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Design of Economical Water Tank with Water Distribution System

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Abstract: Water tanks are widely used for storing potable water. Due to lack of water round the world, importance is given more on the water storage project. So water storage is extremely important because it plays an important role in lifestyle. In order to fulfill the water demand of the continuously growing population, it is essential to provide the sufficient and uniform quantity of water through the designed network of pipes. The design of new water distribution systems, and the strengthening, expansion and rehabilitation of existing water distribution systems, inclusive of design timing, parameter uncertainty, water quality, and operational considerations. It identifies trends and limits in the field, and provides future research directions.

Keywords: Elevated Rectangular, Circular, Intze by using design analysis method.

1. Introduction

In the current situation, there is more importance of water project around the world due to the water scarcity. In general depending upon the location tanks are classified into resting on ground underground water tank, over head or elevated water tank. Depending upon their shape water tanks are further classified`` as:- 1. Elevated Rectangular Tank
2. Elevated Circular Tank 3. Elevated Intze Tank.

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The tank structure is design under IS code 456:2000design method with precautions. Depend in goon the soil bearing capacity, zones population and soil condition are tanks are designed for particular region. Elevated tanks are supported on making which may be included in them as on drywells; RCC fixed together, beams for supporting columns and are generally provided because they have simple design counter walls exposed to water forces. Reinforce have simple design procedure, low cost and massive in nature with leakage proof. The liquid retaining rcc tanks are made water fitted by using. Mix (M25) of concerted in every portion without allowing cracks in structure with the additional waterproofing resource the water distribution are classified into three types:-1. Gravitysystem2. Pumping system 3. Combined gravity.

2. Literature Review

Thorat et al., stated that as height of water tank increases max nodal shift increases. Water tank height gives least nodal shift. All the models of analysis, maximum nodal shift is least for extreme. Current study are going to be beneficial to Civil Engineers to understand the performance of elevated cistern for several heights and also to grow the feeling of effect of earthquake zones of India on earthquake forces and nodal modification For the ESR on sloping ground, it is observed that both shear force and bending moment increase suddenly in the column resting on the advanced side of the sloping ground. However the rise in Shear force & Bending Moment becomes negligible as one goes near downward side of slope. It is also observed that as one moves near higher levels, effect of rising in shear force & bending moment due to sloping ground becomes quiet slight. There is no important modification in axial force with respect to change of slope of ground. For the rise height of staging, the cross segment of important area of column also increases. [1]

Pranjali et al., analyzed the detailed study and analysis some of the conclusions can be made as follows For same capacity, same geometry, same height, with same staging system, in the same Zone, with same Importance Factor & response reduction factor; response by Equivalent Static Method to Dynamic method differ considerably. It also state that even if we consider two cases for same capacity of tank. [2]

Satkarsuryakant et al., contemplated and inspected the limited researches have been done on the effect of the seismic zones and the change of geometry. Present study focuses on the area which had been unfocused in past researches. Present study is an attempt to focus on the various aspects of study for dynamic analysis of elevated water tanks which are still not taken as the matter of interest. Based on the literature review it is observed that the analytical study was carried out and the results determine that the elevated water tanks are more vulnerable to the seismic activities due to

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earthquake. The conclusions of some studies are limited by the facts that only circular shape for overhead water tank is considered. Variation in geometry of tank is not considered. In some the research, the variation in the geometry is not considered as circular shape and rectangular shape behave completely different in stress distribution manner. It is found that H/ R ratio is not taken into account as the time period of the structure changes with varying H/ R ratio for varying geometry. Effect of the cyclonic wind on the tank is not taken into account as the new factor is introduced in IS 875-Part 3 to calculate wind intensity [3]

Sagar Mhamunkar et al., analyzed elevated circular water tank with large capacity and flat bottom needs large reinforcement at the ring beam, to overcome this in intze tank, by providing a conical bottom and another spherical bottom reduces the stresses in ring beams. intze tank is more economical for top capacity reducing the steel requirement. Per capita demand has been calculated which helped us, to understand about the water consumption in residential district and further helped in design the tank. Limit state method was found to be most economical for design of cistern because the quantity of steel and concrete needed is a smaller amount as compare to working stress method. After manual design and analysis in staid pro our structure is safe. [4]

Maulik et al., analyzed the node number and pipe number marking of Kuchhadi village is represented. The presented results are based on the Loop software and manually. It is also based on forecast population of 2001, 2011 & 2014. The comparison of results of Loop and manually is same. The result of water distribution network by Loop software and manually is same for ZONE 1 of village is represented in table. The Loop software calculation is more accurate than manual calculation. The Population of ZONE 1 of Village is 1273. The cost of distribution line of Zone1 for Kuchhadi village is Rs.1, 02, 120.00. [5]

Arjun Kumar et al., stated the method of distribution used here is combined gravity and pumping system as firstly the water is pumped with the help of centrifugal pumps from underground water source i.e. from aquifers then they're lifted up to the overhead water tanks and thru there with the assistance of gravity system is transferred to the most rising pipe. The distribution layout used here is tree system or dead end system which is according to the layout of the Kathgarh area. [6]

Tejaswini et al., analyzed results that shows the area of steel required in limit state method increase when compared to that of working stress method as the allowable stresses in steel were lower. From the above outcomes and discussion, the displacement is high in hard soil fully tank conditions compare with the hard soil in empty tank condition due to in full tank condition lateral

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forces are more. From the results we conclude that base shear and base moment for empty tank condition is more compare to full tank condition. Because of cistern is empty hence no water pressure from inside, only earthquake forces are working from outer side only. Hence more base shear and base moment in empty tank condition. Axial forces are increased within the fully tank condition compare with the empty tank conditions. The increased values fully tank condition is very small varying compare to empty tank. The critical response of elevated water tanks does not always occur the same conditions as mentioned above, it may vary also due to depending on the earthquake characteristics.[7]

3. Conclusion

The water demand is rapidly increasing with the continuously growth population .To meet the daily demand & uniform quality of   water supply .The elevated water tanks are widely provided with the precise water distribution network of the pipe. Infrastructure for the distribution of water for homes, commercially establishment, irrigation, collection and also for public need such as street flushing and free fighting demands. Thus as conclude from above literature review design analysis and detailed estimate calculation of circular, intze and rectangular elevated water tank for the detailed population should be done by considering the future requirements. The estimated cost of rectangular tanks is much less when compared to circular and intze water tank. Therefore, by the manual design analysis and estimation of construction it is proven that elevated rectangular water tank is more economical than other tanks in the descriptive area, in which gravity method for water distribution system can be installed for the supply of water demand in the area. The benefits of using rectangular water tank are that they are modular, fit, and snugly in most yards. Majority of yards are rectangular in shape .The versatility of rectangular vault enables us to adopt the modules to us. As compared to circular and intze rectangular size is small but small space does not mean small water storage.

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