

“SEISMIC ANALYSIS OF ELEVATED CIRCULAR WATER TANK WITH DIFFERENT SECTIONS AND ORIENTATION OF THE COLUMN”

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Abstract— The word "tank" refers to a container used to store water. They are used to store water for a variety of purposes such as drinking, potable water, agriculture, firefighting, chemical processing and food preparation. The water is stored in the reservoir and the tank above. High pressure tanks, also known as water towers, are built at high altitudes to provide sufficient power for the water supply. In many cities, these tanks are considered an essential service within the city.

Their ability to stay safe during a major earthquake is a major concern. In order to be used for basic needs such as drinking water and fire extinguishing, it must not be broken during and after an earthquake. Many studies have looked at seismic behavior, analysis and construction of pressure vessels, taking into account dynamic analysis.

Keywords— water tank, seismic zone, circular tank, Indian standard code, STAAD Pro, analysis and design of structure.

I. INTRODUCTION

Water is a necessity that people need in daily life. Adequate distribution of water depends on the design of the tank in an area. A raised tank is a large water container whose purpose is to store water high to increase water flow. People store water and other liquid substances in different ways and forms, bringing many new ideas and innovations. Storage in the ground, support in the soil, hope, etc. There are many liquid methods such as Liquid storage tanks are widely used by cities and businesses to store water, liquids and other chemicals. Therefore, water tanks are very important for electricity and industry. High pressure tanks have a large amount of water at the top of their rungs, which is most important for tank failure in the event of an earthquake. High pressure water tanks are important structures and damage to these structures during an earthquake will not cause any damage to drinking water resources, fire and disasters. Since raised tanks are generally used in seismically active areas; seismic behavior should be studied in detail. Due to the lack of support, some tanks exploded or were severely damaged. Therefore, it is necessary



to focus on the seismic safety of the lifeline rope system, where other ropes that were safe during the earthquake were used and at the same time many designs were durable. Fig.1 RC elevated water tanks with frame staging.

II. LITERATURE REVIEW

1. Upgraded Fuel Tank Design Using Carbon Fiber / Fiber Reinforcement as Reinforcement Material and Historical Analysis Using STAAD-Pro Software. "2022 Krushnarth Chondikar In this paper, the author has developed a high fuel tank using carbon fiber / fiber to support and analyzed with the help of STAAD-Pro software, with linear and non-linear processing, different loading methods, time. The maximum process according to historical analysis and time history, achieved The results of the basic reaction performed show that the reaction base increases with time (in seconds). Because less carbon fiber / fiber and concrete should be compared to the hard work method.

Software Design and Analysis of StaadPro V8i SS6 Circular

Elevated Intze Tank, 2022 Shahid Nazir and Ashish Kumar In this article, the author designed an 832m³ capacity intez tank on staad pro and observed the design results after it was successfully completed without error and Safety error. Design results are similar to manual calculations, showing the same support. After getting the accurate design results from StaadPro, we found a good design for the overhead Intze tank.

1. Design and Evaluation of Different Tanks Considering Walls and Packaging in Seismic Zones, 2022 BOGGULA RAJESH, G. SREEKANTH This article discusses different tanks in seismic zone from wall plate and volume perspective. The study found that the base slip of both full and empty water tanks increased in the zone II-III earthquake due to the influence of regional conditions, response reduction coefficients and other factors. Mixed water and empty water tank are exposed to high shear force and bending moment due to area coefficient, behavior reduction coefficient and other reasons in earthquake analysis.

2. Plate tension increases with increasing water column. Base cutoffs increase as tank level increases by 5% to 15%, get base cut values for circle, rectangular and intze samples with 2019 Ajmal Tokhi and Sahil Arora Response spectrum method STAAD PRO

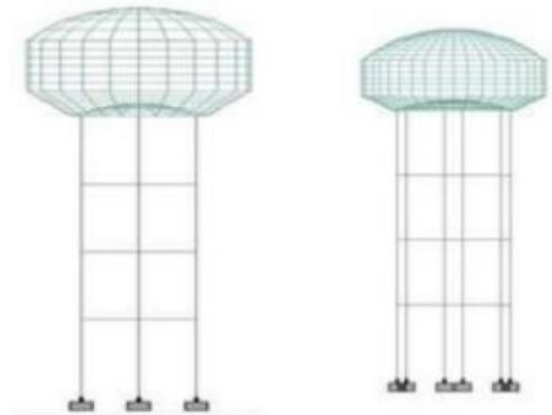
3. Tank Height Analysis with different section heights and widths (June 2018) Author: Mr. Santosh Rathod, Prof. M. B. Ishwaragol In this article, we try to examine, compare and analyze the performance of reinforced concrete elevated tanks with a capacity of 10 liters for different models with different section heights and widths. This article attempts to examine the behavior of using the calculator and the STADD.PRO software. Consider the following water levels, full tank, partial tank and empty tank, seismic zone III. After the analyzes were completed, a comparative study was conducted on the changes in bending moment, shear strength and displacement of lines and beams with different tank heights and wide base. Fixed loads are applied to the whole system, live loads are only applied to the upper dome (1.5KN/m²) for maintenance, and water loads are made on the cylindrical wall, conical plates and the lower dome or from the inside out. model. Air pressures are converted to coordinates and values are calculated, coordinates are used by selecting each panel joint and placing its coordinates as X + and Z + in the instructions. Wind loads are calculated according to IS: 875: Part-3.

4. Combined loading complies with IS: 1893: Standard Chapter 2 Codal rules for the storage of liquids. In this analysis, various loads on the tank such as vertical loads (weight of the tank structure, including fittings) and lateral loads (such as wind loads and earthquake loads) were evaluated with a damping ratio of approximately seismic zone III and 5%. . . Wind loads are calculated using IS 875 (Chapter 3) and earthquake loads are calculated using IS 1893-2002. The tank is modeled with parameters such as Zone III earthquake and wind difference level, base width difference (X+ and Z+). The characteristics of this study are the displacement of the support beam due to shear force in the tank (box and section), bending moment and column displacement, lateral forces such as earthquake and wind, and as a result, a comparison of the samples stored at ground level.

5. The bending moment value increased slightly due to the increase in section height, and increased by 2.9% and

3.1%, respectively, due to the air load on the tank. It was determined that the bending moment values increased by 32.0% and 38.0% with the decrease in the height of the cylinder wall and the increase in the base width. 8% Due to the increase in height, the sole cutting value slightly increased and the sole cutting force increased by 3.3% and 3.6%, respectively.

6. The output value increases due to the decrease in the height of the cylindrical wall and the width of the base, and the displacement increases from 39.38% and 46.4%, respectively.



A. Staging Height

B. Base Width

Fig. 2 2D elevation view of the structural model

(water tank) in STADD.pro

7. "Analysis and design of roller compacted concrete high-level water tank". , 2016 Jahnnabi Basumatary and Dhanjit Barman Intze type tanks are designed in the M30 class. It is created by another type of AutoCAD software.

8. "Seismic Analysis and Design of INTZE Type Water Tanks." Chapter 2015 Chapter The findings suggest that components and impact be considered in seismic investigations of tanks.

9. "Economics of Soil Material Based RCC Tanks and Soil Based Prestressed Concrete Tanks" 2015 Prof. SM Methkar and AR Mundala RCC tanks are cheaper, with a capacity of only 10-1.2 million liters. High performance is the best choice for large tanks and saves 20% on.

10. Seismic Analysis of RC Elevated Rectangular Tank Using IS 1893 (Part 2) (Part 2): 2016 By Sayed HabiburrahmanHaqbin, Chintan.D.Patel and Bansal. Section Section A good understanding of the behavior of the tank during seismicity is required to analyze the force applied and the response of the tank due to the earthquake.

In the case of section, the resistance of the pressure vessel to seismic forces depends on the size of the support. Section has decided on different heights for this study, such as 6m, 9m, 12m, 15m, 18m and 21m, three of which are shown in Figure 6. The effect of section height on seismic activity of high water water reservoir. IS 1893) Part 2: According to the 2006 model specification, the calculation method includes two spring-mass models for each model. The response of the pressure vessel (bottom shear,

overturning moment and displacement) was recorded. Two sample sizes were used according to the above rules. The liquid is divided into two parts: the impulse mass and the convective mass.

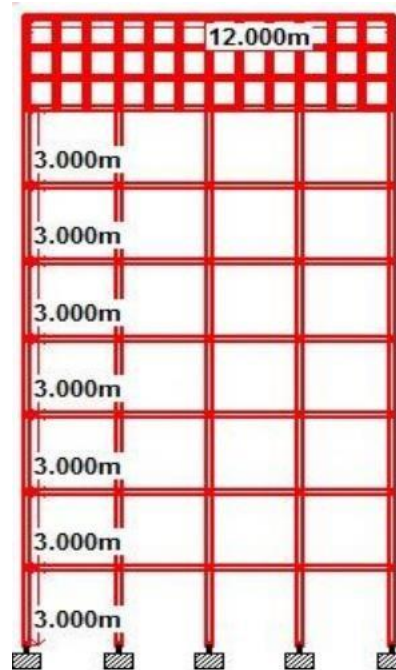
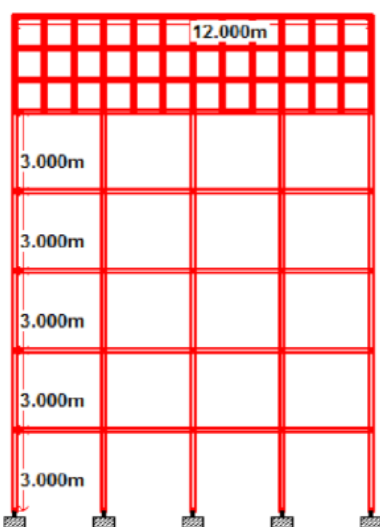
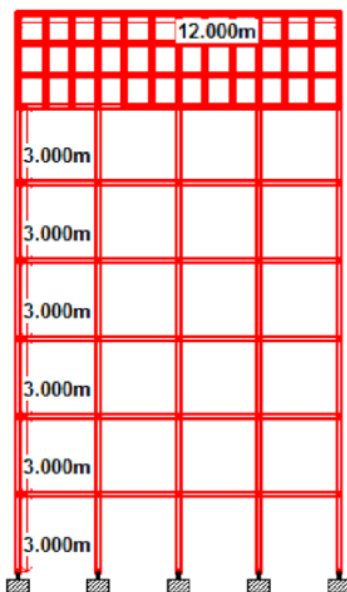
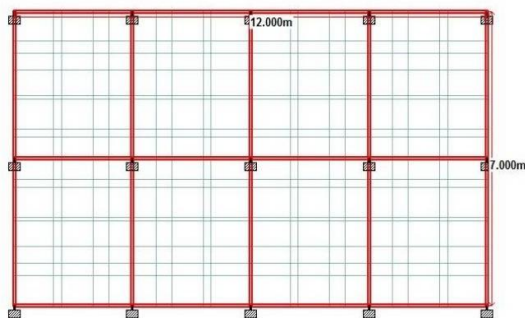


Fig. 7 Elevation of Different Staging Height of Water T

Perform an analysis to find and plot the results of the maximum base shear and tipping time on a graph. However, the STAAD.pro package was used to check the displacement value and found the maximum displacement at the top of the tank. The results of this study are the static analysis of the maximum base shear force, tipping moment and displacement and seismic coefficient shown in the figure. They found that the maximum base shear force, tipping time, and displacement increased with increasing altitude and seismic area. Draw conclusions based on the comparison of results. Base shear force and tipping time are a little more important. Also, as the height of the structure increases, the exchange value increases proportionally because the structure changes easily and the results of the exchange indicate the current need and adequate support for all lines.

11. Seismic Investigation of RC Elevated Tanks with Different Leveling Systems Sonali M. Pole, Amey R. Khedikar In this article, the elevated tank is a very important structure and is considered the main lifeline. In other words, working during and after the earthquake. Many researchers have worked on the behavior, analysis and design of tanks, especially underground tanks, only some of them have focused on concrete reinforcement. Due to the stress of very few earthquakes such as the Bhuj earthquake (2001) in India, the

R.C.C upgraded tanks have been severely damaged or broken. This may be due to the lack of knowledge of the correct behavior of the support tank due to adverse effects and poor geometry selection for grading. The main purpose of this study is to understand the behavior of different distributions according to different loading conditions and to develop the normal distribution system to make it more practical when earthquakes occur. This article presents the seismic evaluation of pressure tanks of different structures and capacities. Here, two different supports, i.e. radial

support and transverse support, are compared with simple supports of different levels rated using STAAD pro. After, calculate the base shear and node displacements for the eleven models at no-load and fully loaded conditions. Three types of staging systems have been described. A legal document for the water storage system is one of the results of this project. The current work explores the response model of a pressure sensitive circuit, considering different techniques using STADD pro.

combinations of full and empty boxes examined study three types of arrangements have been considered i.e normal, radial and cross as shown in Figure 4.

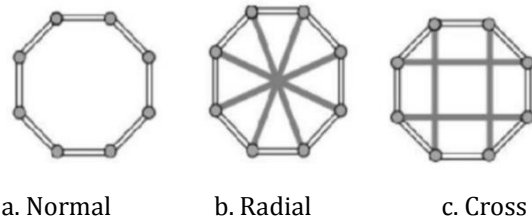


Fig. 5 Different Types of Staging Height

This project focuses on the work of STAAD pro V8i to solve the seismic coefficient. The system gives priority to the time period and to the basic cutoff decided by the manual measurement result. A parametric study was carried out using different measurements of tank pressure. Building a tank is a very difficult process. In particular, the pressure tank design has many mathematical models and calculations. It still takes a long time So STAAD pro does not have to do with base shear node displacement etc. Instantly provides all the results obtained from the analysis, such as The bottom shear force is lower in the full tank case compared to the full tank case. And vice versa for escape. The cruciform system has more deflection from the pole and the least radial deflection, and vice versa. The bottom cutout for full and empty tanks is mostly used for frame configuration, then cross configuration, then radial configuration.

The Effect of Column Dimensions on the Seismic Capacity of the Elevated Reinforced Concrete Water Tank Authors: M I Adiyanto, A A A Damit, S N Yaakup, S A HS Mustapha, S C Chin Components will be analyzed.--Andrew Push Analysis The Study investigated the seismic potential of the existing upgraded RC tank through thrust analysis, providing relocation plans and recommendations. Section. The seismic capacity of the existing pressurized RC tank was evaluated with SAP 2000 software. Section. The method to evaluate the effect of column size on the seismic capacity of upgraded RC tanks is Thrust analysis Section All samples are taken from upgraded RC tanks located in Malaysia Section 4 floors Structure is single floor, high and short Equal to 3.0m, in Figure 8 As shown. The height of and the width of the 7-storey building are equal to 3.5m and 5.0m as shown in Figure 9



Fig. 3. Collapse of water tank in bhuj



Fig. 4. Flexure cracks in staging

The frame type is the most commonly used stage in practice. Article The main components of the stage frame are columns and strips. In sections, each line is set on perimeters and is internally connected by support at each level. Level acts as a bridge between the container and base for the transfer of cargo from the tank. Section. The distribution of water height should be monitored by adjusting the height of the gradation. Section Harassment Section Harassment There are 9

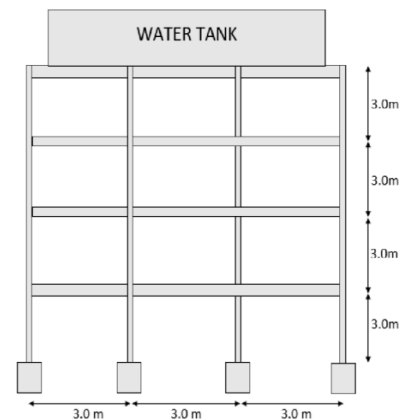


Figure 8. Elevation view of 4 storey elevated RC water tank

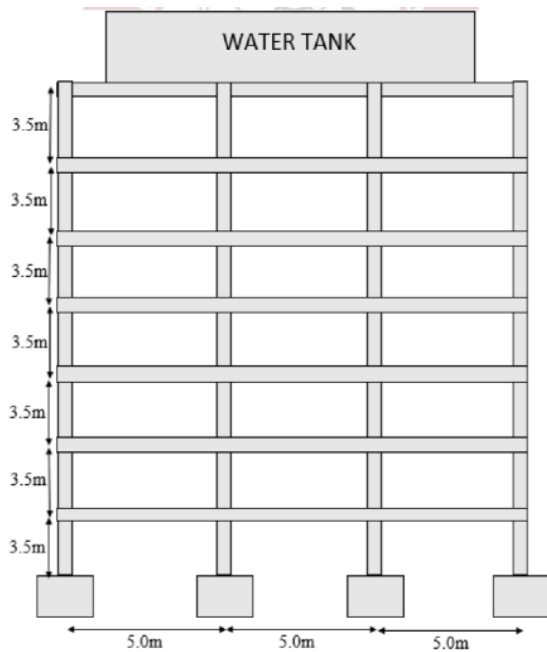


Figure 9. Elevation view of 7 storey elevated RC water tank

II. IMPORTANT FINDINGS

1. Research and have an underground water reservoir with a capacity of 100,000 liters in a magnitude 3 earthquake zone and make a business decision.
2. Investigation of the analysis and design of the RCC drainage system in the earthquake zone.
3. The design process for the liquid storage system was examined according to the IS code.
4. Understand design concepts for safe, economical design of tanks and ensure better orientation of uprights
5. Define and design tanks for H/D ratio = 1, 1.5, 2

IV Conclusion based on Literature Review

The main purpose of this study is to investigate the effect of column size on the seismic capacity of reinforced concrete tanks. The seismic capacitance can be represented by the capacitance curve, which is a diagram of the relationship between lateral loads (called the base shear force, F_b) and lateral displacements. Several conclusions can be drawn from this study:

- a. Column size affects the horizontal pressure withstand power of the RC tank pressure. Larger lines will cause seismic effects through greater efficiency and ultimate strength.
- b. The size of the column also affects the magnitude of the lateral displacement of each floor when exposed to horizontal lines. Larger lines will reduce the size of the outward transition due to their stiffness.

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