International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 4 Issue 1, December 2019 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Review Paper Study on Overhead Circular Water Tank

Mahesh Kumar Pal[1], Nitesh Kushwaha[2]

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

How to cite this paper: Mahesh Kumar Pal | Nitesh Kushwaha "Review Paper Study on Overhead Circular Water Tank" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-4 | Issue-1, December 2019, pp.1222-1224, URL: www.ijtsrd.com/papers/ijtsrd29941.pdf

IJTSRD29941

INRODUCTION

A water tank is used to store water to tide over the daily requirement. In the construction of concrete structure for the storage of water and other liquids the imperviousness of concrete is most essential .The permeability of any uniform and thoroughly compacted concrete of given mix proportions is mainly dependent on water cement ratio .The increase in water cement ratio results in increase in the permeability .The decrease in water cement ratio will therefore be desirable to decrease the permeability, but very much reduced water cement ratio may cause compaction difficulties and prove to be harmful also. Design of liquid retaining structure has to be based on the avoidance of cracking in the concrete having regard to its tensile strength. Cracks can be prevented by avoiding the use of thick timber shuttering which prevent the easy escape of heat of hydration from the concrete mass. the risk cracking can also be minimized by reducing the restraints on free expansion or contraction of the structure.

Literature Survey

General

(Mainak Ghosal Ghosal (2019)

Mainak Ghosal Ghosal currently works at the Dr. M. N. Dastur School of Material Sciences, Indian Institute of Engineering Science and Technology, Shibpur. Mainak Ghosal does research in Structural Engineering, Materials Engineering and Civil Engineering. Their current project is 'Nano materials in Cement Concrete' base paper Every design comes out when there is a problem. A design is created to solve the existing problems. People in the region where there is scarcity of water, don't get enough flow or speed or discharge especially those living on the upper floors in a multi-storied building. As a consequence people suffer from lack of water due to insufficient supply for compensating their daily needs. As a first solution of this problem, one needs to develop a water storage project as has been designed with the help of STAAD principles, known as Overhead Water Reservoir. The present study reports the analysis and design of an elevated circular water tank using STAAD. Pro V8i. The design involves load calculations manually and analyzing the whole structure by STAAD. Pro V8i. The design method used in STAAD. Pro analysis is Limit State Design and the water tank is subjected to wind load, dead load, self-weight and hydrostatic load due to water.

L. P. Shrivastava & Akshit Lamba (2018)

A design analysis for water tank based on new IS code 3370-2009 and draft code of 1893-Part 2. They considered two mass models one being the impulsive one and the other being the convective model. Simulation work is performed on STAAD Pro on Intze type water tank supported on frame staging. The loading conditions were seismic and wind forces. From this study, it was clear that for elevated tanks, two degree of freedom idealization of tank showed better results when they were compared with the one degree of freedom of idealization. The model was loaded with earthquake loads (seismic loads) followed by Wind loads on the columns of the tank and summed up by considering the self-weight of the entire assembly. Few observations were made – the first being the variation of hydrodynamic pressures on the geometrical aspects of the tank, the second being the comparison of total base shear and moment for empty and full conditions of the tank and the last being a comparative study among time period, base shear and base moment for impulsive and convective modes of vibration.

Issar Kapadia, Purav Patel, Nilesh Dholiya, Nikunj Patel (2017)

In their paper entitled "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". carried out the study with help of the STAAD Pro Software, We made the conclusion as pointed There is an increase in moment when the, height of the structure increases. When using fix joint at the base its remarkable reduction in base settlement. This type tank is simplest form as compare to the circular tank. We have given the inclination to the staging of water tank because as respected inclination the tank performs better than that type of straight one.

Rajkumar, Shivaraj and Prof. Mangalgi (2017)

In their paper entitled "Response-Spectrum Study Of High-Rised Intze and Circular Water Tanks" The total base shear in full tank condition are more than those in empty tank condition and half-filled condition in both seismic zones II and seismic zone V for both Intze and circular type of tank. Hence design is governed by full tank condition. Design of elevated water tank is very complex which involves lot of mathematical calculations and time consuming. Hence Staad

pro gives all parameters which are useful in design of elevated water tank.

Hasan Jasim Mohammed (2016), conclude that:
An application of optimization method to the structural design of concrete rectangular and circular water tanks, considering the total cost of the tank as an objective function with the properties of the tank that are tank capacity, width and length of tank in rectangular, water depth in circular, unit weight of water and tank floor slab thickness, as design variables. A computer program has been developed to solve numerical examples using the Indian IS: 456-2000 Code equations .The results shown that the tank capacity taken up the minimum total cost of the rectangular tank and taken down for circular tank. The tank floor slab thickness taken up the minimum total cost for two types of tanks. The unit weight of water in tank taken up the minimum total cost of the circular tank and taken down for rectangular tank.

Vijay K. Puri and Shamsher Prakash, (2014), concludes that:
Design of foundations in earthquake prone areas needs special considerations. Shallow foundations may experience a reduction in bearing capacity and increase in settlement and tilt due to seismic loading. The reduction in bearing capacity depends on the nature and type of soil and ground acceleration parameters. In the case of piles, the soil-pile behavior under earthquake loading is generally non-linear. The nonlinearity must be accounted for by defining soil- pile stiffness in terms of strain dependent soil modulus. A comparison of observed and predicted pile behavior under dynamic loads has attracted the attention of several investigators. The lateral dynamic pile response of single piles predicted by analytical models often yields higher natural frequencies and lower resonant amplitudes compared to those determined from field tests in horizontal vibrations only. This has been found to be due to overestimated shear modulus and radiation damping of the soil. The authors made an investigation to determine a simple method to improve the theoretical predictions of piles embedded in fine soils. Based upon this investigation shear strain dependent reduction factors are proposed for determining the shear modulus and damping for pile response calculations.

Pandey et al. (2015)
Limit state method is widely used at present in comparison to working stress method with the following advantages: i) Materials are treated according to their properties. ii) Loads are treated according to their nature. iii) Structures generally fail when they reach their limit state, not their elastic state. However, when structures reach to their limit state, the cracking width in the structure may be significantly higher comparative to a structure designed by working stress method at the same stage. IS: 3370 i.e. the Indian Standard specifications for construction of liquid retaining structures did not adopt limit state design method for long. However, IS:3370 has adopted the limit state design method after considering checks over the cracking width. It has been recently adopted in the new version of IS 3370-2009 concrete structures for storage of liquids – code of practice, while going through IS 3370 – 2009 it can be found that three methods of design are available.

OBJECTIVES

- To Study Design of water tank using STAAD PRO V8i Software.

METHODOLOG
Overhead water tanks models are designed using STAAD Pro. The columns are taken circular for both tanks and diameter are 300 mm and height is 15 meter. The height of water tank is 4.3 meter and diameter is 8 meter for circular water tanks. Capacity of water stored is 200KL or 200000 liter. These models are analyzed for dead load, water load and seismic load. Dead load was designed according to IS: 875-1987(Part 1) and Seismic load was designed using response spectrum method for earthquake zone III of India using IS: 1903-2002. The details of the modeled tanks are listed below. Modal damping of 5% is considered with SMRF and Importance Factor (I) =1.

CONCLUSION
study of capacity in overhead circular tank without center column and circular tank with center column it is clear that the seismic hazard and water pressure are the measure component for the analysis of the tank. Water pressure is not same in all places of the tank.

REFERENCES

[1] Al-Badri (2005) "Application Evolutionary Global Optimization Techniques in the Design of RC water tanks" Engineering Structure, Pp 332-334.

[2] AsatiAnkush N., KaduMahendra S. (2014), "Seismic investigation of RC elevated water tank for different types of staging patterns",4-7

[3] Bhandari M, Singh Karan Deep (2014), "Comparative study of design of water tank", 231- 238

[4] Bhandari M, Singh Karan Deep (2014), "Economic design of water tank of different shapes"45-53 Dixit B

[5] Dona Rose K J, Sreekumar M, Anumod A S (2015), "A study of overhead water tanks subjected to dynamic loads"344-348

[6] Durgesh, C. R. (2001) "Design of Differences Types of Tanks". Department of Civil Engineering, London Institute of Technology, London.

[7] Gray, W. S. and Manning, G. P. (1964) "Water Towers, Bunkers, Silos and other Elevated Structure". London. Concrete Publications Limited.

[8] H. J. Mohammed (2011), "Economic Design of water concrete tanks", European journal of scientific researchvol.49.

[9] Hassan Jasim Mohammed, "Economical design of water concrete tanks" Europeans Journal Publication, Vol 49 NO.4 (2011), Pp 510-520.

[10] IS 13920: 1993 Code of practice - Ductile detailing of reinforced concrete structures subjected to seismic forces.

[11] IS 1893 (PartI): 2002 Criteria for Earthquake Resistant Design of Structures, IS: 1893-1984 "Criteria for Earthquake Resistant Design of Structures".

[12] IS 3370: 1967 (PartI, II, III, IV) Code of Practice for Concrete Structures for the Storage of Liquids.

[13] IS 4326: 1993 Code of practice for Earthquake Resistant Design and Construction of Buildings.

[14] J. Yogeshwarana, C. Pavithra,(2015), " Behaviour of an elevated RC tank subjected to various earthquake responses", 440-444

[15] Jain Sudhir K., Sameer U.S., 1990, "Seismic Design of Frame Staging For Elevated Water Tank" Ninth Symposium on Earthquake Engineering (9SEE-90), Roorkey, December 14-16, Vol-1.

[16] KagdelwarBhagyashree Prakash, Patil A. V. (2016), "Economic design of RC elevated water tanks by using IS 3370 and its revision is 3370 (2009)", 517- 527

[17] Mohana H., Kavan M. R (2015) Comparative Study of Flat Slab and Conventional Slab Structure Using ETABS for Different Earthquake Zones of India IJRET: International Journal of Research in Engineering and Technology, Volume: 02 Issue: 03 | June-2015.

[18] More and Sawant (2013) "Analysis of Flat Slab" International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064,

[19] Navyashree K, Sahana T. S(2014) Use of flat slabs in multi-storey commercial building situated in high seismic zone, IJRET: International Journal of Research in Engineering and Technology, Volume: 03 Issue: 08 | Aug-2014.

[20] Patel. Patel. Chirag. N. (2016), "A review on overhead water tank staging considering Fluid-Structure-Soil Interaction" 116-120

[21] Pathak & Agarwal, (2003) and Pall, (2004),"Cost Prediction of overhead water tanks using Artificial Neural Networks", IE (I) Journal, Vol 113 No.9.

[22] Prof. R. V. R. K. Prasad, Akshaya B. Kamdi, "Effect of Revision of IS 3370 on water storage tank". International Journal of Engineering Research and Applications (IJERA), ISSN: 2248-9622 Vol.2, Issue 5, Pp.664-666, September-October 2012.

[23] Reshma, Arunima V(2017) Seismic Analysis Of Multi Storied Irregular Building Using Flat Slab And Grid Slab In Zone III & V Volume: 04 Issue: 06 | June -2017

[24] S. N. Utane, Prof. H. B. Dahake(2016) Effect of shape irregularity on flat slab industrial building under lateral loading" International journal of modern trends in engineering & research. (IJMTER) ISSN: 2349-9745,Volume 03, Issue 03, [March – 2016]

[25] Sable (2012) "Comparative study of seismic behaviour of multi-storey flat slab and conventional reinforced concrete framed structure", International Journal of Computer Technology and Electronics Engineering (IJCTEE) Volume 2, Issue 3, June 2012,

[26] Salman I. Khan & Ashok R Mundhada (2015), Comparative study of seismic performance of multistoried RCC Building with Flat Slab & Grid Slab: A Review, IJSCER, ISSN 2319-6009, Vol.02-Feb 2015.

[27] Sandesh D. Bothara, Dr. Valsson Varghese (2012) "Dynamic analysis of special moment resisting frame Building with flat slab and grid slab, International Journal of Engineering Research and Applications Vol. 2, Issue 4, July-August 2012, pp.275-282.