

# Impact of Varying Height to Diameter Ratio of Intze Tank on Different Component of Tank

Virendra Sahu<sup>1</sup> Satish Kumar Prabhakar<sup>2</sup> Dr. Pankaj Singh<sup>3</sup>

<sup>1,2</sup>M. Tech. Scholar <sup>3</sup>Head of Department

<sup>1,2,3</sup>Department of Civil Engineering

<sup>1,2,3</sup>S.R.K. University, Bhopal, India

**Abstract**— Intze tank is an important overhead water storage tank, there for it is necessary that it should be constructed keeping in view its economy. To obtain economical design of tank, the proportion of container such as, staging container diameter ratio, height of cylindrical wall container diameter ratio and horizontal angle of dome have been varied as well as no of column for design of staging .To achieve this objective 15 different depth to diameter ratio of Intze tank. For this purpose a computer program in Microsoft excel has been developed .In Microsoft excel program continuity correction have been work out .The design of container is carried out by working stress method but staging is carried out by using limit state method. To get the economical design of Intze tank horizontal angle of conical dome should be 'less than 45°, ratio of height of cylindrical wall and container diameter ratio should be between 0.3 and 0.35. On the other hand staging container diameter ratio effects the economy of higher capacity of tank only.

**Key words:** Intze Tank, Water Storage Tank

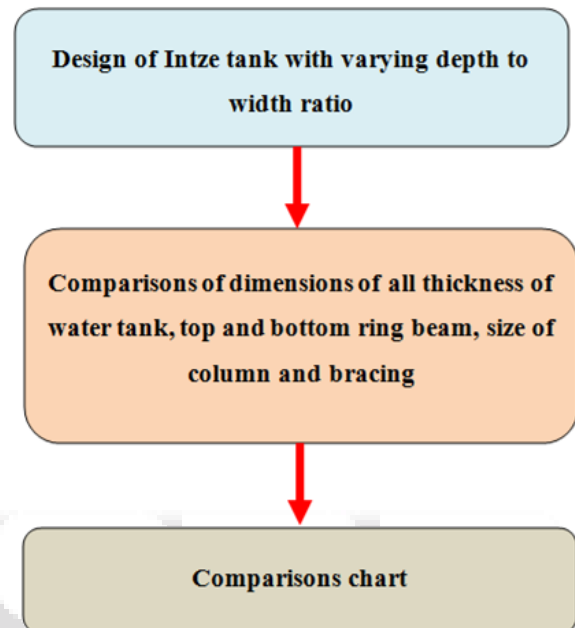
## I. INTRODUCTION

A water tank is used to store water to tide over the daily requirement. In the construction of concrete structure for the storage of water and other liquids the imperviousness of concrete is most essential .The permeability of any uniform and thoroughly compacted concrete of given mix proportions is mainly dependent on water cement ratio .The increase in water cement ratio results in increase in the permeability .The decrease in water cement ratio will therefore be desirable to decrease the permeability, but very much reduced water cement ratio may cause compaction difficulties and prove to be harmful also. Design of liquid retaining structure has to be based on the avoidance of cracking in the concrete having regard to its tensile strength. Cracks can be prevented by avoiding the use of thick timber shuttering which prevent the easy escape of heat of hydration from the concrete mass the risk of cracking can also be minimized by reducing the restraints on free expansion or contraction of the structure.

## II. OBJECTIVE

- 1) Elevated water tank construction is complex process as well as costly affair, hence it is important to check impact of varying size on dimensions of different component of Intze tank.
- 2) To develop excel sheet for design of Intze tank.

## III. METHODOLOGY



## IV. INTZE TANKS

This is a special type of elevated tank used for very large capacities. Circular tanks for very large capacities prove to be uneconomical when flat bottom slab is provide Intze type tank consist of top dome supported on a ring beam which rests on a cylindrical wall .The walls are supported on ring beam and conical slab. Bottom dome will also be provided which is also supported by ring beam.

The conical and bottom dome are made in such a manner that the horizontal thrust from conical base is balanced by that from the bottom dome. The conical and bottom domes are supported on a circular beam which is in turn, supported on a number of columns. For large capacities the tank is divided into two compartments by means of partition walls supported on a circular beam.

Following are the components

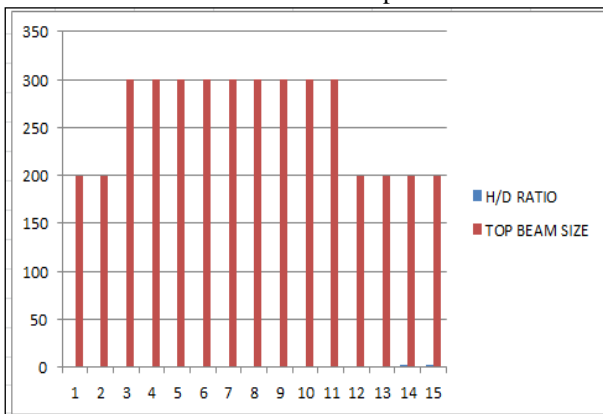
- 1) Top dome.
- 2) Ring Beam supporting the top dome.
- 3) Cylindrical wall.
- 4) Ring beam at the junction of the cylindrical wall and the conical shell.
- 5) Conical shell.
- 6) Bottom dome.
- 7) The ring girder.
- 8) Columns braces.
- 9) Foundations.



V. RESULTS & GRAPHS

H/D RATIO	TOP BEAM SIZE	
H/D	B	t
0.1	200	200
0.2	200	200
0.3	300	300
0.4	300	300
0.5	300	300
0.6	300	300
0.7	300	300
0.8	300	300
0.9	300	300
1	300	300
1.2	300	300
1.4	200	200
1.6	200	200
1.8	200	200
2	200	200

Table 5.1: H/D Ratio & Top Beam Size

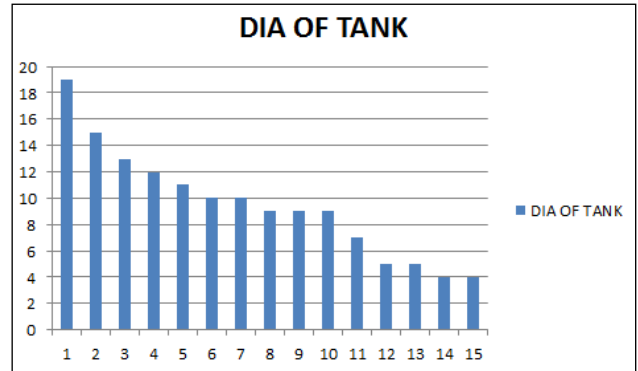


Graph 5.1: GrGraph 5.1 Graphs between H/D Ratio & Top Beam Size

H/D Ratio	Dia Of Tank
H/D	D
0.1	19
0.2	15
0.3	13
0.4	12

0.5	11
0.6	10
0.7	10
0.8	9
0.9	9
1	9
1.2	7
1.4	5
1.6	5
1.8	4
2	4

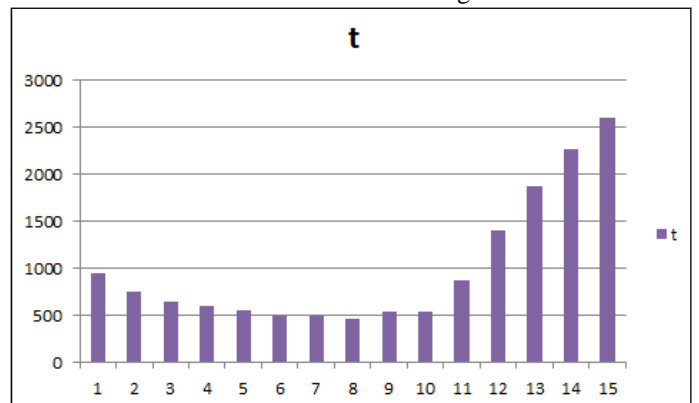
Table 5.2: H/D Ratio & Dia Of Tank



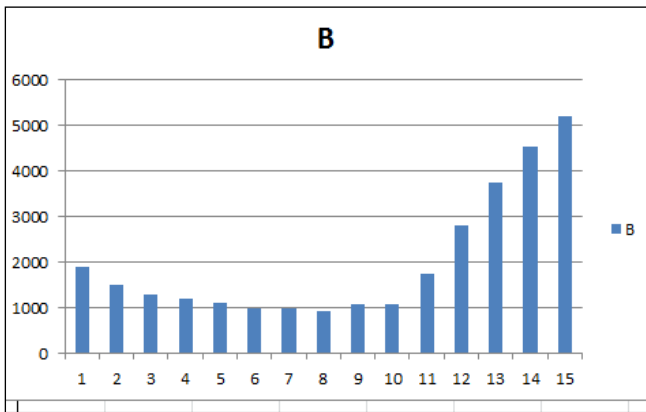
Graph 5.2: Graph between H/D Ratio & Dia Of Tank

H/D Ratio	Bottom Ring Beam Size	
H/D	B	T
0.1	1900	950
0.2	1500	750
0.3	1300	650
0.4	1200	600
0.5	1100	550
0.6	1000	500
0.7	1000	500
0.8	933	467
0.9	1067	533
1	1067	533
1.2	1733	867
1.4	2800	1400
1.6	3733	1867
1.8	4533	2267
2	5200	2600

Table 5.3: H/D Ratio & Bottom Ring Beam Size



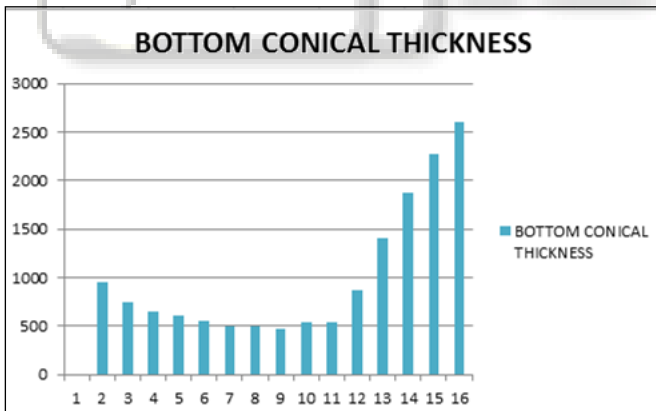
Graph 5.3: Graph H/D Ratio & Bottom Ring Beam Size



Graph 5.4: Graph between H/D Ratio & Bottom Ring Beam Size

H/D Ratio	Bottom Conical Thickness
H/D	T
0.1	950
0.2	750
0.3	650
0.4	600
0.5	550
0.6	500
0.7	500
0.8	467
0.9	533
1	533
1.2	867
1.4	1400
1.6	1867
1.8	2267
2	2600

Table 5.4: H/D Ratio & Bottom Conical Thickness

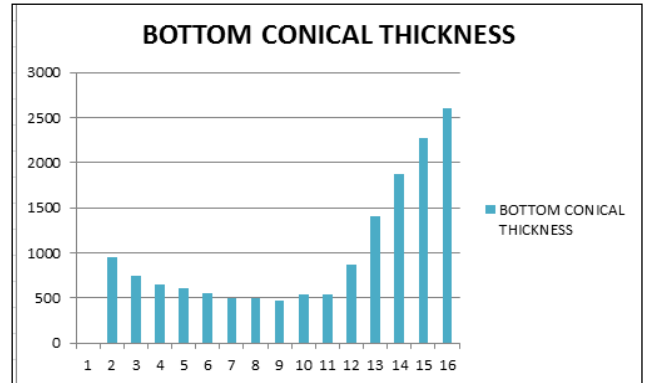


Graph 5.5: Graph between H/D Ratio & Bottom Conical Thickness

H/D Ratio	Circular Column Dia.
H/D	D
0.1	1000
0.2	800
0.3	700
0.4	650
0.5	600
0.6	550
0.7	550
0.8	517

0.9	583
1	583
1.2	917
1.4	1450
1.6	1917
1.8	2317
2	2650

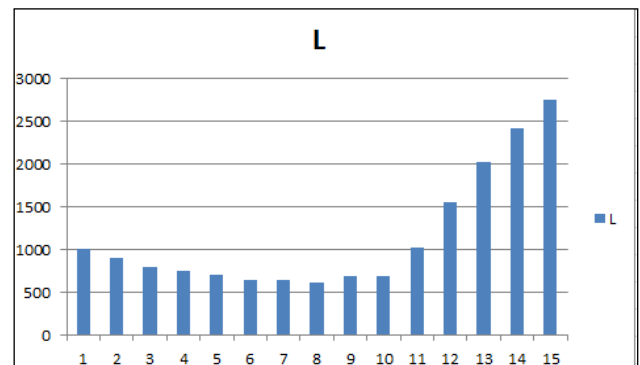
Table 5.5: H/D Ratio & Circular Column Dia.



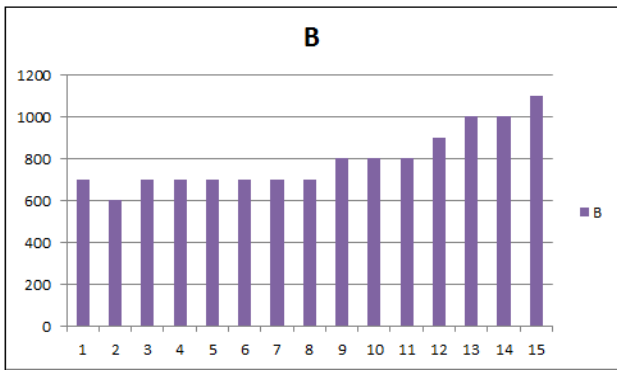
Graph 5.6: Graph between H/D Ratio & Circular Column Dia.

H/D Ratio	Circular Bottom Girder For Raft	
H/D	L	B
0.1	1000	700
0.2	900	600
0.3	800	700
0.4	750	700
0.5	700	700
0.6	650	700
0.7	650	700
0.8	617	700
0.9	683	800
1	683	800
1.2	1017	800
1.4	1550	900
1.6	2017	1000
1.8	2417	1000
2	2750	1100

Table 5.6: H/D Ratio & Circular Bottom Girder for Raft



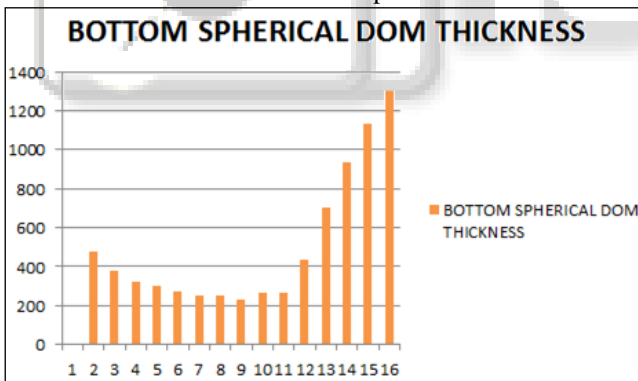
Graph 5.7: Graph between H/D Ratio & Circular Bottom Girder for Raft



Graph 5.8: Graph between H/D Ratio & Circular Bottom Girder for Raft

H/D Ratio	Bottom Spherical Dom Thickness
H/D	T
0.1	475
0.2	375
0.3	325
0.4	300
0.5	275
0.6	250
0.7	250
0.8	233
0.9	267
1	267
1.2	433
1.4	700
1.6	933
1.8	1133
2	1300

Table 5.7: H/D Ratio & Bottom Spherical Dom Thickness

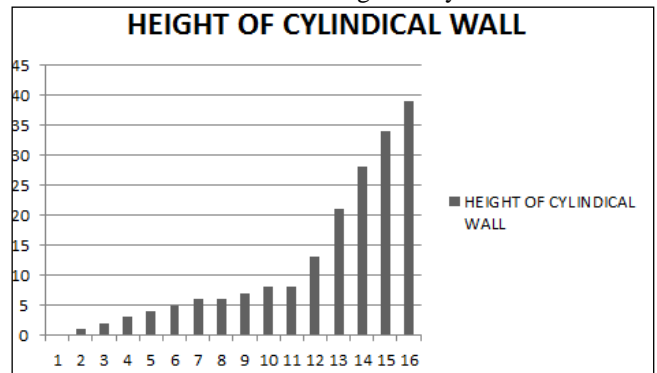


Graph 5.9: Graph between H/D Ratio & Bottom Spherical Dom Thickness

H/D Ratio	Height Of Cylindrical Wall
H/D	T
0.1	1
0.2	2
0.3	3
0.4	4
0.5	5
0.6	6
0.7	6
0.8	7
0.9	8
1	8
1.2	13

1.4	21
1.6	28
1.8	34
2	39

Table 5.8: H/D Ratio & Height of Cylindrical Wall



Graph 5.10: Graph between H/D Ratio & Height Of Cylindrical Wall

## VI. CONCLUSIONS

Traditional decision of size of tank depends upon available of land. In this work a study has been done to optimize size of tank to reduce material consumption. From the study it has been observed when height of tank has substantial impact on Intze tank construction. When aspect ratio was changed from 0.1 to 2.0, in this pursuit it has been observed initially the material consumption is high which reduces with change of aspect ratio. Thereafter material consumption increases substantially. The material construction is almost double. When aspect ratio is (1/0.1) (d/h), this reduces till (d/h) (1/0.8) thereafter this hence substantially. When (d/h) (1/1.2) the material consumption is approximately double than (d/h) (1/0.8). The material consumption increases in three folds at (d/h) (1/1.4). In case (1/1.6) the material consumption is four times the minimum. Thereafter rate of increase of material consumption reduces to 21 to 40%.

## REFERENCES

- [1] Pooja malviya Dr. Pradeep kumar Design And Evaluation Of The Super Structure Of Intze Water Tank International Journal of Latest Research in Engineering and Technology (IJLRET) ISSN: 2454-5031 www.ijlret.com| Volume 2 Issue 4| April 2016 | PP 25-30
- [2] Prasad S. Barve, Ruchi P. Barve Effect of Variation of Diameter to Height (D/H) Ratio on the Cost of Intze Tank Using IS 3370:1965 and IS 3370:2009 International Journal of Innovative Research in Science, Engineering and Technology (An ISO 3297: 2007 Certified Organization) Vol. 4, Issue 7, July 2015 ISSN(Online) : 2319-8753 ISSN (Print) : 2347-6710
- [3] Neha. S. Vanjari,krutika. M. Sawant,Prashant .S. Sisodiya,S. B. Patil Design of Circular Overhead Water Tank International Journal of Engineering Research in Mechanical and Civil Engineering (IJERMCE) Vol 2, Issue 7, July 2017 ISSN (Online) 2456-1290
- [4] Nitesh J Singh1, Mohammad Ishtiaque2 Design Analysis & Comparison Of Intze Type Water Tank For

- Different Wind Speed And Seismic Zones As Per Indian Codes IJRET: International Journal of Research in Engineering and Technology eISSN: 2319-1163 | pISSN: 2321-7308
- [5] Issar Kapadia<sup>1</sup>, Purav Patel<sup>2</sup>, Nilesh Dholiya<sup>3</sup>, Nikunj Patel<sup>4</sup> Analysis and Design of Intze Type Overhead Water Tank under the Hydrostatic Pressure as Per IS: 3370 & IS: 456 -2000 by Using STAAD Pro Software International Research Journal of Engineering and Technology (IRJET) Volume: 04 Issue: 07 | July - 2017 www.irjet.net p-ISSN: 2395-0072, e-ISSN: 2395-0056
- [6] Kanan Thakkar, Dr.R.P.Rethaliya, Jay S. Patel Parametric Study of Intze-Type Water Tank Supported on Different Staging Systems based on IS:3370-1965 & IS:3370-2009 RESEARCH PAPER Engineering Volume - 5 | Issue - 1 | Jan Special Issue - 2015 | ISSN - 2249-555X
- [7] Dhruv Saxena<sup>1</sup> Study of Continuity Analysis in Intze Type Tank using Conventional and Finite Element Method American Journal of Engineering Research (AJER) e-ISSN: 2320-0847 p-ISSN : 2320-0936 Volume-6, Issue-11, pp-128-134 www.ajer.org
- [8] Mr. Dixit kumar. B. Patel <sup>1</sup> Response of Overhead Water tank staging considering Fluid-Structure-soil Interaction International Journal of Advance Engineering and Research Development Volume 3, Issue 4, April -2016 Impact Factor: 4.14 (Calculated by SJIF-2015) e- ISSN: 2348-4470 p- ISSN: 2348-6406
- [9] IS 3370:1965 (Part 1,2& 4), "Code of practice for concrete structures for the storage of liquids", Bureau Of Indian Standards, New Delhi, 1965.
- [10] IS 3370:2009 (Part 1 & 2), "Code of practice for concrete structures for the storage of liquids", Bureau of Indian Standards, New Delhi, 2009.
- [11] Phanisri P. Pratapa and DevdasMenon, "Optimal design of cylindrical reinforced concrete water tanks resting on ground", Indian Concrete Journal, Feb. 2011.
- [12] N. Srinivas and DevdasMenon, "Design criteria for crack control in RC liquid retaining structures – Need for a revision of IS:3370 (Part II) – 1965", Indian Concrete Journal, August 2000.
- [13] Dr. Ashok K. Jain, Dr. Vipul Prakash and Sushil K. Agarwal, "Recommendations of workshop on revision of I.S. codes on Liquid Retaining
- [14] Lalit Kumar Jain, "Guide to & Comments on IS 3370 Part 1 & 2 - 2009, (First Revision)", Indian Concrete Institute, June 2010.
- [15] Dr. H.J. Shah, "Reinforced concrete, Vol II [Advanced Reinforced Concrete]", Charotar Publishing House, Anand, Gujarat, 2012.
- [16] B.C.Punmia, Ashok kumar Jain and Arunkumar Jain, "R.C.C. Designs", 10th edition, Laxmi Publications Limited, New Delhi, 2010.
- [17] N Krishna Raju, "Advanced reinforced concrete design", CBS publications.
- [18] Jai Krishna and O.P.Jain, "Plain and Reinforced Concrete, Vol. 2", 8th revised edition, Nem Chand & Bros., Roorkee, 1987.
- [19] P. Dayaratnam, "Design of Reinforced Concrete Structures", 4th edition, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2000.
- [20] P.C. Varghese, "Advanced reinforced concrete design", Prentice Hall of India Pvt. Ltd., New Delhi, 2002.
- [21] M.L. Gambhir, "Design of Reinforced Concrete Structures", PHI Learning Private Limited, New Delhi, 2010.