

Analysis and Design of water tank Using STAAD Pro considering Shape factor

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Abstract- Due to enormous need by the public, water has to be stored and supplied according to their needs. Water demand is not constant throughout the day. It fluctuates hour to hour. In order to supply constant amount of water, we need to store water. So, to meet the public water demand, water tank need to be constructed.

Water tank is a structure used to store water for supplying to households as drinking purpose, for industries as a coolant and irrigational water for agricultural farming in some areas. Water tanks are classified on bases of their shapes and position of structure. In this project, the design of overhead water tanks of shapes rectangular, square and circular are designed and analysed using STAAD Pro Connect Edition. Then analysis is to be done for maximum stress values and material cost required for each tank is found out. From the analysis results concluding about the influence of shape factor in design loads and how shapes of the tanks play predominant role in the design and in stress distribution and overall economy.

Keywords- Water Tank, Structural design and Analysis, STAADPro

I. INTRODUCTION

For the elements of every society need five important things to survive in the world that are food, water, shelter, energy and education. The water is the only things behind life of living things on earth. The water is extensively used by societies and these societies uses storage reservoir.

Water tanks are the structures used for storing drinking potable water. In present scenario, there is much emphasis for water storage projects all around the world. Water plays predominant role in day-to-day life, so water storage is not a need it is necessary to store the water. In design of water tanks, design aspects are to be followed as per code books and loads is to be applied carefully.

Following are the objectives behind this study:

1. To Study the influence of shape factor in design loads and how shapes of the tanks play predominant roll in the design and in stress distribution and overall economy.
2. To Analyze & design different shapes of elevated water tanks
3. To study the various forces acting on a water tank and understanding the most important factors that play role in designing of water tanks
4. To study the plate stress distribution of the water tanks according to shape
5. To find the cost required for the total concrete and steel quantity and find the economical shape of the tank
6. To know about the design Philosophy for the safe and economical design of water tanks

II. LITERATURESURVEY

1. LITERATURE-

Mr. Manoj Nallanathel, Mr. B. Ramesh, L. Jagadeesh had done the," Design and Analysis of Water Tanks Using STAAD Pro". This paper, discusses about the design of water tanks of both overhead and underground tanks of shapes rectangular, square and circular shapes are designed and analysed using STAAD Pro. From the analysis results concluding about the influence of shape factor in design loads and how shapes of the tanks play predominant role in the design and in stress distribution and overall economy.

2. LITERATURE-

Neha. S. Vanjari, krutika. M. Sawant, Prashant. Sisodiya had done the," Design of Circular Overhead Water Tank". This paper gives an overall designing procedure of an Overhead Circular Intze tank using LIMIT STATE METHOD from IS-3370:2009. In IS-3370:2009, limit state method considering two aspects mainly limits the stress in steel and limits the cracking.

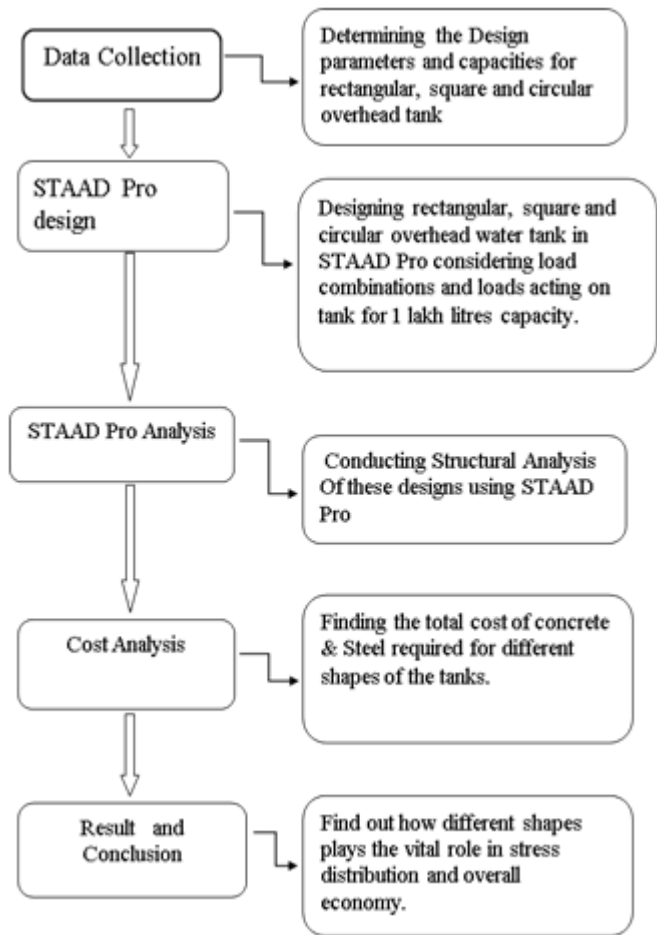
3. LITERATURE-

Mr. Manoj Nallanathel, Mr. B. Ramesh, L. Jagadeesh had done the, "Effective Utilization of STAAD Pro in The Design and Analysis of Water Tank". This paper discusses on design aspects of water tank and other structural parameters like Bending moment, shear force and stress contours. Comparison of different types of water tanks with respective to literature reviews of different authors. Conclusions made on new techniques and construction practices with architectural exposure

4. LITERATURE-

Issar Kapadia, Purav Patel, Nilesh Dholiya and Nikunj Patel had done the, "Design, analysis and study of the combined rectangular water tank: combination of the rectangular overhead water tank and the rectangular ground water tank using STAAD Pro" This research, considered a new idea that is Combined Rectangular Water Tank in which combination of Rectangular Surface Water tank and Rectangular Overhead Water Tank are taken as together. For the given water tank Design and Analysis is to be prepared with help of STAAD Pro. Software Also the deflected shapes, Pressure exerted are to be described as result.

III. METHODOLOGY



IV. DESIGNASPECTS

1. Volume Carrying Capacity: 1 lakh liters
2. Staging Height: 12m
3. Height of the tanks: 4m (considering free board)
4. Staging Type: Columns
5. Dimensions of tanks: For 1 Lakh Capacity(100m³)

Shape	Circular	Rectangle	Square
L/D(m)	6	6	5
B(m)		4.2	5
H(m)	4	4	4

6. Loads considered: Deadload, wind load (asper IS875), hydraulic load (Weight of water due to gross volume is calculated and applied on bottom of container and walls, unit wt. of water is 10 KN/m³.)
7. Grade of concrete: M30
8. Grade of steel: Fe415

9. Load Combinations are assigned as per Is 456-200010.

V. STAAD PRODESIGN

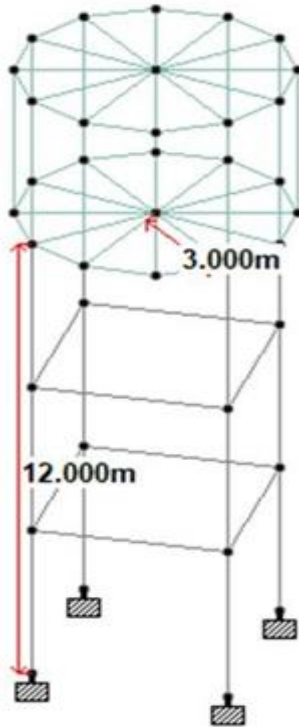


Figure.1 Overhead circular tank

VI. RESULTS

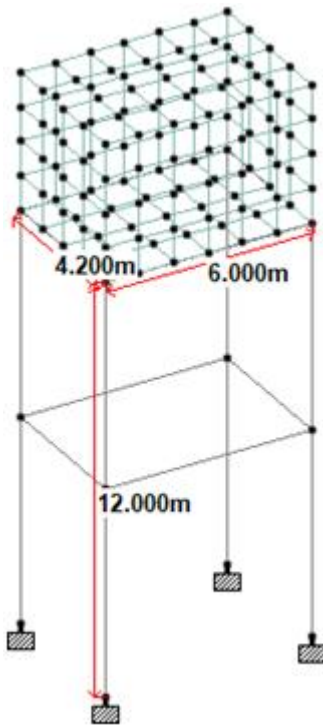


Figure 2 Overhead rectangular tank

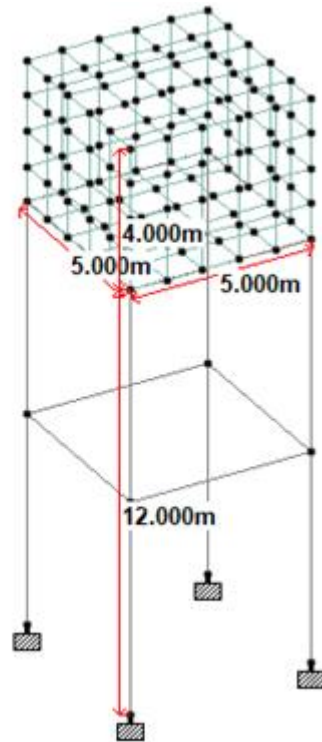


Figure 3 Overhead square tank

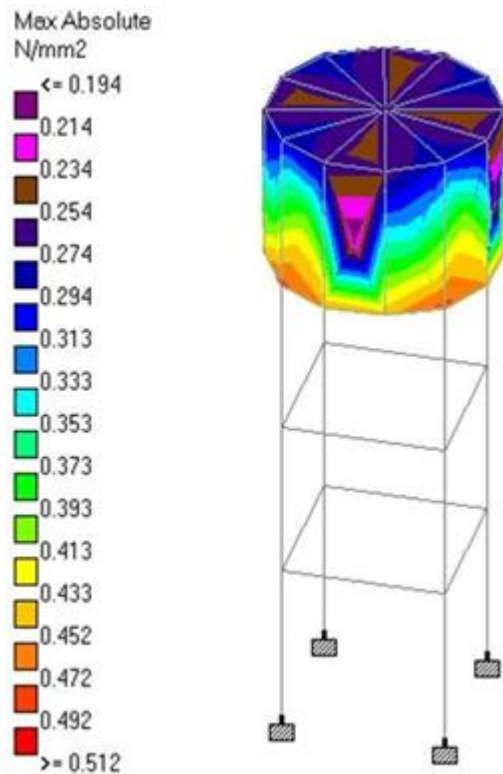


Figure 4 Max absolute stress for circular tank

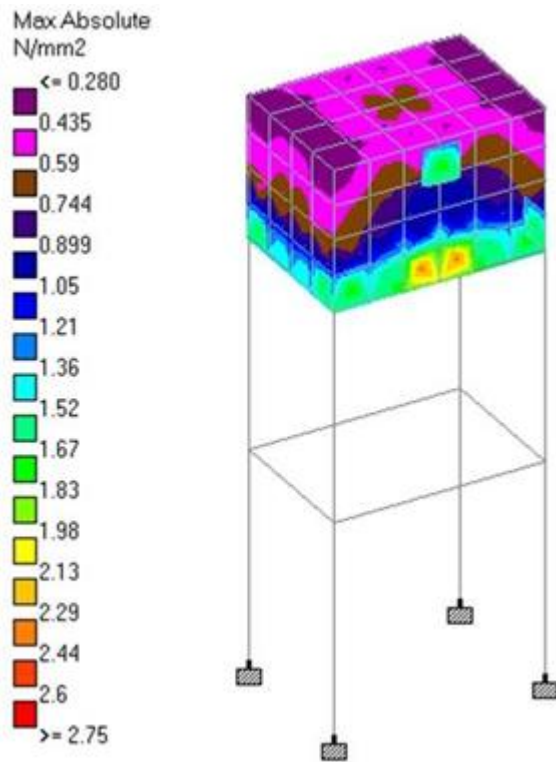


Figure 5 Max absolute stress for rectangular tank

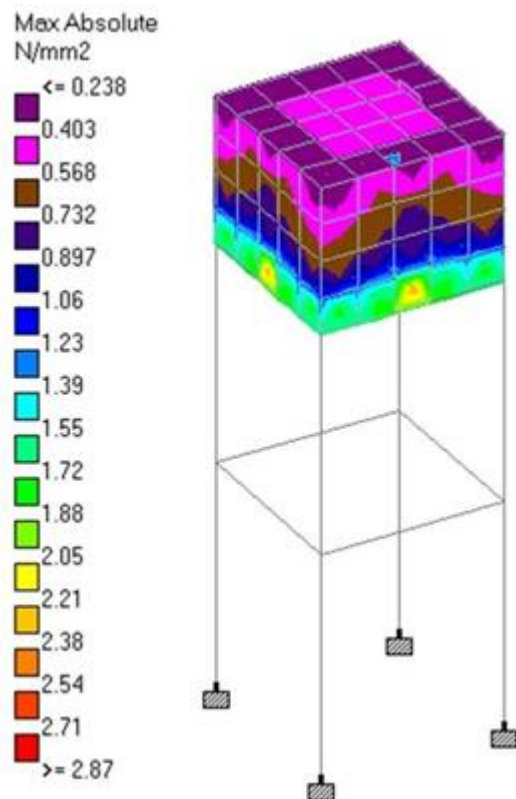


Figure 6 Max absolute stress for square tank

VII. CONCLUSION

1. Circular tank is more difficult to design as compared to square & rectangular tank because the geometry of circular tank and more skilled labor is required for its construction.
2. We have to design the structure for maximum stresses, forces and bending moments. It is clearly seen that the maximum values of square and rectangular water tank are higher. So, we prefer circular tank over square seeing the maximum stresses.
3. Total cost of material for circular water tank is Rs. 2,74,264 whereas for rectangular water tank it is Rs. 2,05,330 and for square tank it is Rs. 2,53,677. So, if we want a cost-effective model, we would refer rectangular water tank
4. Circular water tank is more pleasing to look and require lesser space because of its circular space. So, if we have space problem, we would choose circular tank.

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