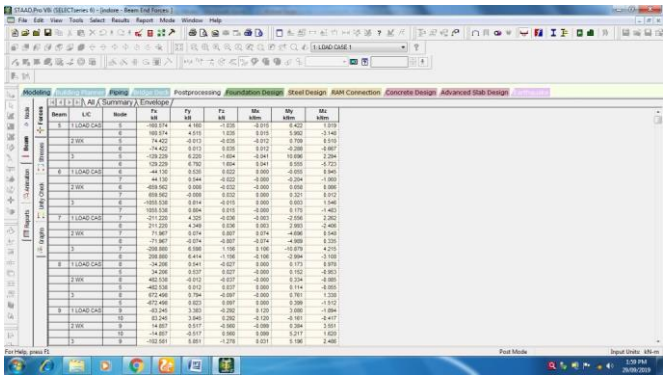

Figure6: Pictorial view of end forces in the members

Results indicated that, the maximum compression force is obtained from the results in the member number 129 and maximum tensile forced obtained from the results in the member number 96 with the load combination as per IS code.

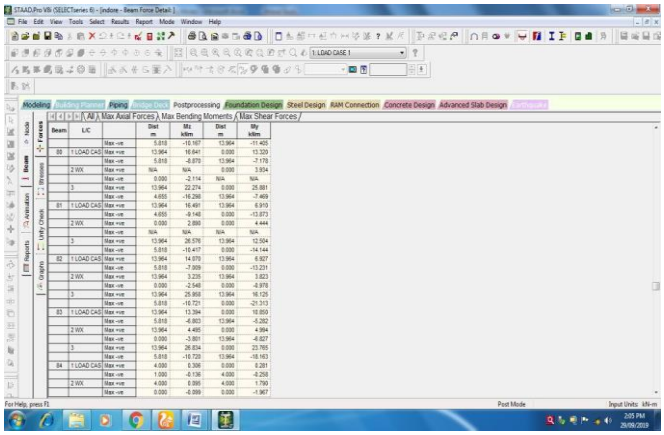

Figure7: Pictorial view of results of moments

The outcomes showed that the most extreme positive twisting minute is acquired in the part number 80 and greatest negative minutes is gotten in the part number 82 because of burden mix as determined in code.

The minutes with worries inside the all individuals from the pinnacle is additionally exhibited in Figure as pictorial perspective on minutes and shear worry in individuals.

D.Sagging force and reaction

The end reactions obtained from the analysis in model using STAAD Pro in each of the steel members of the tower represented in pictorial view of some of the steel members.

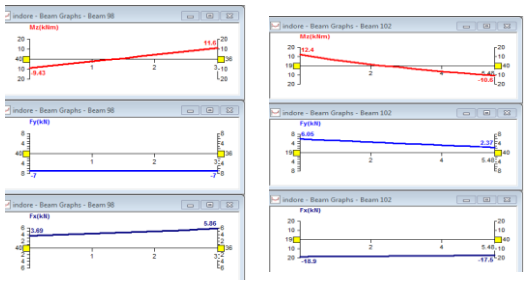

Figure8: . Pictorial view of end forces in the members

The vertical deformtion of some of the horizontal strut of compression members obtained from the analysis is presented in the Figure

E. Result table of safer section

The analysis, the safe members either tensile members or compression members are obtained, the size of the tensile or compressive members under safe condition for the optimum load combination are presented in the Figure

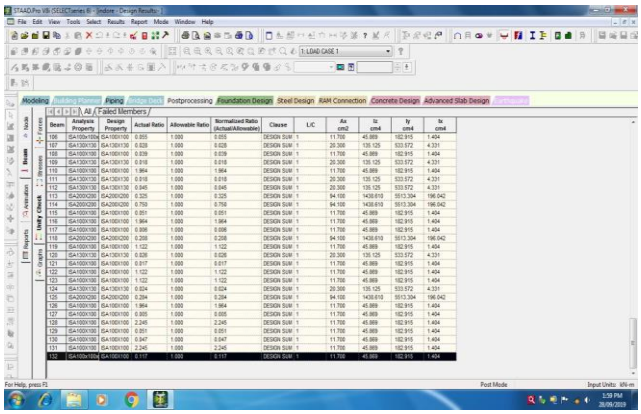

Figure9: Pictorial view of safe section of tensile members

V. CONCLUSION

The steadiness of steel transmission tower for the most part relies upon security of various pieces of steel individuals used in the arrangement of a total steel transmission tower. Right now steadiness of 36 m high transmission steel tower incorporates strain and pressure steel individuals from transmission line tower is investigated utilizing scientific technique just as with the assistance of STAAD Pro PC based displaying. The static, wind and dynamic stacking is considered for the investigation according to IS code particulars. The outcomes demonstrated that the solidness of every single accepted component of pressure and pressure individuals utilized in the development of a steel transmission tower are steady and safe in investigative just as programming based calculations.

ACKNOWLEDGMENT

It is our privilege to express my thankfulness and gratefulness to my thesis gratitude to my thesis guide DR. Raghvendra Singh and DR. P B.

Murnal professor, civil engineering Ujjain Engineering College for their invaluable guidance wholehearted support and encouragement in accomplishing the present work. I am grateful to the Dept. of structural designing U. E. C UJJAIN for giving me junctures to implement a project which is an integral part of the curriculum in the M.E programs at the U. E. C UJJAIN.

I am very thankful to DR. Atul Sthapak, principal Ujjain Engineering College and the faculty members of the department, especially structural engineering specifications for their constant incentive, precious guidance, motivation and blessing during their project.

Last yet not least I might want to thankfulness my parents, who taught me the value of hard work by their example.

REFERENCES

1. Hadimani,P.andKulkarni,S.(2017)."Staticand dynamic evaluation oftran smissionline tower", IJERM&Tvol.6(2),pp.987-992
2. STAAD PRO, Bentley Corporation
3. IS 802 Part 1 Sec 1 1995 Code of practice for the use of structural steel, Part
4. IS 875 parts 3 part
5. DR.Subramaniam Narayanam “designs of steel structural elements”
6. 323cbip transmission towers by manually.
7. Analysis and Design of 220 KV Transmission Line Tower(A conventional method of analysis and Indian Code based Design.
8. Design of steel structural element by punmia (Basic Book/Monograph Online Sources) J. K. Author. (year, month, day). *Title* (edition) [Type of medium]. Volume(issue).
9. Gopi SudamPunse “Analysis and Design of Transmission Tower”
10. Bharath Kumar Reddy, 2K. Rasagnya, 3V. “ A Study on Analysis of Transmission Line Tower and Design of Foundation.”
11. Shubham Kashyap1*, Prof. Sumit Pahwa2 “ A Review Study of Transmission Line Tower, Structure by FEM Volume V, Issue VIII, August 2018.”
12. Taiji Mazda1, Hisanori OTSUKA2, Seiji IKEDA3 and Kunihiko UNO4 “A STUDY ON DAMAGE OF THE“TRANSMISSION STEEL TOWER WITH UNEQUAL LEGS IN THE CHI-CHI EARTHQUAKE TAIWAN August 1-6, 2004 Paper No. 739”
13. P. B. Shinde, Y. M. Ghugal “ WIND ANALYSIS OF THREE-LEGGED TRANSMISSION TOWERS WITH DIFFERENT BRACING SYSTEMS 17 MARCH 2017”

AUTHORS PROFILE

Priya Dhillon, 23year old localized of ujjain and completed his engineering from Mahakal institute iof technologyujjain and in present he pursuing masters in specialization of computer aided structural design and drafting branch from Ujjain engineering college, Ujjain, M.P., INDIA

Dr. Raghvendra singh, They are the professor of, Department of Civil Engineering, Ujjain engineering college, Ujjain, INDIA. They publish many research papers related to civil engineering. Dr. Raghvendra singh is the guide of Priya Dhillon in thesis of m. tech**.** they have 11 research items, 848 reads and 141 citations in present with highest qualification of PH.D**.**