International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 04 Issue 09
August 2017

Seismic Study of Selfsupporting Telecommunication Tower Mounted On Roof Top

Aditya Sharma & Arpit Chawda
M-Tech scholor, Assistant professor Department of civil engineering, RKDF SOE, Indore

ABSTRACT

The availability of land in urban areas is extremely limited for satisfying the ideal installation of tower thus giving no alternative but to adopt roof top towers. The location of these towers is specified in terms of latitude and longitude with height of mounted antenna dictated by functional requirements of the network. The analysis has been performed on the tower located on roof of the existing structure by varying position of tower and analyzing the displacement at various heights of existing structure and tower.

As tower plays a significant role for wireless communication network, the failure of such structure in a disaster is a major concern therefore utmost important has been given considering the effect of wind & the seismic effect acting on the tower and existing structure . The seismic effect has been done for different seismic zone IV. The analysis is also done at different properties of soil (soft soil, hard soil & medium soil), and it is observed that the displacement is different at various height of structure and telecommunication tower and different position of telecommunication tower i.e. the deflection is greater at tower and minimum at building. The results obtained from the above analysis are tabulated, compared and conclusions is drawn that displacement is minimum when the position of tower is at the centre of existing structure .

KEYWORDS seismic effect, roof top tower, types of soil, different position of tower, displacement compression

INTRODUCTION

For supporting parabolic antennas which are generally used for microwave transmission for communication and information are use for sending signals for radio, television signals to remote places, a tall structure named telecommunication tower is installed at specific height. These towers are categorized as three legged and four legged space trusses structure, which are self supporting. These self supporting structures are supported either on ground or on building and are generally square in

plan or it may be triangular in plan. The major cause of failures of telecommunication tower throughout the world though still remains to be high intensity winds (HIW).therefore several studies has been done in telecommunication towers taking into consideration the wind as well as static effect. These structures are generally designed to carry wind load as well as seismic load, which acts as cantilever trusses. As they cover less base area in towers, they are suitable in many situations but these structures demands more steel. The installation of these towers requires the availability of land depending and the location and availability of fund. The use of these towers is more in urban areas, but due to limited availability of land in urban areas, the concept of roof top tower is adopted in which tower is installed of the roof top of the building. Thus by this, the problem of land requirement can be removed and it serves efficiently.

Based on placement of tower:-

Based on this placement, communication towers are classified as follows:

1) Green field towers
2) Roof top towers

1. Green field tower:-

Green field towers are erected on natural ground with suitable foundation. Generally, the height of green field tower is 30-200m. Basically, it is placed in rural areas.

2. Roof top tower:-

Roof top towers are erected on existing building with raised columns and tie beams. Basically, height of the roof top tower is 9-30 m and it is placed in urban areas. It is more economical compare than to green field towers. Roof top tower is a tall skeleton steel structure with relatively small cross-section having larger ratio between height & maximum width. Such towers have their base or foundation on the roof of building or structures, therefore named as ROOF TOP tower.

Objective of the study –

The present study investigates that the telecommunication tower is placed on roof of a building at different positions under seismic effects along with the wind effects on the roof top tower

The main objectives of the present study are –

1) To study the displacement in structure by changing the position of roof top telecommunication tower.

2) To study the behavior of roof top telecommunication tower when subjected to lateral loads.

3) To study the roof top lattice tower for seismic zone-IV

METHODOLOGY

Seismically deficient buildings and their rehabilitation are major problems for earthquake regions of India. Recently, the target of building rehabilitation and firmness has gained research attention and various techniques have been developed to achieve this. However, many of the techniques for strengthening raise problem for the occupants, who must have to vacate the building during renovation. In this study the proposed solution is to rehabilitate an existing structure which is seismically deficient.

In the proposed project, the tower is building manually and the wind load is calculated. After this study, the dimensions of building are assumed. Now, the collected data is fed into STAAD PRO, and the analysis is carried.

Various cases are studied in this project. Firstly, the zone is selected and the positions of tower are changed at different parts of building and then the displacement is calculated.

In order to achieve the above mentioned objective following methodology is adopted:-

1. Selection of a building that is designed only for gravity loads.
2. Study the behavior of building under the effect of earthquake.
3. Application of different position of tower on the selected building.
4. Study the effects displacement at various positions of tower for zone IV, generated at the time of earthquake.
5. A comparison of displacement, different position of tower.

RESULTS AND CONCLUSION

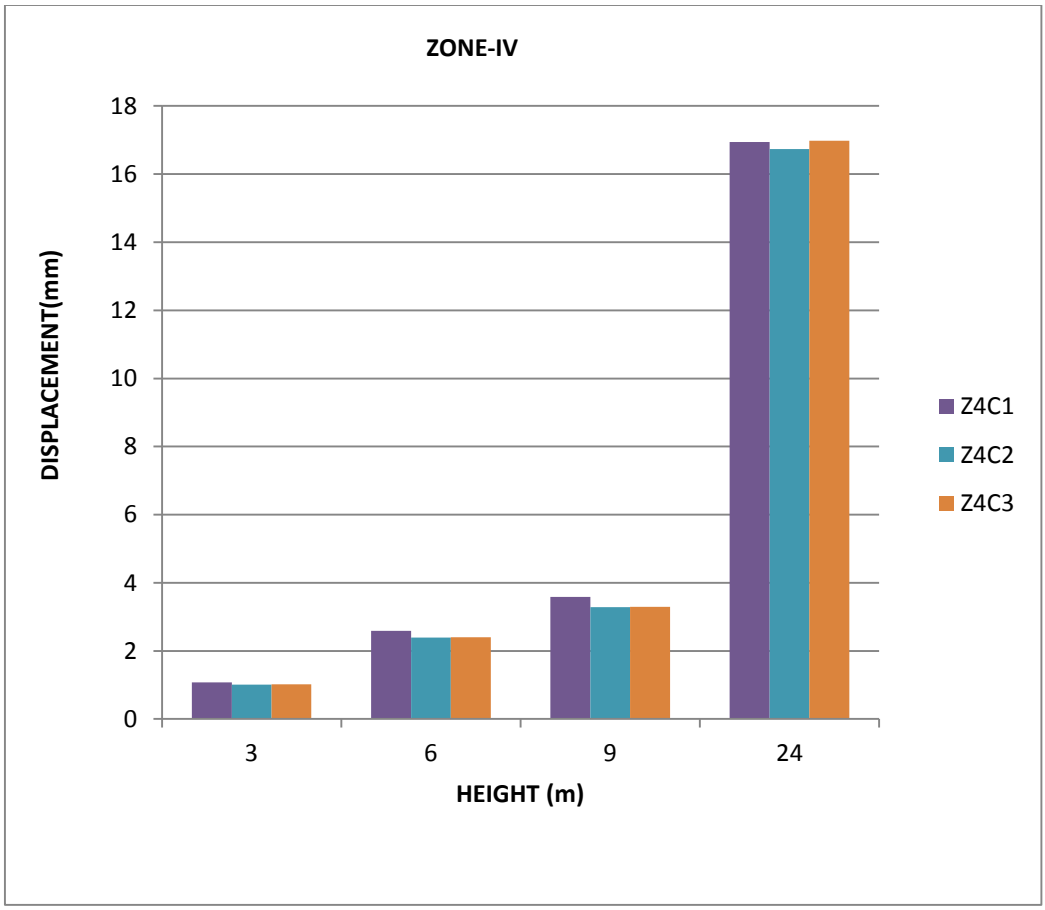
After the analysis, we have concluded that , when telecommunication tower is placed at different positions on the existing structure it shows minimum deflection at the centre of the existing structure as compared to other position of tower. The comparison for different position of tower. At the end of whole study, When we take a different kind of soil such as soft soil, medium soil and hard soil and do the comparison for the displacement over this soil. It is observed that the displacement is greater at the height of tower but lesser at the height of building. The result of this comparison was shown in the graph.

Comparison of displacement at different position of tower

In this section, comparison is carried for zone IV but at different position of tower on the structure. Following table shows the comparison of displacement for different height and different position at zone IV.

Table no.1 Displacement table of zone IV

Height(m)	Maximum Horizontal Displacement(mm)		
	z4c1	z4c2	z4c3
3	1.08	1.01	1.015
6	2.588	2.393	2.405
9	3.588	3.28	3.297
24	16.946	16.731	16.983



International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 04 Issue 09
August 2017

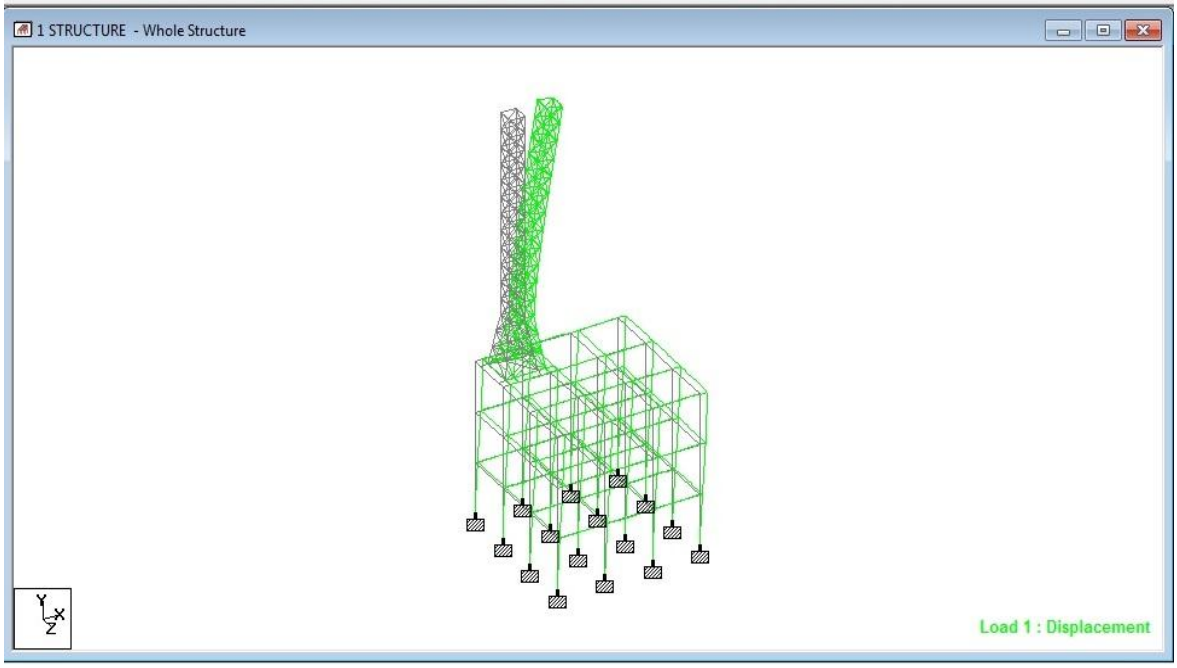


Figure 1 sway mode (case-1)

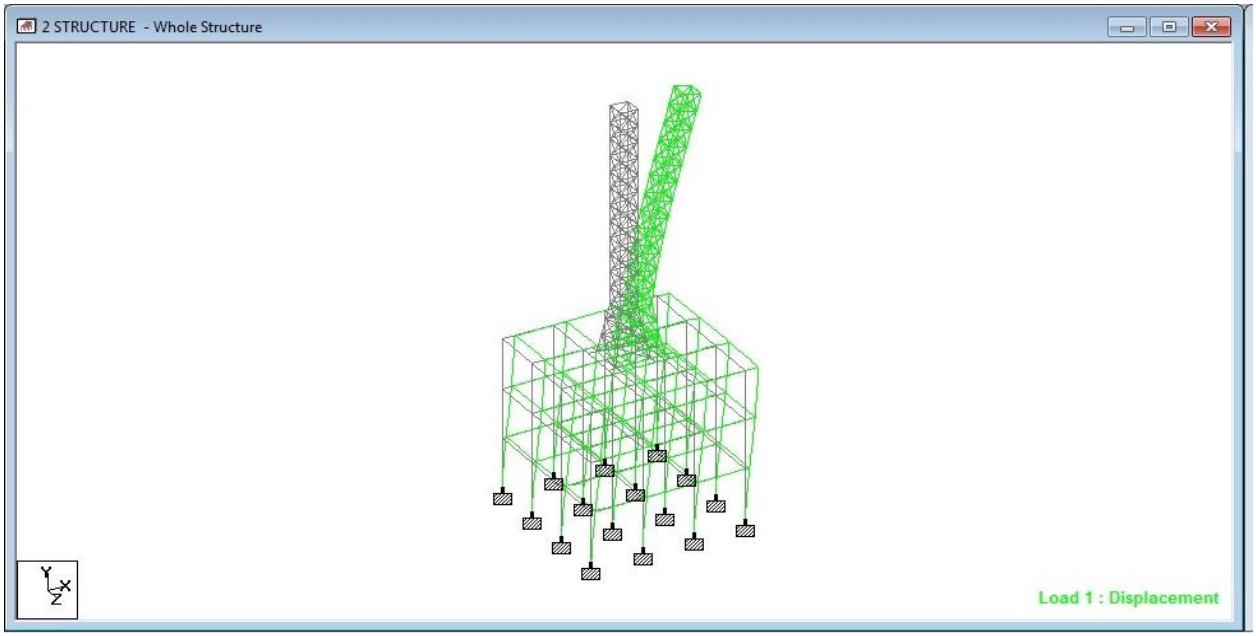


Figure 2 sway mode (case-2)

International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 04 Issue 09
August 2017

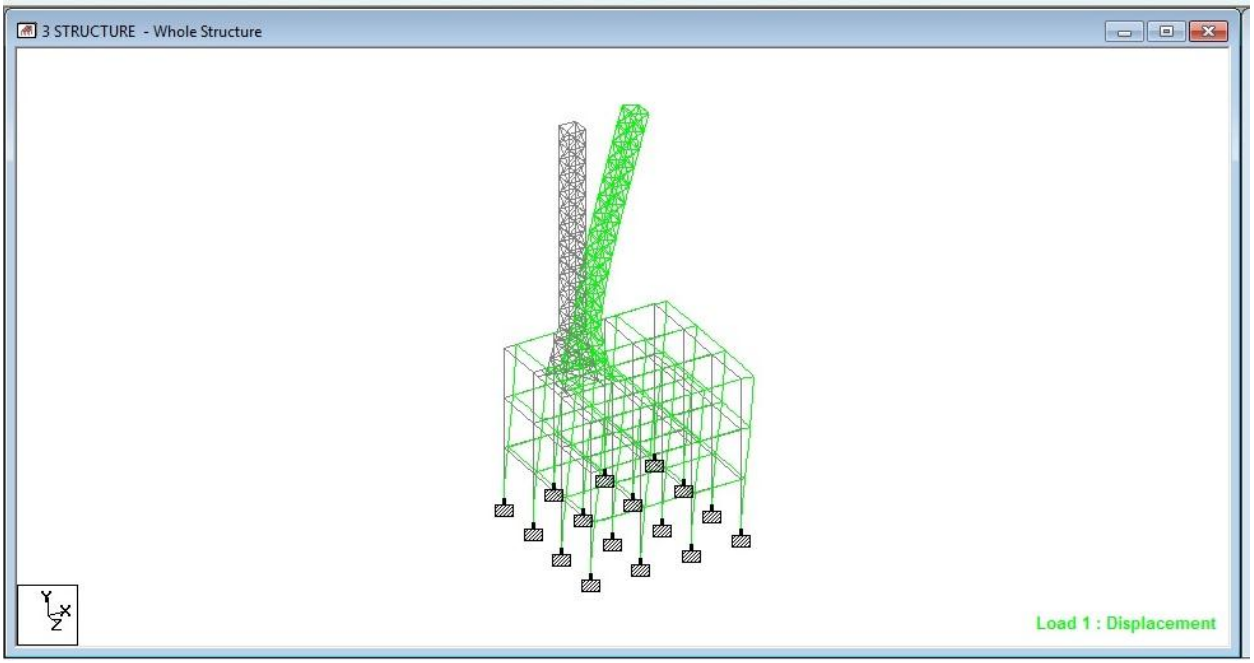


Figure 3 sway mode (case-3)

Comparison of displacement by changing soil type

The soil type is changed in STAAD PRO and the displacement measurement is compared. The types of soil used are soft soil, medium soil and hard soil. The result is found that the displacement is minimum for hard soil. Mathematical expression used is

$A_h = ZIS_n / 2Rg$

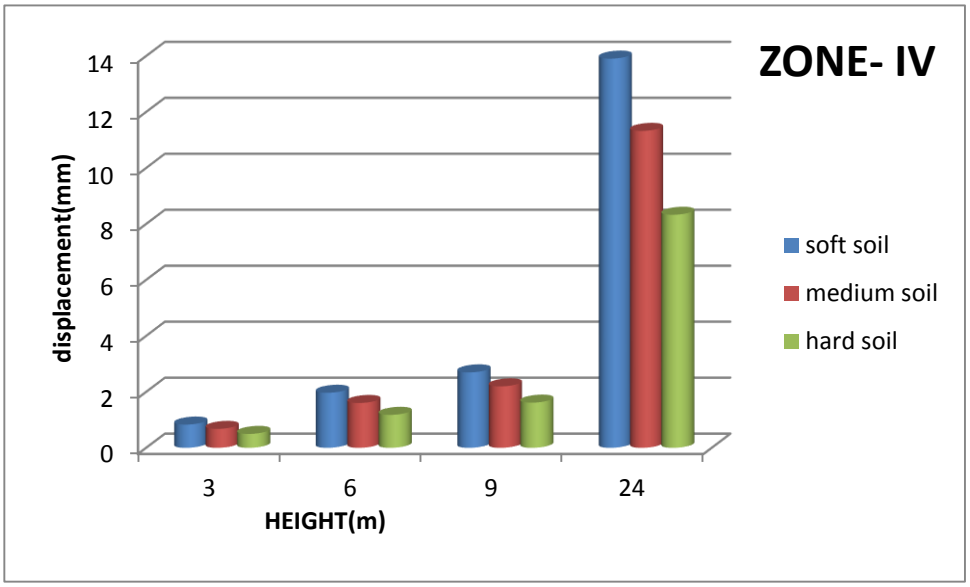
This expression is from clause no 6.4.2 (IS 1893 (Part 1) - 2002). In the expression, S_n /g is average response acceleration coefficient which is dependent on soil property and time period (Clause no 6.4.5 from 1893 (Part 1) - 2002).

Following is the table showing the comparison of displacement with the types of soil for different zones.

Table no 2 Displacement according to soil type for case 2

ZONE-4

Height	Types of soil		
	Soft soil	Medium soil	Hard soil
3	0.83	0.676	0.497
6	1.967	1.602	1.178
9	2.695	2.195	1.614
24	13.906	11.324	8.327



CONCLUSION

As per the objective of this project, the analysis of lattice tower at different positions on rooftop and configurations of related structure was done for the seismic load. The following conclusions are drawn from the above analysis.

1. The displacement is directly proportional to the increasing height of structure.

2. Horizontal displacement of the telecommunication tower was analyzed by considering different positions on rooftop using STAAD PRO software. As a result of this study the minimum value of displacement will be achieved when it is placed at the centre of the existing structure.

3. Also the variations are observed at variety of soils affecting the height of structure.

REFERENCES

[1] Jithesh Rajasekharan, S. Vijaya (2014): "Analysis of Telecommunication Tower Subjected to Seismic & Wind Loading" International journal of advancement in engineering technology, management & applied science, Volume 2, Issue 2 July 2014,ISSN:2349-3224 ,68-79.

[2] Siddesha.H (2010): "Wind Analysis of Microwave Antenna Towers". International Journal of Applied

Engineering Research, Dindigul, Volume 1, No 3,ISSN:0976-4259,574-584.

[3] Ghyslaine McClure, Laura GEORGI and Rola ASSI (2004): "Seismic Considerations for Telecommunication Towers Mounted on Building Rooftops"13th World Conference on Earthquake Engineering Vancouver, B.C., Canada,19-88

[4] Nitin Bhosale, Prabhat Kumar, PandeyA.D (2012):"Influence of host structure characteristics on response of rooftop telecommunication towers".International Journal of Civil and Structural Engineering Volume 2, No 3, ISSN 0976-4399, 737-748.

[5] G. Ghodrati Amiri* and S.R. Massah(2007): " seismic response of 4-legged self-supporting

[6] Telecommunication towers." Vol. 20, No. 2, August 2007, 107-126.