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Parametric Study of Intz water tank with varying height to Diameter ratio using Staad Pro

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Abstract: **Intz tank is an important overhead water storage tank, there for it is necessary that it should be constructed keeping in view its economy. The main aims of this paper are hydrostatic analysis of Intze water tank, To obtain economical design of tank, the parametric study must needed, for this purpose we can vary the proportion of container such as, staging container diameter ratio, height of cylindrical wall to diameter ratio and horizontal angle of dome have been varied as well as no of column for design of staging .To achieve this objective 4 different depth to diameter ratio of Intze tank consider for analysis on staad pro software and comparative results obtained in term of principal and Von mises stresses on cylindrical wall. Maximum shear force and bending moment on beams and node displacement. For the parametric study of Intze tank horizontal angle of conical dome should be 45°, ratio of height of cylindrical wall to diameter ratio should be kept 0.5, 0.8, 1 and 1.5. with constant volume and height of staging.**

Keywords: **Intz tank, Parametric study, Staad pro.**

1. INTRODUCTION

Intz water tank most common type of elevated water retaining structure to store water as per locality demand. It consists of cement concrete because imperviousness of concrete but as we know that due to hydrostatic pressure, the cylindrical wall under tensile stresses, and concrete weak in tension. So, it is very essential to keep this tensile stress within the permissible limit which depends upon the height of the cylindrical wall and diameter of the container. In this paper, we use a different ratio of height to diameter ratio of container to check the stresses' behaviour on the cylindrical wall with the same quantity of water.

2. OBJECTIVE OF WORK

1. Perform Parametric study of Intz water tank with varying the height to diameter ratio of a cylindrical container with the same volume and height of staging by using Staad pro software.

2. Find out the variation of Principal and Von mises stress on cylindrical wall with same thickness.

3. METHODOLOGY

1. Design of Intz tank by using IS 3370 & IS 456: 2000 with different Height to Diameter ratio.

2. Create a Model with the help of Staad pro software and Apply the same load on the tank wall which is obtained in Manual Calculations.

3. keep the thickness of the cylindrical wall is constant for all Model with same volume.

4. Prepare a comparative chart of all output quantities such as Principal and Von mises Stresses on Cylindrical plate, Node displacement in all directions, support reaction and shear force and bending moment of the beam and circular girders.

Table 1: Height to Diameter Ratio of Cylindrical portion

Sr.n	Diameter of Cylindrical Wall	Height of Cylindrical Wall	H/D ratio Approx.
1	12	5	0.5
2	10	8	0.8
3	9	9	1
4	8	12	1.5

Table 2: Tank Description

Sr n.	Parameters	Height/Diameter Ratio of Cylindrical wall			
		0.5	0.8	1	1.5
1	Volume of tank	650m3	650m3	650m3	650m3
2	Thickness of Cylindrical wall	250mm	250mm	250mm	250mm
3	Rise of Top Dome	2	2	2	1
4	Rise of Bottom Dome	1.6	1.2	1.2	1
5	Angle of Conical Dome	45	45	45	45
6	Size of Top Ring Beam	300X300mm	300X300mm	300X300mm	300X300mm
7	Size of Bottum Ring Beam	1200X600mm	1067X533	1200X600mm	1600X800mm
8	Size of Bottum Circular Girder	600X1200	533X1067	600X1200	800X1600
9	Thickness of Top Dome	100mm	100mm	100mm	100mm
10	Thickness of Bottum Dome	300mm	267mm	300mm	400mm
11	Thickness of Conical Dome	600mm	533mm	600mm	800mm
12	No. of Circular Column	8	8	8	8
13	Size of Circular Column	650mm	533mm	650mm	850mm

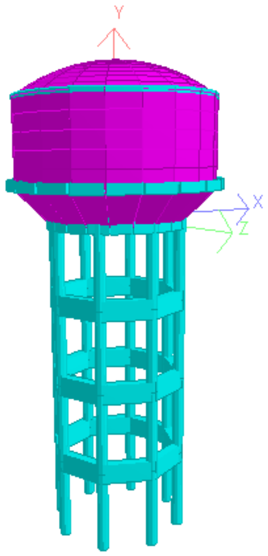


Figure 1: Height to Diameter ratio 0.5

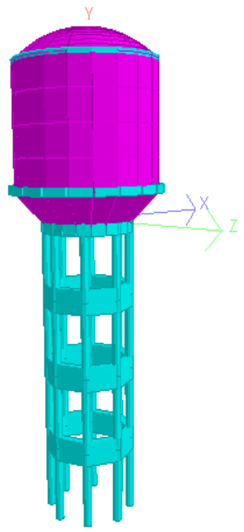


Figure 2: Height to Diameter Ratio 0.8

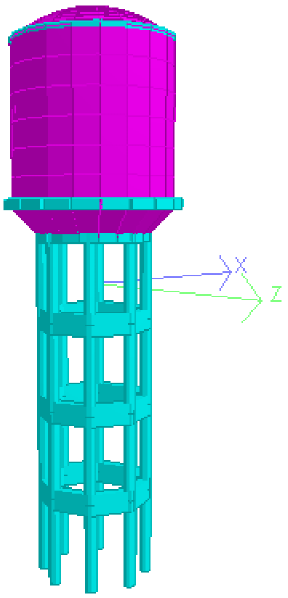


Figure 3: Height to Diameter Ratio 1

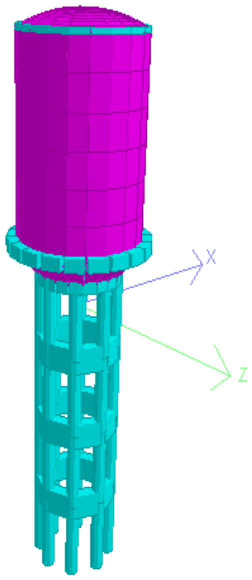
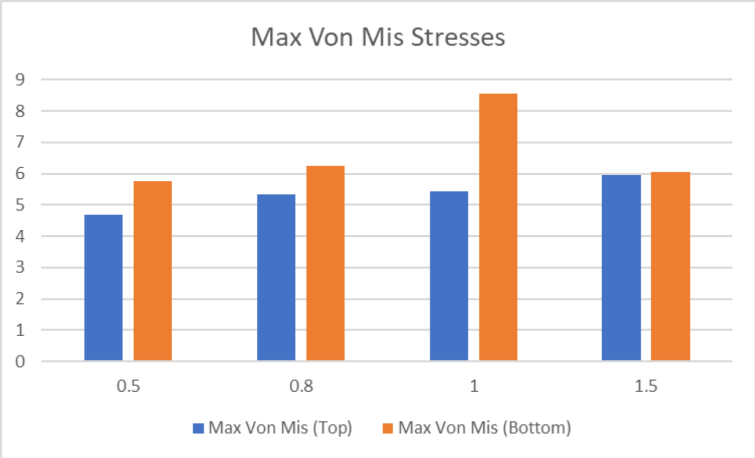
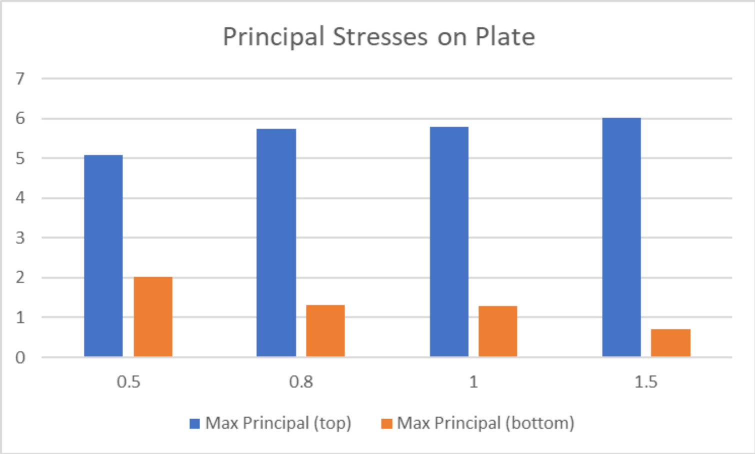


Figure 4: Height to Diameter Ratio 1.5

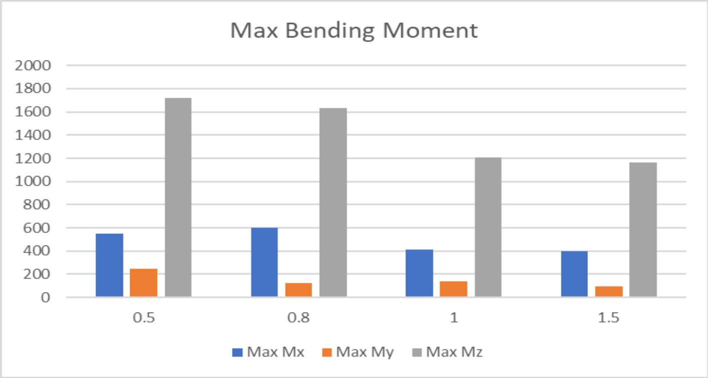
4. RESULTS



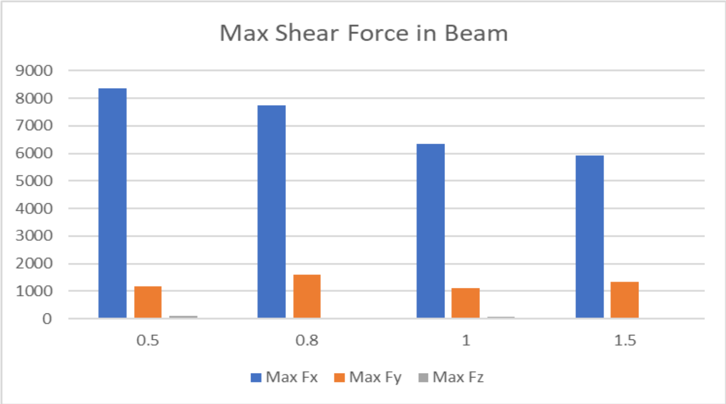
Graph 1: Von mis Stresses on Cylindrical Plate



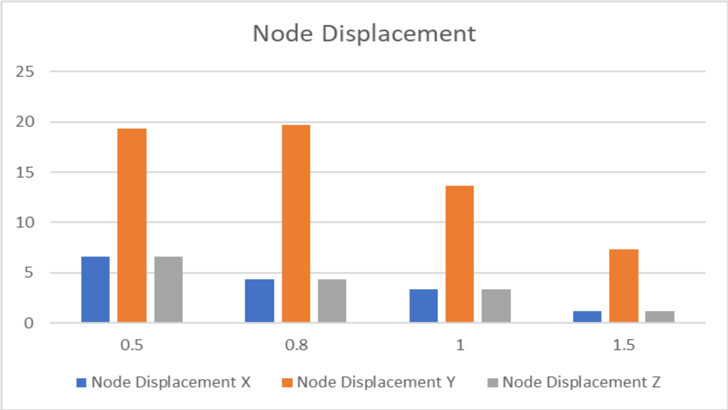
Graph 2: Principal Stresses on Cylindrical Plate



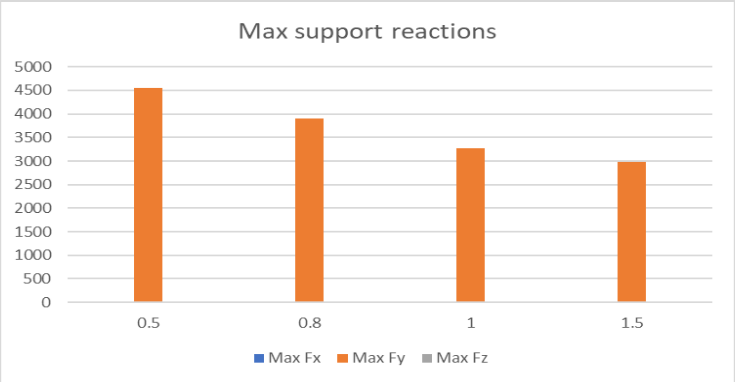
Graph 3: Maximum Bending Moment on Girders



Graph 4: Maximum Shear force on Girder



Graph 5: Maximum Node Displacement



Graph 6: Maximum Support reaction

5. CONCLUSIONS

Traditional decision of size of tank depends upon availability of land, in this work a study has been done to optimize tank dimensions to reduce stresses on cylindrical tank wall. when we vary the height to diameter ratio of cylindrical container in Overhead water tank we conclude:

1. H/D ratio varied from 0.5 to 0.8, 1.0 and then 1.5 the maximum principal stresses at top increases to 11,12 and 15% and Maximum principal stresses at bottom decreases by 53,57 and 182% respectively in cylindrical wall with same thickness.

2. Similarly, the max von mises stresses at top and bottom increases by 12, 13 and 20% and 7,32 and 5% respectively when H/D ratio increases from 0.5 to 1.5.

3. Node displacement in vertical downward direction also decrease with H/D ratio

4. Maximum Shear forces and bending moment on beam decreases up to 28% when H/D ratio varies from 0.5 to 1.5.

5. Maximum support reaction decreases by 34% at H/D ratio 1.5 as compared with 0.5.

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