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Impact of Varying Height to Diameter Ratio of Intze Tank on Different Components and Cost of Tank

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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 0.35.0n the other hand staging container diameter ratio effects the economy of higher capacity of tank only.

KEYWORDS: *Intze Tank, Water Storage Tank*

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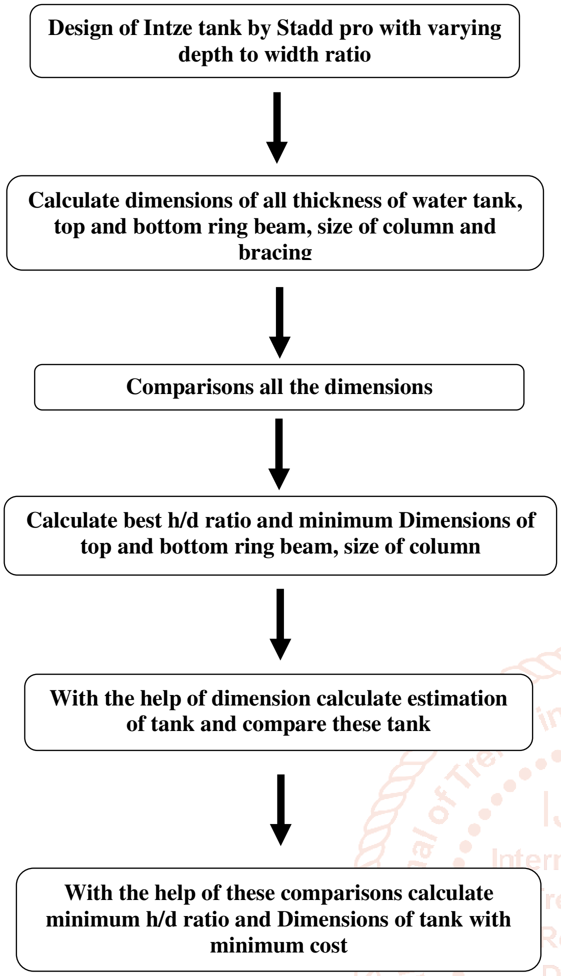
I. INTRODUCTION

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



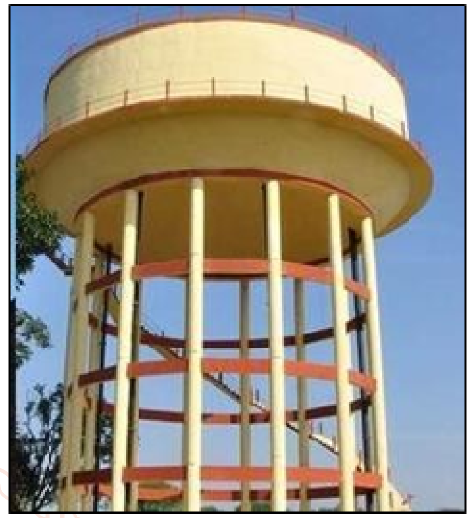
IV. INTZE TANKS

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

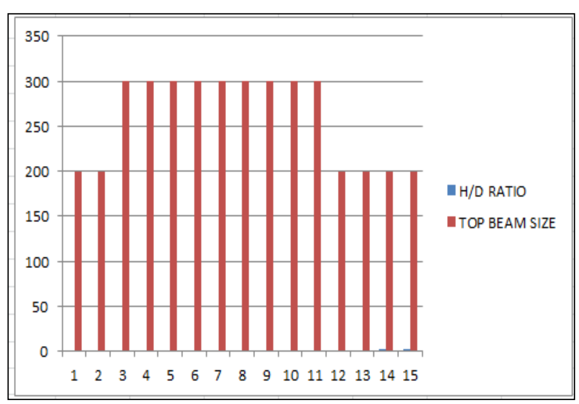
1. Top dome.
2. Ring Beam supporting the top dome.
3. Cylindrical wall.
4. Ring beam at the junction of the cylindrical wall and theconical shell.
5. Conical shell.
6. Bottom dome.
7. The ring girder.
8. Columns braces.
9. Foundations.



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

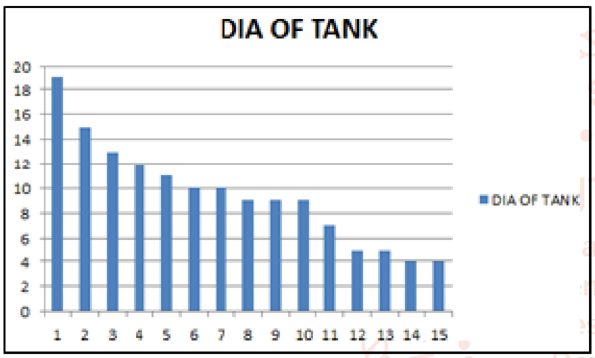
Table 5.1: H/D Ratio & Top Beam Size



Graph 5.1: 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

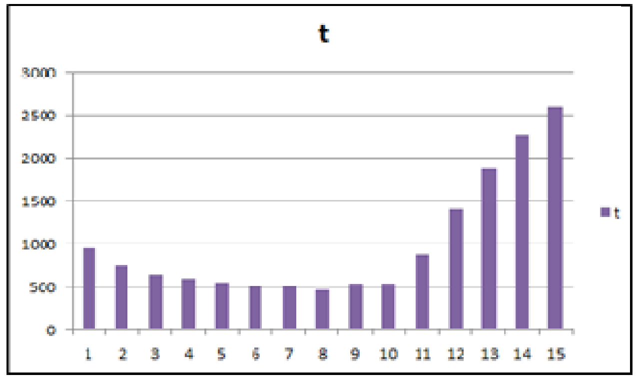
Table 5.2: H/D Ratio & Dia Of Tank



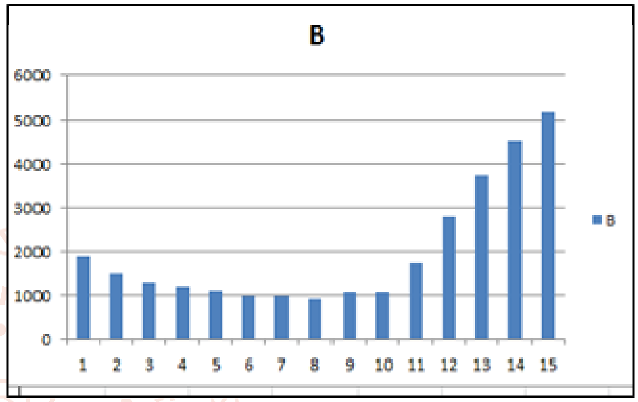
Graph 5.2: Graph between H/D Ratio & Dia Of Tank

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



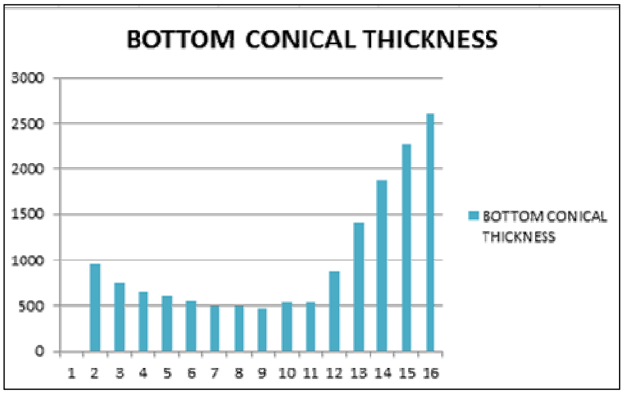
Graph 5.3: Graph H/D Ratio & Bottom Ring Beam Size



Graph 5.4: Graph between H/D Ratio & Bottom Ring BeamSize

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

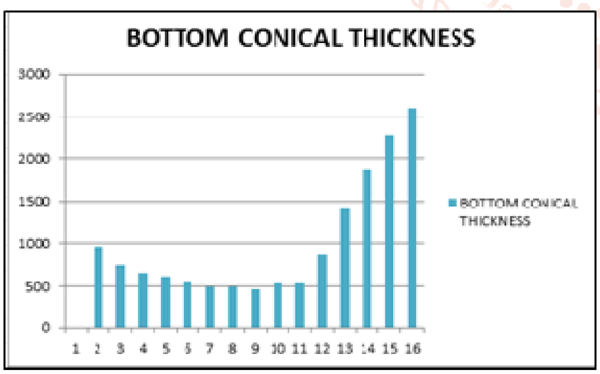
Table 5.4: H/D Ratio & Bottom Conical Thickness



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

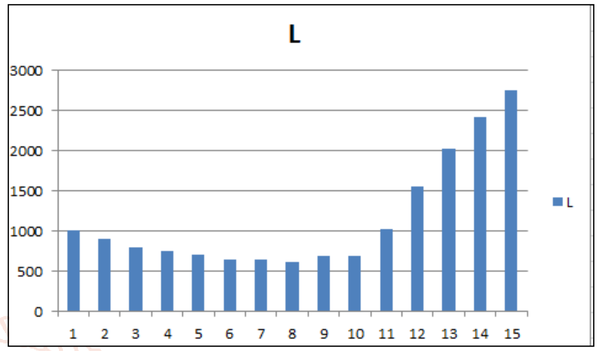
Table 5.5: H/D Ratio & Circular Column Dia.



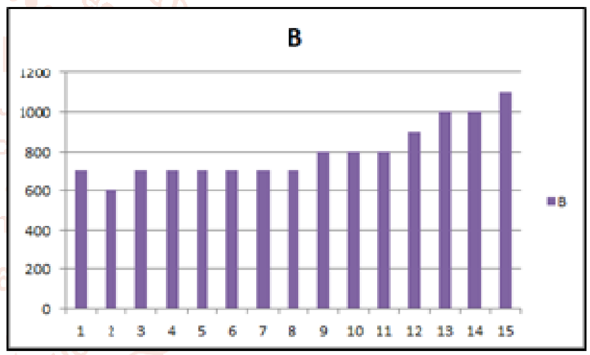
Graph 5.6: Graph between H/D Ratio & Circular Column Dia.

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



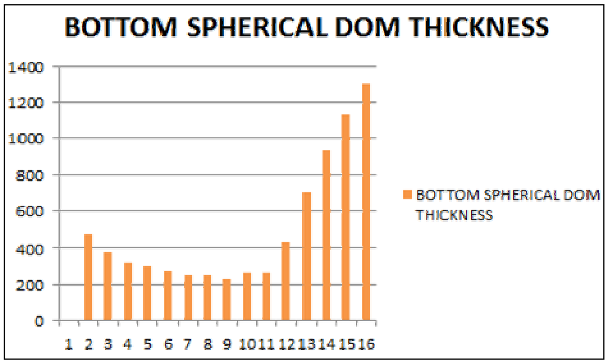
Graph 5.7: Graph between H/D Ratio & Circular Bottom Girder for Raft



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

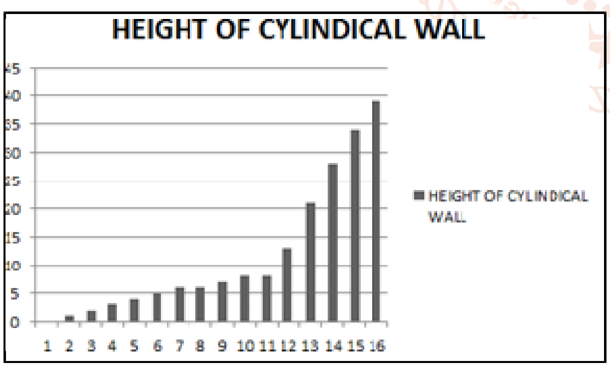
Table 5.7: H/D Ratio & Bottom Spherical Dom Thickness



Graph 5.9: Graph between H/D Ratio & Bottom SphericalDom 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



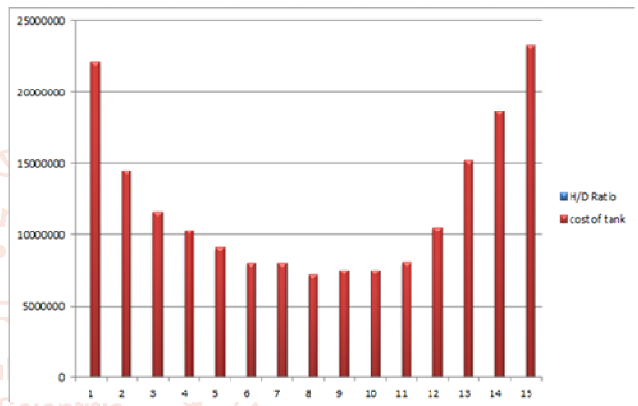
Graph 5.10: Graph between H/D Ratio & Height OfCylindrical Wall

Table 5.9: All Design Parameters

l/D atio	Top Beam Size		Dia Of Tank	Height Of Cylindrical Wall	Bottom Ring Beam Size		Conical Dia Thickness	Circular Column Dia	Circular Girder For Raft		Bottom Spherical Dom Thickness
	mm	mm	m	m	mm	mm	mm	mm	mm	mm	mm
.1	200	200	19	1	1900	950	950	1000	1000	700	475
.3	300	300	13	3	1300	650	650	700	800	700	325
.5	300	300	11	5	1100	550	550	600	700	700	275
.7	300	300	10	6	1000	500	500	550	650	700	250
.8	300	300	9	7	933	467	467	517	617	700	233
.9	300	300	9	8	1067	533	533	583	683	800	267
1	300	300	9	8	1067	533	533	583	683	800	267
.2	300	300	7	13	1733	867	867	917	1017	800	433
.4	200	200	5	21	2800	1400	1400	1450	1550	900	700
.6	200	200	5	28	3733	1867	1867	1917	2017	1000	933
.8	200	200	4	34	4533	2267	2267	2317	2417	1000	1133
2	200	200	4	39	5200	2600	2600	2650	2750	1100	1300

Table 5.10: Cost of Intze tank

H/D RATIO	COST OF TANK
0.1	22141870.36
0.2	14485121.82
0.3	11571173.28
0.4	10300616.88
0.5	9135184.70
0.6	8070249.78
0.7	8070249.78
0.8	71,79,216.28
0.9	7546414.37
1.0	7546414.37
1.2	8072739.77
1.4	10489998.91
1.6	15240520.14
1.8	18659922.16
2	23299393.94



Graph 5.11: Cost Comparison of Intze tank

In the study it has been observed when height of tank has subsitunal impact on Intze tank construction. When aspect ratio was change 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 there after material consumption increase substantially the material construction is almost double. When aspect ratio is (1/0.1) (d/h).this reduce till (d/h) (1/0.8) there after this hence substantially. when (d/h)(1/1.2) the material consumption is approximately double than (d/h)(1/0.8) the martial consumption increases in tress folds at (d/h)(1/1.4) in case (1/1.6) the material consumption is four times the minimum. There after rate of increase of material consumption reduces to 21 to 40%.

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 subsitunal impact on Intze tank construction. When aspect ratio was change 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 there after material consumption increase substantially the material construction is almost double. When aspect ratio is (1/0.1) (d/h).this reduce till (d/h) (1/0.8) there after this hence substantially. when (d/h)(1/1.2) the material consumption is approximately double than (d/h)(1/0.8) the martial consumption increases in tress folds at (d/h)(1/1.4) in case (1/1.6) the material consumption is four times the minimum. There after rate of increase of material consumption reduces to 21 to 40%.

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