International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 4 Issue 2, February 2020 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Modeling Analysis & Design of Intz Water Tank Considering Different Wind Speed using STAAD PRO V8I Software

Pammy Barnawal[1], Nitesh Kushwaha[2]

[1]M. Tech. Scholar, [2]Professor,
[1,2]Department of Civil Engineering,
[1,2]Millennium Institute of Technology & Science, Bhopal, Madhya Pradesh, India

ABSTRACT

In order to compete in the ever growing competent market it is very important for a structural Engineer to save time as well as money, as a sequel to this is an attempt made to analyze and design a INTZE water tank by using IS method & software package of staad.pro. For analyzing a INTZE water tank one has to consider all the possible loadings and see that the structure is safe against all possible loading conditions. STAAD-Pro V8i is a comprehensive and integrated finite element Analysis and design offering, including a state-of-the-art user interface, visualization tools, and international design codes. There are several methods for analysis of different frames like finite element method. The present project deals with the design & analysis of a INTZE water tank with 12 lakh liters capacity for Jharkhand. The dead load, live loads & seismic load are applied and the design for different structural component, columns is done by using IS code method and STAAD. Pro with its new features surpassed its predecessors, and competitors with its data sharing capabilities with other major software like AutoCAD, and MS Excel. Intzetank is a type of elevated water tank supported on staging There are several methods for analysis of different frames like finite element method. Analysis of results of structural design and estimation of quantities of Intze tank for different wind speed and different bearing capacity of soil, For same bearing capacity of soil, if wind speed is increased the quantity of concrete and steel in Intze type elevated water tank are also increased. For same bearing capacity of soil, if wind speed is increased the quantity of concrete and steel in Intze type elevated water tank are also increased. Keeping the values of bearing capacity of soil constant, for every incremental increase of 10 m/sec of wind speed, the quantites of concrete is increased. If the design of intze type elevated water tank is devided into two parts namely super structure (above columns) and super structure (upto columns) the analysis of results of this study reveals that with the change in the wind speed and/or the bearing capacity of soil, there is an appreciable change is required quantities of concrete and steel for sub structure while these is almost no change in the required quantities of concrete and steel for super structure.

How to cite this paper: Pammy Barnawal | Nitesh Kushwaha "Modeling Analysis & Design of Intz Water Tank Considering Different Wind Speed using STAAD PRO V8I Software" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-4 | Issue-2, February 2020, pp.383-388, URL: www.ijtsrd.com/papers/ijtsrd30035.pdf

IJTSRD30035

INTRODUCTION

Water tanks are very important components of life line. They are critical elements in municipal water supply, fire fighting systems and in many industrial facilities for storage of water. A reinforcement concrete tank is a very useful structure which is meant for the storage of water, for swimming bath, sewage sedimentation and for such similar purposes. Reinforced concrete overhead water tanks are used to store and supply safe drinking water. With the rapid speed of urbanization, demand for drinking water has increased by many folds. Also, due to shortage of electricity, it is not possible to supply water through pumps at peak hours. In such situations overhead water tanks become an indispensable part of life

OBJECTIVES

- To Study Modeling, analysis and Design of INTZ water tank.

GEOMETRY OF STRUCTURES

Type of structure = Liquid storing structure
Capacity = 12 lakh liters

Table no. 4.1 Preliminary Data for Intze Water Tank

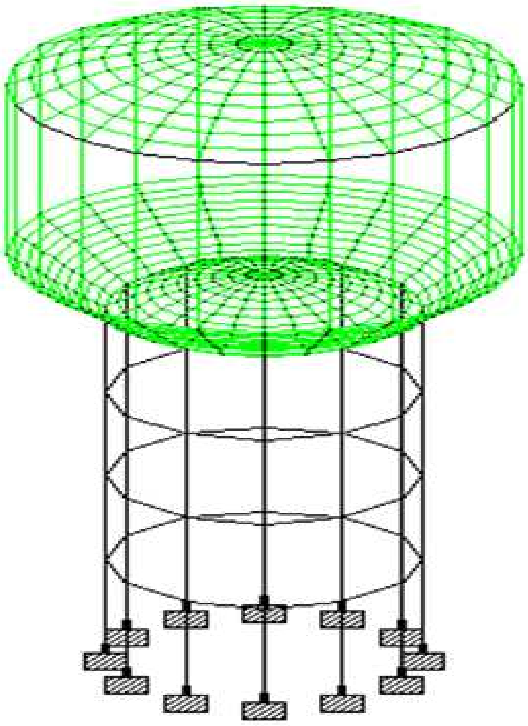
Top Dome	90mm thick
Bottom Dome	200 mm thick
Conical Dome	570mm thick
Columns	500 mm dia.
Concrete	M-25
Steel	Fe-415
No. of columns	12
Height of columns	16

Assumptions & Boundary conditions

The following assumptions were made before the start of the modeling procedure so as to maintain similar condition model.

- Only the main block of the water tank is considered for analysis. The staircases are not considered in the design procedure.
- Capacity of the water tank is considered 1200000 L.
- Cylindrical Wall of 330 mm thick with 15 mm plaster on each side will be considered for storage of water. Height of the freeboard is 420 mm provided
- The bottom slab is 200 mm thick and Conical Dome is 570mm thick.
- For all structural elements, grade of concrete is taken M-25 &and grade of steel is taken Fe-415.
- The footings are not designed. And supports are assigned in the form of fixed supports.
- Seismic loads zone 3 are considered in the horizontal direction only and the vertical direction are assumed to be insignificant.
- Sizes of the members are as follows: (All dimensions are in mm)

Figure 4.2: Model of Intze Water Tank



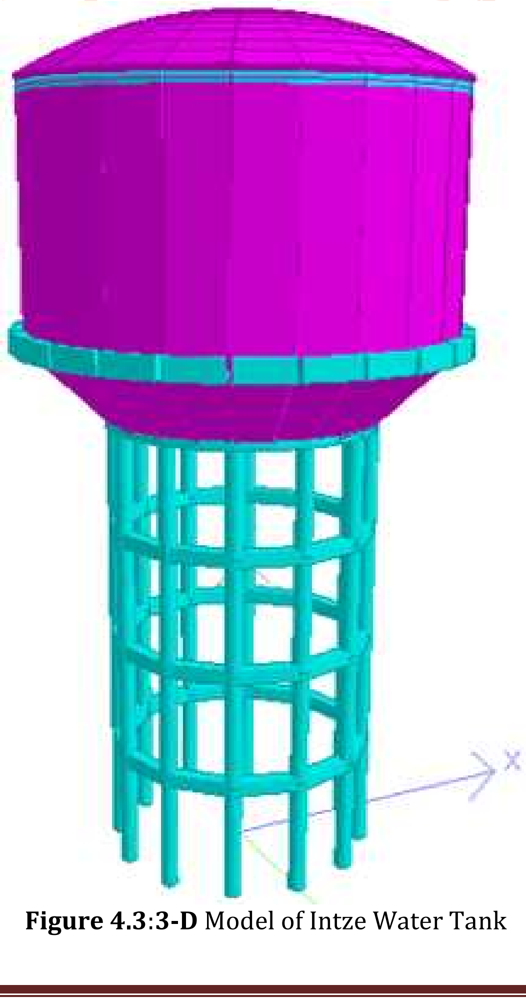


Figure 4.3:**3-D** Model of Intze Water Tank

ANALYSIS AND DESIGN BY MANUAL METHOD-

DESIGN OF INTZE TANK (CAPACITY 1200000 LITERS)

TABLE 4.1 DATA OF INTZE TANK

Capacity of tank	1.2 million lit. (i.e. 1200m³)
Height of Supporting Tower	16m
Number of Column	12nos.
Practices Area	JHARKHAND
Material	M25 concrete & Fe415 steel

RESULTS

RELATION BETWEEN WIND SPEED, VOLUME OF STEEL AND VOLUME OF CONCRETE (BEARING CAPACITY 10 t/m²):-

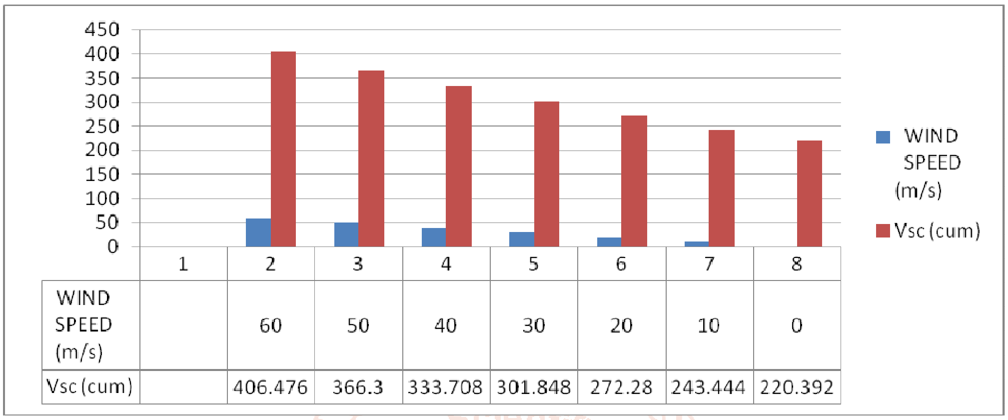


Fig. 5.1 Wind speed & Volume of Concrete

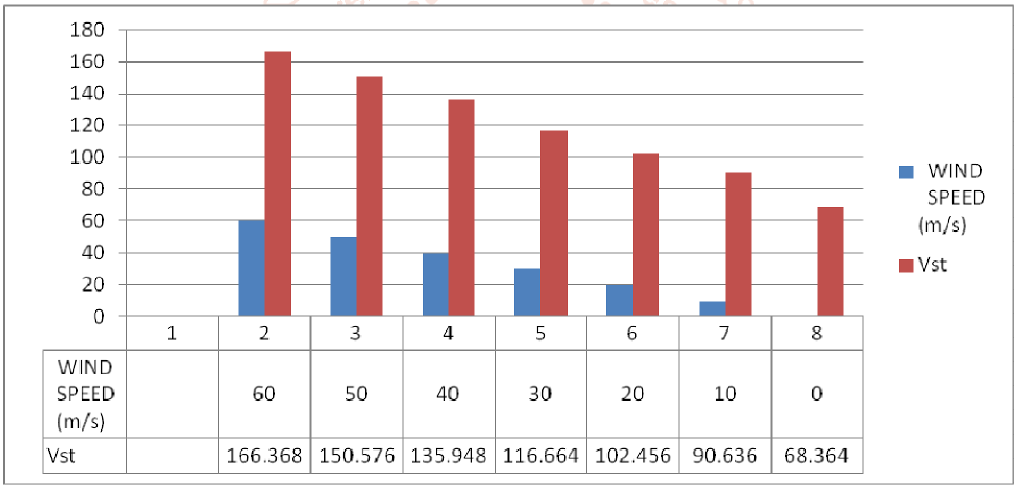


Fig. 5.2 Wind speed & Volume of steel

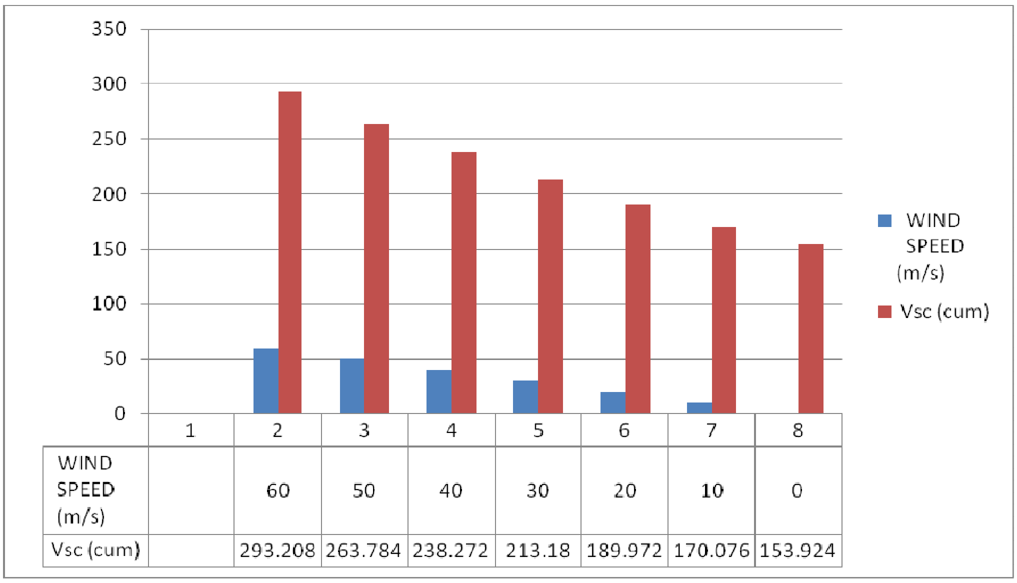


Fig. 5.3 Wind speed & Volume of Concrete

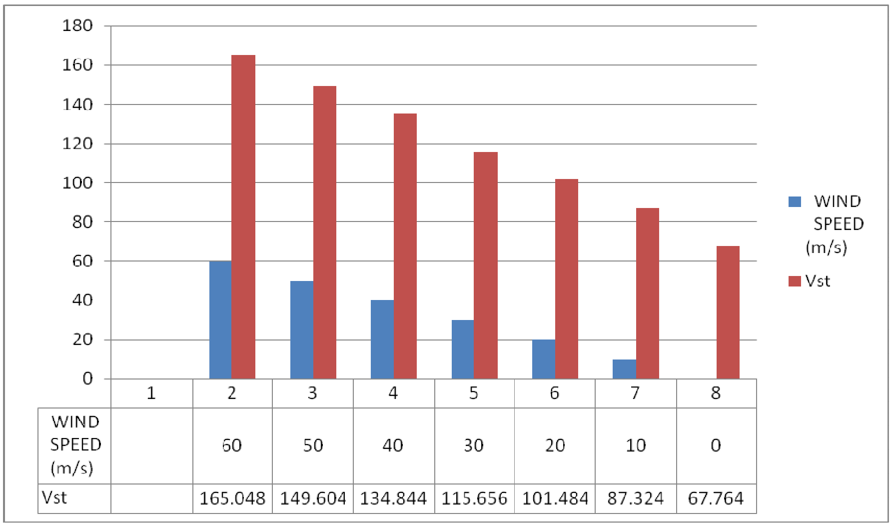


Fig.5.4 Wind speed & Volume of steel

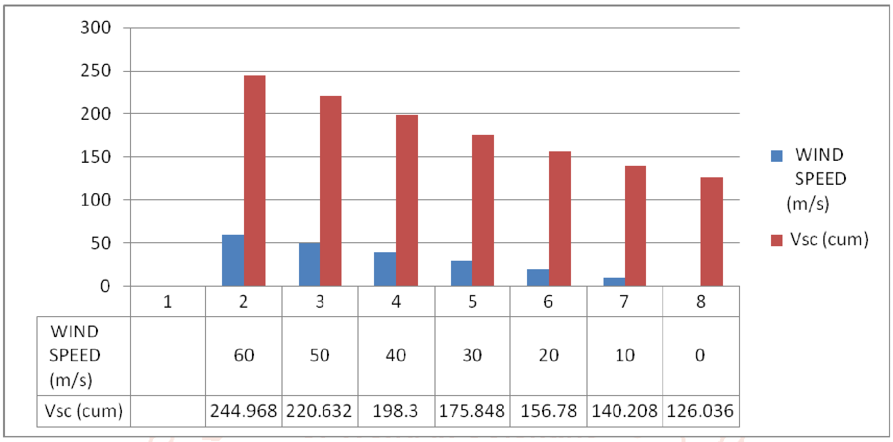


Fig. 5.5 Wind speed & Volume of Concrete

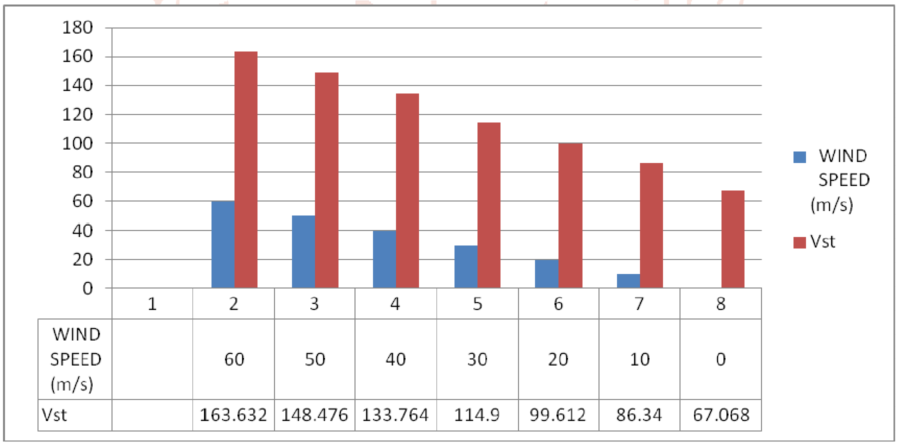


Fig. 5.6 Wind speed & Volume of steel

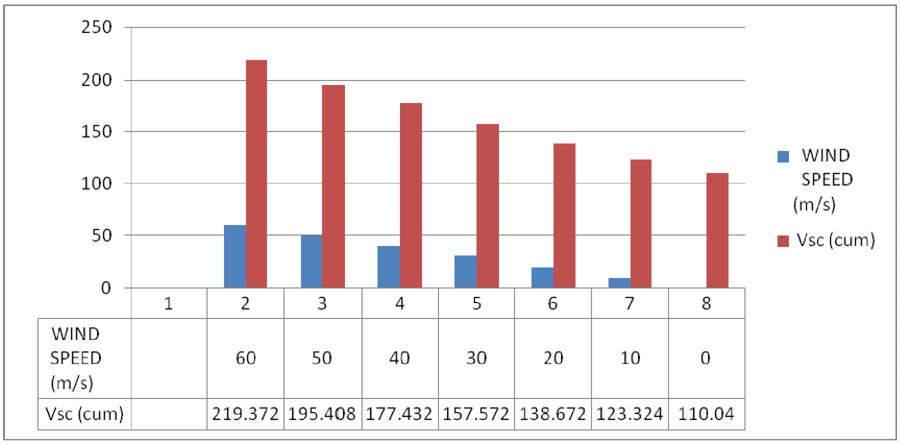
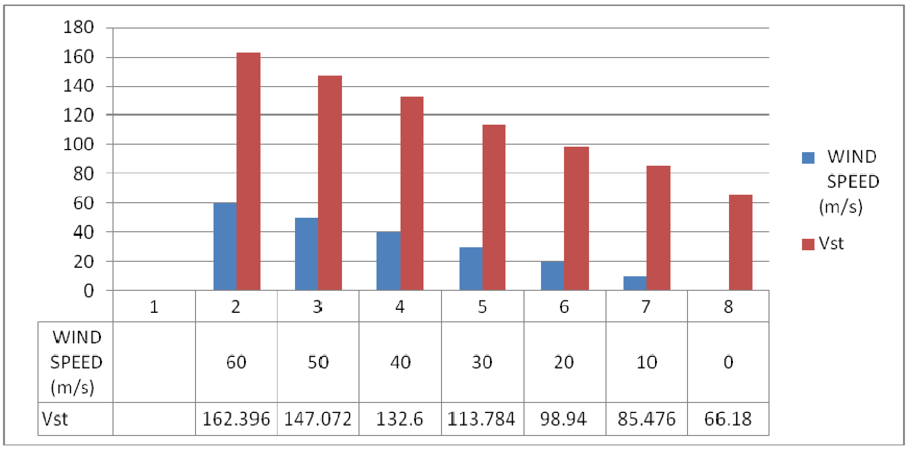
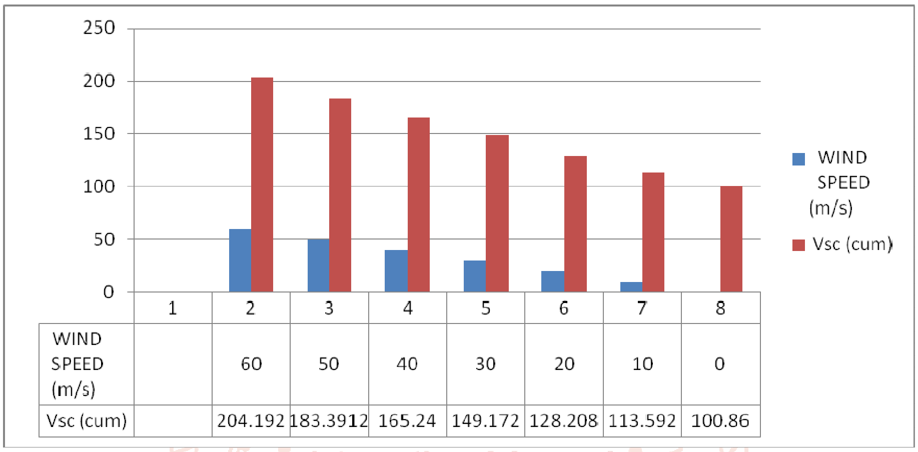


Fig.5.7 Wind speed & Volume of Concrete



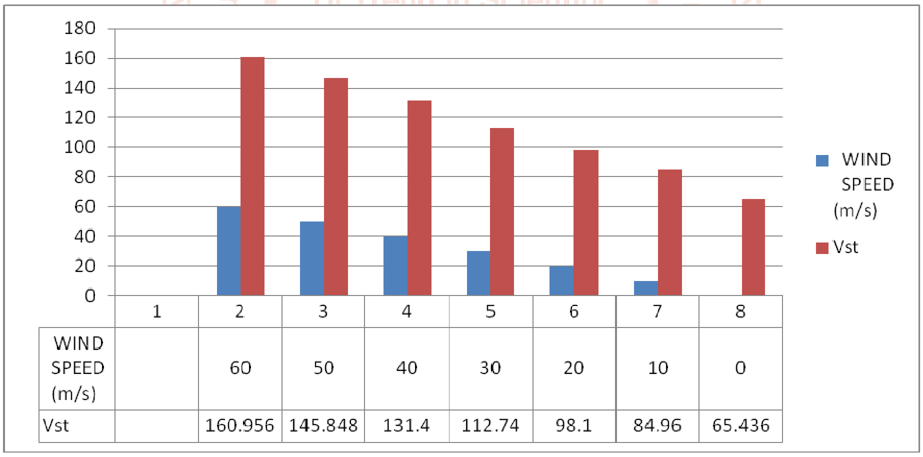
	1	2	3	4	5	6	7	8
WIND SPEED (m/s)		60	50	40	30	20	10	0
Vst		162.396	147.072	132.6	113.784	98.94	85.476	66.18

Fig.5.8 Wind speed & Volume of steel



	1	2	3	4	5	6	7	8
WIND SPEED (m/s)		60	50	40	30	20	10	0
Vsc (cum)		204.192	183.3912	165.24	149.172	128.208	113.592	100.86

Fig. 5.9 Wind speed & Volume of Concrete



	1	2	3	4	5	6	7	8
WIND SPEED (m/s)		60	50	40	30	20	10	0
Vst		160.956	145.848	131.4	112.74	98.1	84.96	65.436

Fig.5.10 Wind speed & Volume of steel

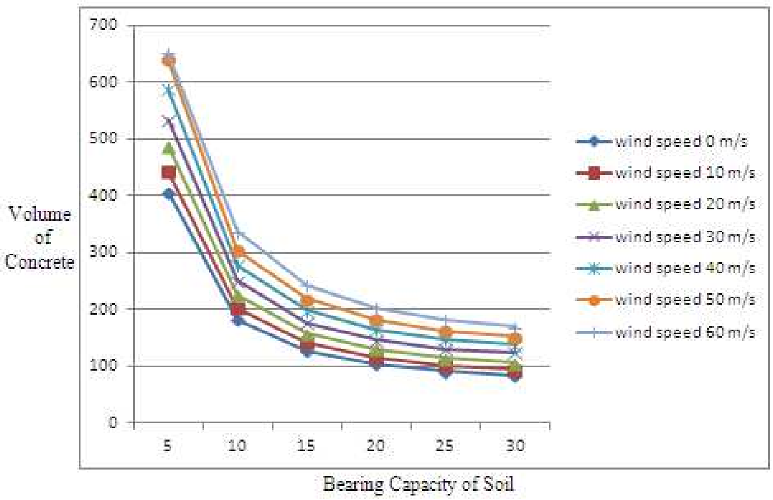


Fig.5.11 Combined graph of bearing capacity of soil, volume of concrete and wind speed

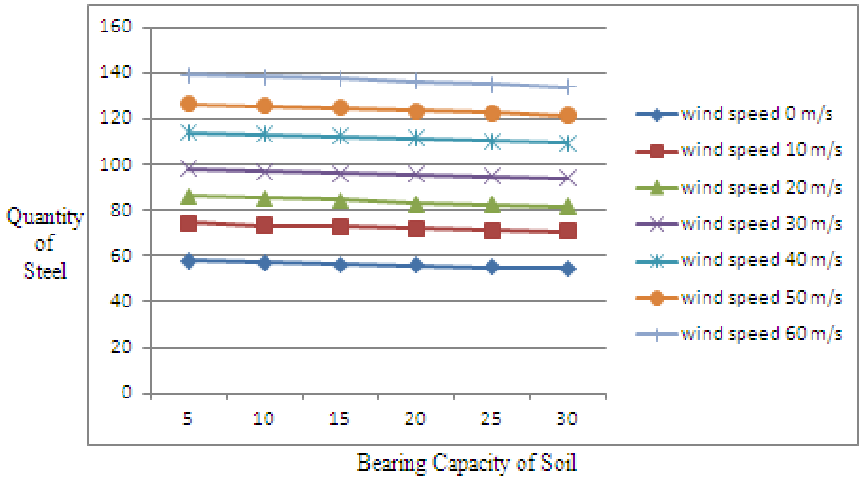


Fig. 5.12 Combined graph of bearing capacity of soil, quantity of steel and wind speed

CONCLUSIONS

Analysis of results of structural design and estimation of quantities of Intze tank for different wind speed and different bearing capacity of soil the following conclusion are drawn: -

1. For same bearing capacity of soil, if wind speed 10m/sec is increased the quantity of concrete and steel in Intze type elevated water tank are also increased.
2. Keeping the values of bearing capacity of soil constant, for every incremental increase of 10 m/sec of wind speed, the quantites of concrete is increased.
3. For every incremental increase of 10 m/s of wind speed, the increase of quantity of concrete is more than the quanity of steel.
4. For the same wind speed, if the baring capacity of soil is increased, the quantities of concrete and steel are decreased.
5. If the design of intze type elevated water tank is devided into two parts namely super structure (above columns) and super structure (upto columns) the analysis of results of this study reveals that with the change in the wind speed and/or the bearing capacity of soil, there is an appreciable change is required quantities of concrete and steel for sub structure while these is almost no change in the required quantities of concrete and steel for super structure.

REFERENCES

[1] Asari Falguni, Prof. M. G. Vanza,(2012), "Structural control system for Elevated water tank", International Journal of Advanced engineering research and studies, IJAERS/Vol-I/April-June,2012.

[2] Ayazhussain M. Jabar & H. S. Patel,(2012), "Seismic behavior of RC elevated water tank under different staging pattern and earthquake characteristics", International journal of advanced engineering research and studies, IJAERS/Vol-I,April-June,2012.

[3] B. C. Punmia, A. K. Jain, and A.K. Jain, (2001) "R.C.C. Design", Laxmi Publications (P) LTD, New Delhi.

[4] Manish N. Gandhi, Prof. A. Rajan, "Necessity of Dynamic Analysis of Elevated Water Storage Structure Using Different Bracing in Staging", International Journal of Research in Advent Technology, Vol.2, No.2, February 2014.

[5] Meen-Wah Gui and Balasingam Muhuthan, (2006), "Bearing Capacity of Foundations on Sand Using The Method of Slip Line", Journal of Marine Science and Technology, Vol. 14, No. 1, pp. 1 – 14.

[6] N. Krishna Raju, "Advanced Reinforced Design" CBS Publishers and Distributers, New Delhi.

[7] R. Livaoglu, A. Dogangin, "An investigation about effects of supporting systems on fluid-elevated tanks interaction", First International conference on Seismology & Earthquake Engineering (SEE),Turkey,May-07.

[8] Rai, D. C., (2003), "Performance of Elevated Tanks in Mw 7.7 Bhuj Earthquake", Indian Acad. Sci. (Earth Planet. Sci.).

[9] S. Ramamrutham and R. Narayan "Design of reinforced Concrete Structure" Dhanpat Rai Publishing Company (P) LTD, New Delhi PVT. LTD.

[10] Sanjay P. Joshi, (2000) "Equivalent Mechanical Model For Horizontal Vibration Of Rigid Intze Tank", ISET Journal of Earthquake Technology, Technical Note, Vol. 37, No. 1 – 3, March – Sept. 2000, pp. 39 - 47

[11] Sayal & Goel .Reinforced Concrete Structures. New Delhi. S Chand publication.2004.

[12] Soheil Soroushnia, Sh. Tavousi Tafreshi, F. Omidinasab, N. Beheshtian, Sajad Soroushnia, "Seismic Performance of RC Elevated Water Tanks with Frame Staging and Exhibition Damage Pattern", The Twelfth East Asia-Pacific Conference on Structural Engineering and Construction (2011).

[13] Suchita Hirde Dr., Ms. Asmita Bajare, Dr. Manoj Hedaoo, "Seismic performance of elevated water tanks", International Journal of Advanced Engineering Research and Studies (2011).

[14] V. K. Puri, (2008) "Foundation for Dynamic Load" Geotechnical Earthquake Engineering and Soil Dyanmics IV, CD-ROM, May 18-22, Sacramento, CA.

[15] Vazirani & Ratwani. Concrete Structures. New Delhi. Khanna Publishers.1990.

[16] Yashwant kanetkar "C++ Language", BPS Publishers, New Delhi.