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A REVIEW PAPER ON WIND ANALYSIS OF ELEVATED INTZE TANK USING DIFFERENT ARRANGEMENTS OF BRACING SYSTEM

Ketan Ashok Akolkar*1, K.S. Patil*2

*1PG Student, Department of Civil Engineering, JSPM's Imperial College of Engineering and Research Wagholi, Pune, Maharashtra, India.

*2Assistant professor, Department of Civil Engineering, JSPM's Imperial College of Engineering and Research Wagholi, Pune, Maharashtra, India.

ABSTRACT

Water is one of the important element in our life. As water is used in many different fields like distribution of drinking water, agriculture, industry, fire-fighting etc. all these purpose needs various types of flows throughout the year according to the use. We need to store the water to maintain the flow of water. For this purpose we have to construct an elevated water tanks. INTZE water tank is one of the large structure to store the water and these type of structure are build for long term use. These types of structures need to resist the strong winds and earthquakes. The primary intention of this paper is to analyze the behaviour of various staging system under different loading condition. STAAD PRO software is used to analyze the effects of different bracing on base shear, roof displacement and buckling values at different conditions like full-filled, half-filled and empty condition including the wind zone.

Keywords: Water Tank, Staging, Bracing, Base Shear, Roof Displacement, Buckling.

I. INTRODUCTION

Elevated water tanks are crucial structures that must be able to perform as expected, i.e. continue to function during and after heavy winds. It's very challenging to analyze a hydrodynamic structure like an elevated concrete water tank. This could be due to a lack of understanding of the tank's supporting system's proper behaviour due to the dynamic effect, as well as incorrect geometrical staging selection. Water is stored in a water tank to meet the daily requirement. The imperviousness of concrete is critical in the construction of concrete structures for the storage of water and other liquids. The water cement ratio determines the permeability of any homogenous and properly compacted concrete of given mix proportions. The increase in the water cement ratio has a number of consequences.

WATER TANK IN GENERAL AND TYPES OF WATER TANK

Water supply projects have received a lot of attention in recent years all over the world, and they are critical for the country's social and industrial growth. Water tanks come in a variety of capacities, depending on the amount of water consumed. Water tanks are divided into three categories based on their location:

1. Water tanks buried underneath
2. The tank is sitting on the ground.
3. Water tanks that are elevated.

The water tanks are also divided into categories based on their shape:

1. Circular tanks
2. Rectangular tanks
3. INTZE tanks
4. Circular tank with conical bottom
5. Spherical tanks.

II. LITERATURE REVIEW

Niraj Kumar Soni et. Al (2020) Studied hydrostatic analysis of INTZE type elevated water tank. To make the design economical they have done the parametric study in which they vary the staging container diameter ratio, horizontal angel of dome, number of columns for design of staging etc. to analyze this model they have used the software STAAD PRO and manual calculations has been done. They conclude that as H/D ratio decreases with node displacement in vertical downward direction and the maximum support reaction decreases by 34% at H/D ratio 1.5 as compared with o.5.

Mohammed Quais Khan et. Al (2019) Studied the design of INTZE water tank as per the norms in IS:3370, IS 800:2002, IS:875. In this study they have design all the members of INTZE water tank including dome, ring beam supporting the dome, cylindrical wall, ring beam at junction, conical slab, ring girder, column, tower with bracing etc. They have made a 2D model in the STAAD PRO software. They conclude that horizontal forces like wind and earthquake can affect the design of the structure.

Chetan Agari et. Al (2019) Studied the seismic analysis of INTZE water tank. They study for stability of elevated water structure during seismic activity. They have considered the four seismic zones for the study. They used the STAAD PRO software to analyze the model and to determine the values of displacement, maximum bending moment, base shear and maximum shear force under different zones. They conclude that the bending moment values are changing in staging due to different bracings.

Ajmal Tokhi et. Al (2019) Design of elevated tank is complex and requires a lot of calculation and time. Capacity of all tanks is 45000litres holds up on RCC frame of stage height of 27m. Time period is more in tank others in full filled condition and is dependent of zones. In all condition, base shear in circular tank is less than that of INTZE tank in seismic zone 3.

R Uma Maheshwari Rao et. Al (2018) Studied the effects of lateral forces produced by wind and seismic waves on tank. In this they study some parameters like axial forces, bending moment, shear force etc. and these parameters are then compared for different structures. They use the finite element method for analysis. They have used the STAAD PRO V8i software for analysis. They found bending moment at the top of the tank is 29.086kNm with shear force of 28.59kN.

ISSAR Kapadia et. Al (2017) Studied the structural analysis of all elements of tanks using IS codes. It includes the elements like dome, ring beam supporting the domes, cylindrical walls, conical wall, conical slab, floor of the tank, ring girder, column and foundation. To study the hydrostatic forces acting on tank, a 3D model is prepared in STAAD PRO software. They conclude that when the height of structure increases, it causes the increase in moment.

Shriram Nagarao Bengal et. Al (2017) Studied the rectangular and circular water tank of constant staging height of 12m, under the influence of seismic forces. As per IS 1893:1984/2002 for design of seismic structure. The design of the was carried out in the software STAAD PRO V8i. they have taken the capacity of tank as 100 cubic meter for both shapes. Tank was tested under full filled and empty condition. They conclude that the base shear in full filled tank is slightly higher than that of empty tank and shear force generated is slightly higher in full filled tank than the empty tank.

Sonali M Pole et. Al (2017) In this paper, they have studied different pattern of staging with different type of storage capacity of tanks. They used two types of staging system cross bracings and radial bracings at various fluid level for the comparison. They perform their study on the STADD PRO V8i software. They find out the parameter like overturning moment, base shear and roof displacement. They conclude that base shear as well as base moment is less for empty tank as compared to fully filled water tank.

Ankush N Asati et. Al (2016) They have studied the dynamic analysis for the circular tank considering the seismic forces. They have used various staging system like normal, cross and radial. They used the SAP2000 software to analyze the structure for above parameters. They conclude that the radial arrangement with six staging level is best.

Neeraj Tiwari et. Al (2015) In this, they have studied the conventional analysis for overhead water tank assuming the column rests on yielding support. They have taken the deformable soil strata for the study. They used the ANSYS software to carry out their 3D model. They study the parameter like resultant deflection, Von-mises stress, neural frequency of tanks. They evaluate the natural frequency of tank for different filling conditions and comparison is made between the non-interaction and interaction analyses.

III. CONCLUSION

After studying many research paper it seems that the wind force and earthquake forces are the major forces that affects the design of elevated water tank. In some researches it seems that INTZE type elevated water tank is more stable and can resist more forces as compared to other type of elevated water tank structure.

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IV. REFERENCES

[1] Niraj Kumar and Dr. Pankaj Singh, "Parametric study of INTZE water tank with varying height to diameter ratio using STAAD PRO", International journal of civil and structural Engineering Research, Vol-7, Issue-2, pp.39-43, march 2020

[2] Issar Kapadia, Purav Patel, NileshDholiya, "Parametric study of RCC staging (support structure) for overhead water tankas per IS: 3370", IJAERD, Vol-4, Issue-1, 2017.

[3] Mohammad Quais Khan and Mr. Baber Hussain, "Analysis and design of INTZE water tankas per IS: 3370 and IS: 456-2000 using STAAD PRO software", IJAERD, vol- 5, Issue-6, 2019

[4] ChetanAgari, V.K Verma& Aman Gupta "Seismic analysis of INTZE water tank with different bracing configuration", International Journal of Research in Engineering, Science and management, Vol-2, Issue-8, August 2019.

[5] Tokhi Ajmal & Sahil Arora, "Seismic analysis of elevated water tank, circular water tank and rectangular and response spectrum analysis", International Journal of Civil engineering and Technology, Vol-10, Issue-3, March 2019, pp. 2519-2527.

[6] R.Umamaheswara Rao, P.Goverdhan, Divyavani .B,Vidya "Analysis and design of RCC overhead water tank for seismic and wind loads", Indian journal science research, 17(2): 425-428,2018.

[7] Issar Kapadia, Purav Patel, NileshDholiya, Nikunj Patel "Analysis and Design of INTZE type overhead water tank under the hydrostatic Pressure as per IS: 3370 & IS 456-2000 by using STAAD PRO software "International Research Journal of Engineering and Technology (IRJET)", Vol-04, Issue-07, July 2017.

[8] Shriram Nagarao Bengal, Sandip A. Tupat "Seismic analysis of elevated water tank with variation of H/D ratio and container shape", International Journal of computer science and mobile computing, Vol-6, Issue-5, pg. 209-217,May 2017.

[9] Sonali M. Pole Professor, Amey R. Khedikar "Seismic Investigation of RC elevated tank for different types of staging system", International Journal of Innovative Research in Seismic Engineering and Technology, vol-6, Issue-7, July 2017.

[10] Ankush N.Asati, Mahendra S. Kadu, S.RAsati "Seismic analysis and optimization of RCC elevated water tank using various staging patterns", International Journal of engineering research and application, ISSN:2248-9622, Vol-6, Issue-7(part 1), July 2016.

[11] Neeraj Tiwari and M. S. Hora "Transient analysis o elevated INTZE water tank-fluid–soil system", ARPN Journal of Engineering and Applied Sciences, Vol-10, February 2015.

[12] Rupachandra J. Aware, Dr. Vageesha S. Mathada "Seismic Performance of Circular Elevated water tank", International Journal of Science and Research (IJSR) ISSN, Vol-4, Issue-12, December 2015.

[13] Prasad S. Barve & Ruchi P. Barve "Parametric study to understand the seismic behaviour of INTZE tank supported on shaft", International Journal of Engineering sciences and Research Technology, Vol-4 (version 7), pp.161-168, July 2015.

[14] Ankita R Patil and Dr.S.A Balchandra "Effect of different staging configuration on seismic performance of circular elevated water tank", International Journal of Engineering Research and Applications, Vol-4, (Version 6), pp. 39-43, August 2014.

[15] Cherukupally Rajesh and Sudip Jha, Professor P. Shrilaskhmi "Seismic Behaviour of an elevated water tank for different staging height", International Journal and magazine of Engineering Technology, Management and Research, 2014.