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Analysis of elevated water tank using staad pro.

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ABSTRACT

Water tank is a design used to store water for providing to families as drinking inspiration, for ventures as a coolant and irrigational water for horticultural cultivating in certain areas. Water tanks are arranged on bases of their shapes and position of construction. In this paper, we had examined about the plan of water tanks of both upward and underground tanks of shapes rectangular, square and roundabout shapes are planned and investigated utilizing Staad star. From the investigation results finishing up about the impact of shape factor in plan loads and how states of the tanks assume overwhelming part in the plan and in pressure circulation and generally economy.

Keywords: Water Tanks, Design, Staad Star, Overwhelming.

Introduction: -

Water tanks are the designs utilized for putting away drinking consumable water. In present situation, there is a lot of accentuation for water capacity projects from one side of the planet to the other. Water assumes prevalent part in everyday life, so water capacity isn't a need putting away the water is essential. In plan of water tanks, plan perspectives are to be followed according to code books and loads is to be applied cautiously. Water tanks are grouped into two kinds in view of position and state of the tank.

1.2 Based on the area the water tanks are characterized into three different ways: -

1. Underground water tanks
2. Tank laying on grounds
3. Elevated or upward water tanks.

Likewise, the water tanks are grouped in view of shape:

1. Circular tanks
2. Rectangular tanks
3. Intez tanks
4. Circular tank with cone shaped base
5. Square tanks

The draft code utilized in the current review for fluid holding structures are IS 3370 (Part-I to IV), IS 1893 (Part-II, Liquid Retaining Tanks), and IS 11682. The way of behaving of raised water tank is carryout by utilizing Dynamic investigation i.e., Response Spectrum technique. The displaying of tank holder is done considering rash and convective water masses inside the compartment utilizing limited component based programming STAAD.Pro. The current review center way of behaving of raised water tanks utilizing different organizing example, for example, Normal arranging, Hexagonal organizing, Cross organizing, and Radial organizing with focal section and for various h/d proportion such h/d= 0.5, h/d= 0.6 and h/d= 0.7.

Raised tanks are upheld on organizing which might comprise of stone work dividers, R.C.C. segments propped together. The dividers are exposed to water pressure. The base needs to convey heap of water and tank load. The organizing needs to convey heap of water and tanks. The organizing is additionally intended for wind powers

STAAD.Pro-STAAD.Pro is a broadly useful underlying apparatus used with the end goal of investigation and development of essential utilizations of the structure business, for example, business structures, public government assistance structures like water tanks, capacity tanks, interstate structures, petrochemical plants, business structures, dams, holding dividers, turbine establishments, channels and other installed systems. It can utilize different types of investigations from the conventional first request static examination, second request p-delta examination, mathematical nonlinear investigation, Pushover analysis(Static-Non-Linear Analysis) or a clasp examination. It can likewise utilize different types of dynamic examination from modular destruction to time history and reaction range study. STAAD.Pro was at first evolved by Research Engineers International at Yorba Linda, CA in 1997. As of late in 2005 the Research Engineers International was acquired by Bentley Systems [14]. Starting there onwards, STAAD.Pro has turned into a fundamental piece of Bentley Systems, who has been running after ceaseless upgrades in its most its different deliveries.

The term „Liquid stockpiling tank“ alludes to unmistakable fluid holding structure. Numerous novel thoughts and development have been made for the capacity of water and other fluid materials in various structures and designs. Water is human essential requirements for day to day existence. Adequate water appropriation relies upon plan of a water tank in specific region. Water tank has been created around 80 years prior and perceived too planned, effective, and prudent unit for business as well as private use. Likewise, it is inescapable piece of water supply framework, and broadly utilized for capacity and handling of assortment of fluid like material like water, oil based commodity, melted gaseous petrol, compound liquid, and wastage of various structures. In this manner, Water tanks are vital for public utility and for modern construction. Raised water tank, and Earthquake Influence Water supply is a life saver office that should stay useful following fiasco. Most regions in India have water supply framework which relies upon raised tanks for capacity. Raised water tank is a huge raised water capacity compartment built to hold a water supply at a stature adequate to compress a water dissemination framework. In significant urban communities the fundamental stock plan is increased by individual stockpile frameworks of organizations and modern homes for which raised tanks are a basic part. Raised water capacity tanks element to search for are strength and sturdiness, and obviously spillages can be tried not to by recognize great development rehearses. Importance and Scope of present Study The investigation of harm accounts uncovered harm/disappointment of supported substantial raised water tanks of low to high limit. Exploring the impacts of tremors has been perceived as an essential advance to get the regular perils and its gamble to the general public over the long haul. Most water supply frameworks in emerging nations, like India, rely upon supported concrete substantial raised water tanks.

The strength of these tanks against sidelong powers, for example, those brought about by tremors, needs extraordinary consideration. It is especially critical to investigations built up concrete substantial raised water tank appropriately. The raised tanks are oftentimes utilized in seismic dynamic areas additionally thus seismic way of behaving of them should be researched exhaustively. Because of the absence of information on supporting framework a portion of the water tanks were imploded or intensely harms. In this way, there is need to zero in on seismic security of life saver structure utilizing regarding substitute supporting framework which are protected during tremor and take more plan powers. In this manner, the current review is to distinguish the way of behaving of raised water tank under various speed increase time history or seismic tremor qualities with thought and displaying of incautious and convective water masses inside the holder utilizing FEM primary programming STAAD.Pro V8i. Goals: The primary goal of this study is to comprehend the way of behaving of supporting arrangement of Elevated fluid capacity tanks, which is more powerful under various tremor attributes or quake zones according to draft code of IS 1893 (Part 2) and GSDMA rules. A built up substantial raised water tank, (Intz type) with 900 cubic meters and with an arranging stature of 18m and 22.35m from ground level is thought of. Here two different supporting frameworks, for example, outspread propping and cross propping are contrasted and essential supporting framework for different liquid filling conditions. The seismic zones of Zone-III and Zone-V and the comparing quake qualities have been taken from IS 1893 (Part 1)- 2002 and draft code IS 1893 (Part-2). The fundamental targets of the current review are • To investigations the firmness of arranging for Basic, Radial, Cross sort bracings of raised water tanks in Earthquake zones of Zone-III and Zone-V according to IS: 1893 Part-2 draft codal rules by utilizing Staad.Pro.V8i.

- To assess the Base shear at the lower part of the organizing in incautious mode and convective mode and the complete sidelong base shear according to IS: 1893 Part-2 draft codal rules.

- To assess the complete upsetting second at the lower part of the arranging in indiscreet mode and convective mode and the absolute toppling second according to IS: 1893 Part-2 draft codal rules.

- To examinations the Roof dislodging for Basic, Radial, cross sort bracings of raised water tanks in Earthquake zones of Zone-III and Zone-V

- A similar report between supporting frameworks of Basic, Radial, Cross sort bracings as far as Stiffness, Base shear, Base second, and Roof relocations in two quake zones Zone-III and Zone-V.

2. Subtleties for Design-

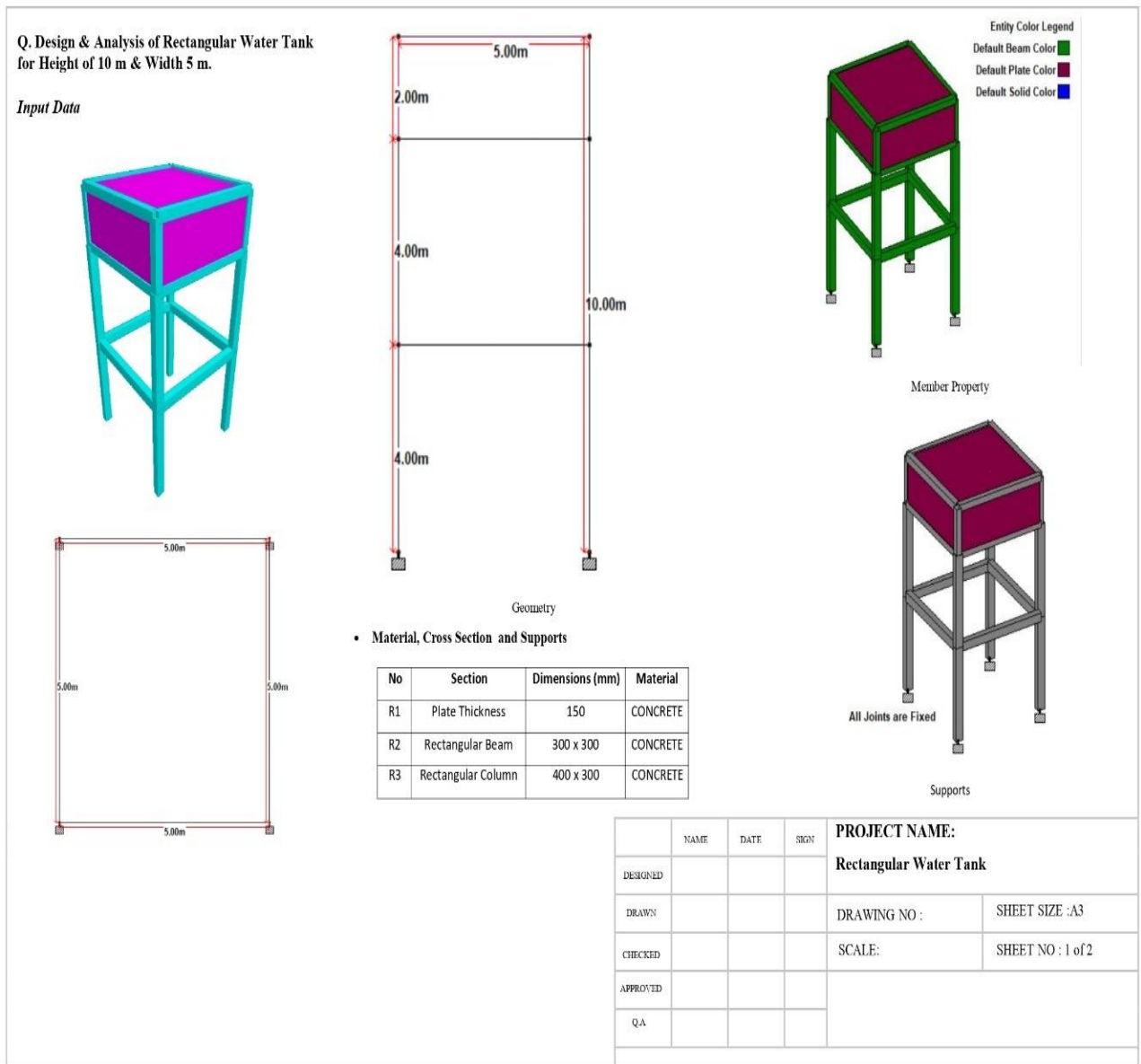
For plan and examination of rectangular water tank we involved information as follow: -

1. Size:

For the examination of rectangular water tank, we utilized stature 10m and width 5m.

2. Properties of entire design: -

- Substantial Plate thickness of tank 150mm
- Concrete Rectangular pillar size 300 x 300
- ConcreteRectangular segment size 400 x 300



Issar Kapadia et al., had done the “Design, Analysis and Comparison of Rectangular Water Tank by Using Staad Pro V18 Software”. This paper includes the study of Rectangular tank that how the shape deflected and what are the actions will be produced when tank empty or by using STAAD Pro software is discussed.

1. **B.V. Ramana Murthy, M Chiranjeevi** had done the “DESIGN OF RECTANGULAR WATER TANK BY USING STAAD PRO SOFTWARE”. In this paper he said that this mini project is conducted for a period of 15 days from 21-05-2021 to 07-06-2021 to have complete practical knowledge of various techniques and problems faced in the field. A different topic like Construction Aspects, Design Parameters, Details of Formwork, Details of reinforcement, Process of Water Treatment Plant and Execution have been dealt with in the course of our mini project.
2. **Thalapathy .M et al.**, had done “ANALYSIS AND ECONOMICAL DESIGN OF WATER TANKS”. In this paper he said this project gives the detailed analysis of the design of liquid retaining structure using working stress method. This paper gives idea for safe design with minimum cost of the tank and give the designer relationship curve between design variable. This paper helps in understanding the design philosophy for the safe and economical design of water tank.
3. **Jindal Bharat Bhushan**, March (2012) The conclusion of this paper is that the size of member remains same for working stress method by both IS 3370(1965) or 3370(2009) and Requirement of area of steel increased in IS:3370(2009) as the allowable stresses in steel were lower. And the size of member or requirement of steel decreases for LSM by 3370:2009 as compare WSM by IS 3370:2009 or 3370:1965

4. **Neeta K. Meshram, Dr. P. S. Pajgade**, August (2014) The steel quantity is more for a reservoir by WSM as compare to LSM. And if we want to design a water tank by LSM, the crack width calculation is necessary. The recent introduction of the LSM of design in IS:3370 Part 2:2009 and IS 456:2000 with crack width limit of 0.2 mm and in line with international codes of practice is found to results in more rational and economical design method
5. **R. V. R. K. Prasad and Akshaya B. Kamdi** (2012), Storage elevated water tanks are used to store water. BIS has brought out the revised version of IS 3370 (part-1&2) after a long time from its 1965 version in year 2009. In this revision important is that limit state method is incorporated in the water tank design. Design of water tanks by LSM is most economical as the quantity of material required is less as compared to WSM. Water tank is the most important container to store water therefore, Crack width calculation of water tank is also necessary.
6. **M. V. Waghmare and S. N. Madhekar** (2013) studied behaviour of tank under sloshing effect. Different parameters have been considered such as height of container, depth of water in tank (30%, 50%, 70% and full) and height of staging etc. It is observed that sloshing of water in tank depends not only on the volume of water in tank but also on staging height and aspect ratio (h/D).
7. **B. V. Ramana Murthy, M Chiranjeevi** [4] had done the "DESIGN OF RECTANGULAR WATER TANK BY USING STAAD PRO SOFTWARE". In this paper he said that this mini project is conducted for a period of 15 days from 21-05-2010 to 07-06-2010 to have complete practical knowledge of various techniques and problems faced in the field. A different topic like Construction Aspects, Design Parameters, Details of Formwork, Details of reinforcement, Process of Water Treatment Plant and Execution have been dealt with in the course of four mini project.
8. **Nallanathel, M, Ramesh. B, Jagadeesh.** (2018), showed that corner stresses and maximum shear and bending stresses are less in case of circular tanks than remaining other designs and the shapes of water tanks play a vital role in the stress distribution and overall economy and by using Staad pro, the results obtained was very accurate than conventional results.
9. **Mr. Manoj Nallanathel** et al., had done "Design and analysis of water tanks using Staad pro" In that paper, they discussed about the design of water tanks of both overhead and underground tanks of shapes rectangular, square and circular shapes are designed and analyzed using Staad pro.
10. **Issar Kapadia** et al. had done the "Design, analysis and comparison of underground rectangular water tank by using Staad Pro software". This paper includes the study of UG Rectangular tank that how the shape deflected and what are the actions will be produced when tank empty or full by using STAAD Pro software is discussed.
11. **Thalapathy .M** et al., had done "Analysis and economical design of water tanks". In this paper he said this project gives the detailed analysis of the design of liquid retaining structure using working stress method. This paper gives idea for safe design with minimum cost of the tank and gives the designer relationship curve between design variable. This paper helps in understanding the design philosophy for the safe and economical design of water tank.

REFERENCES

- 1) Himanshu Dwivedi, Dr. M. K. Gupta, "Analysis and design of water tank employing staad. Pro for cost optimization," *International Journal of Scientific Research and Engineering Development*, 2(4), 2019.
- 2) Mr. Manoj Nallanathel, Mr. B. Ramesh, L. Jagadeesh, "Design and analysis of water tanks using staad pro," *International Journal of Pure and Applied Mathematics*, 119(17), 3021-3029, 2018.
- 3) Kulvendra Patel, "Wind and seismic analysis of elevated tank using staad pro," *International Research Journal of Engineering and Technology*, 5(10), 2018.
- 4) Kalyan Kumar Mandal n, Damodar Maity, "Nonlinear finite element analysis of water in rectangular tank," *Ocean Engineering* 121 (2016) 592-601.
- 5) IS 11682: Criteria for design of RCC staging for overhead water tanks.
- 6) B. V. Ramana Murthy, M Chiranjeevi. "Design of Rectangular Water Tank by Using Staad Pro Software". -International Journal of Computer Science Information and Eng., Technologies, issue 6-volume 1, series 3, issn 2277-4408.
- 7) Ankit Agarwal, Pooja Semwal (2017). "Seismic Analysis of Overhead Water Tanks A -Review Paper". International journal of research in technology and management, Volume 3, Issue 1, ISSN 2454-6240.
- 8) Mehul S. Kishori, Chirag N. Patel (2015). "Parametric Study of Rectangular Water Tank using Different Methodology". International Journal for Scientific Research & Development, Vol. 3, Issue 05, 2015, ISSN: 2321-0613.