

Comparative Analysis & Design of RCC Elevated Service Reservoir of Circular Shape for Ahmadabad Village - A Recent Review

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Abstract— Storage reservoirs and overhead tank are used to store water, liquid petroleum, petroleum products and similar liquids. The force analysis of the reservoirs or tanks is about the same irrespective of the chemical nature of the product. All tanks are designed as crack free structures to eliminate any leakage. This project gives in brief, the theory behind the design of liquid retaining structure (circular water tank with flexible and rigid base and rectangular under ground water tank) using working stress method. This report also includes computer subroutines to analyze and design circular water tank with flexible and rigid base and rectangular under ground water tank. The program has been written as Macros in Microsoft Excel using Visual Basic programming language. In the end, the programs are validated with the results of manual calculation given in Concrete Structure book.

Keywords: Circular Water Tank, Bracings, Staad Pro, Seismic, Tagging System

I. INTRODUCTION

Water is one of the basic needs of all living beings. Hence proper supply of water should be available to public which can be achieved by construction of water tank. A reinforced concrete tank is a very useful structure which is meant for storage of water for various purposes. The usual types of water tank are the following Tanks situated on ground, tank situated underground and tanks situated above ground level. The tanks may be either open or roofed over and they must be either circular, rectangular or square in plan the mix usually adopted is M 25 or M20. Capacity of water tank depends upon the population of locality where water tank is to be constructed. Also the sufficient height should be maintained to obtain required pressure of water. It has been seen from past experience that many water tank leads to collapse due to earthquake. Utmost care should be taken while designing water tank so that it should remain functional during earthquakes to provide facility for earthquake affected people and for firefighting purpose. The main aim is to study the performance of elevated water tank under different bracings patterns and their arrangement. Analysis is carried out by comparing deflection of container and base shear for tank full, tank half and tank empty conditions. height to pressurization the water distribution system. Many new ideas and innovation has been made for the storage of water and other liquid materials in different forms and fashions. There are many different ways for the storage of liquid such as underground, ground supported, elevated etc. Liquid storage tanks are used extensively by municipalities and industries for storing water, inflammable liquids and other chemicals. Thus Water tanks are very important for public utility and for industrial structure

Here we have consider village Ahmadabad where following data was collected-

1) Important data like Population , Area & other important things etc .

POPULATION – 1500

AREA -606 HECTRE

By using Arithmetic Mean Method we have calculated population of Ahmadabad Village for next 50 years. & analysis and design will be done manually and by software and comparative result will be found

II. LITERATURE REVIEW:

Pavan S. Ekbote and Dr. Jagdish G. Kori [1] During earthquake elevated water tanks were heavily damages or collapsed. This was might be due to the lack of knowledge regarding the behavior of supporting system of the water tanks again dynamic action and also due to improper geometrical selection of staging patterns of tank. Due to the fluid structure interactions, the seismic behavior of elevated water tanks has the characteristics of complex phenomena. The main aim of this study is to understand the behavior of supporting system (or staging) which is more effective under different response spectrum method with SAP 2000 software. In this paper different supporting systems such as cross and radial bracing studied.

M Bhandari and , Karan Deep Singh [2] Limit state method which is widely used has been adopted in the new version of IS 33702009 Code of practice for concrete structures for storage of liquids. As per the provisions of the earlier version of the code (IS 3370-1965), the designing of water tanks was permitted by working stress method only. The study was conducted in order to compare the design provisions of IS 3370 (1965) and IS 3370 (2009).In this study, a comparison of design of water tanks using the Working Stress and Limit State methods was economical.

Jain, Sudhir K and Sameer, U.S .: Reviewed IS code provision for aseismic design of elevated water tanks It is seen that, due to absence of a suitable value of performance factor for tanks, the code provides for rather low seismic design force for these structure. Simple expressions are given which allow calculation of staging stiffness, and hence the time period, while incorporating beam flexibility.

Thalapathy.M and et.al: Storage reservoirs and water tanks are used to store water, liquid petroleum, petroleum products and similar liquids. The force analysis of the reservoirs or tanks is about the same irrespective of the chemical nature of the product. All tanks are designed as crack free structures to eliminate any leakage. The study gives the detailed analysis of the design of liquid retaining structure using working stress method. The project takes into consideration the design of reservoir for the following cases: 1) Underground Tank, 2) Tank Resting on ground and 3) Overhead water tank. The paper gives idea for safe design with minimum cost of the tank and gives the designer relationship curve between design variable. Thus design of

tank can be more economical, reliable and simple. The paper helps in understanding the design philosophy for the safe and economical design of water tank.

R. K. Prasad and Akshaya B. Kamdi (2012): BIS has brought out the revised version of IS 3370 (part 1 & 2) after a long time from its 1965 version in year 2009. This paper gives in brief, the theory behind the design circular water tank using WSM and LSM. Design of water tank by LSM is most economical as the quantity of material required is less as compared to WSM.

Khaza Mohiddin Shaikh and Prof. Vasugi K (2014) conclude that: Analysis & Design of elevated water tanks against earthquake effect is of considerable importance. These structures must remain functional even after an earthquake. Most elevated water tank are never completely filled with water. Hence, a two-mass idealization of the tank is more appropriate as compared to one-mass idealization.

Hasan Jasim Mohammed (2011), 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.

George W. Housner [1963]: discussed the relation between the motion of water with respect to tank & motion of whole structure with respect to ground. He had considered three basic conditions of tank for the analysis, i.e. fully filled, empty & partially filled. He said that if water tank is fully filled condition i.e. without free board then the sloshing effect of water is neglected and if the tank is empty then there is no sloshing effect. In the above two cases water body in the tank will behave as one-mass structure. But in third case i.e. water tank is partially filled, the effect of sloshing should be considered. In that case the water body will behave as two-mass structure. Finally he concluded that the maximum force to which the half-full tank is subjected may be significantly less than half the force to which the full tank is subjected.

Uma Chaduvulaa and Deepam Patela et al. [2013]: investigates Fluid-Structure-Soil Interaction Effects on Seismic Behaviour of Elevated Water Tanks. An experimental investigation for a 1:4 scale model of cylindrical steel elevated water tank has been carried out on shake table facility at CSIR-SERC, Chennai. Experimental study on water tank consist of combined vertical, horizontal and rocking motions. For this study a synthetic seismic excitation for 0.1g and 0.2g accelerations, with increasing angle of rocking motion are considered. When earthquake acceleration increases, convective base shear and base moment values are increases, but decreases with increasing angular motion.

III. CONCLUSION

From the literatures it is find out that, structural performance of water tanks depends a lot of factors which includes, fluid structure interaction, soil structure interaction, type of supports, wall flexibility, presence of dampers, staging

height, water fill conditions etc. Failure of water tanks are caused by various reasons. The main problem is water tanks are not much safe under different loading conditions due to lack of its strength and capacity to withstand the worst conditions. Hence design a water tank which provide much safety and strength is a challenging task for the engineers. For this, it is important to know the tank response under various loading, and its failure patterns.

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