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ANALYSIS OF R.C.C OVERHEAD TANK USING STAAD PRO FOR DIFFERENT ZONES WITH FULL, HALF, EMTY CONDITION

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Abstract - *Water tank is a structure used to store water for supplying to households for drinking purpose, for industries as a coolant and irrigational water for agricultural farming in some areas. Water tanks are classified on the bases of their shapes and position of structure. In this project, we shall discuss about the design of circular overhead water tank which is analyzed designed and detailed using Staad pro. 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. Hence water tank needs to be constructed. Storage reservoirs and overhead tanks are used to store water. This project is giving a detailed procedure to model, analyse and design a circular overhead tank in a standard software. Results state that there is more threat of destruction to the tanks with higher capacities as compared to the tanks with lower capacities in a given zone.*

Key Words: Intze Water Tank, Base Shear, Inter story drift, Mass participation Factors, for Full Tank Condition, Half Condition, Empty Condition, All zones, STAAD PRO software

1. INTRODUCTION

Water tank is a structure which is utilized for accumulate drinking water. In current scenario, there is a lot of importance for water storage projects throughout the globe. Water has a predominant role in day-to-day life. In the water tank design, the design aspects are to be kept in mind according to the codal provision and hydraulic and other loads have to be applied carefully. A water tanks are utilized to accumulate the water, in order to use the water for daily requirements. Imperviousness of cement concrete has a crucial part in the design and construction of any liquid retaining structure. Also the water cement ratio has the main role to play in getting a proper permeability in a consistent and properly compacted concert of any mix design. Permeability increases with the water cement ratio raises. Hence it is wise to decrease the water cement ration in order to achieve the desired permeability, however too much reduction in water cement ratio will also effects the workability, and reduced the quality of concrete in achieving its strength. Any liquid retaining structure design has to be carried out by bearing in mind the prevention of concrete cracks. By make increasing the thickness of the shuttering we can avoid the cracks development as thicker shuttering helps in reducing the escape of moisture from the concrete surface. Cracking of concrete can also be avoided by restricting the liquid retaining structure's free contraction and expansion. An elevated tank is the one which is situated at a certain height which provides enough pressure to supplying the water.

2. OBJECTIVES

The object of this project is..

1. To make a0study about the analysis0of water tanks.
2. To0make a study about0the guidelines0for the design0of liquid retaining structure according0to IS Code.
3. Analysis of water tank to different zones of India with full, half, Emty condition.
4. To know about the design philosophy for the safe and economical design of water tank.
5. To increase the design life period and serviceability of the structure.

Table -1 Dimensions of Tank

Capacity	1500 Cum
Diameter	18.00 m
Staging height	20.00 m
Top Dome Thickness	0.15 m
Bottom Dome Thickness	0.30 m
Top Walkway Thickness	0.15 m
Bottom Walkway Thickness	0.15 m
Ring Wall Thickness	0.30 m
Shear wall thickness	0.30 m
Tank height	15.00 m
Wall thickness of tank	0.3 m
Ring beam-1	0.6X0.9 m
Ring beam-2	0.9X0.75 m
Ring beam-3	0.6X0.45 m
Floor slab thickness	250 mm

Grade of steel	Fe500
Grade of concrete	M30

3. Plant Site Information:

- Location0of the Site : Bangalore, Agra, Chandigarh, Bhuj.
- Basic Wind speed : 33 m/s, 47 m/s and 50 m/s
- Seismic Zones : II, III, IV, V

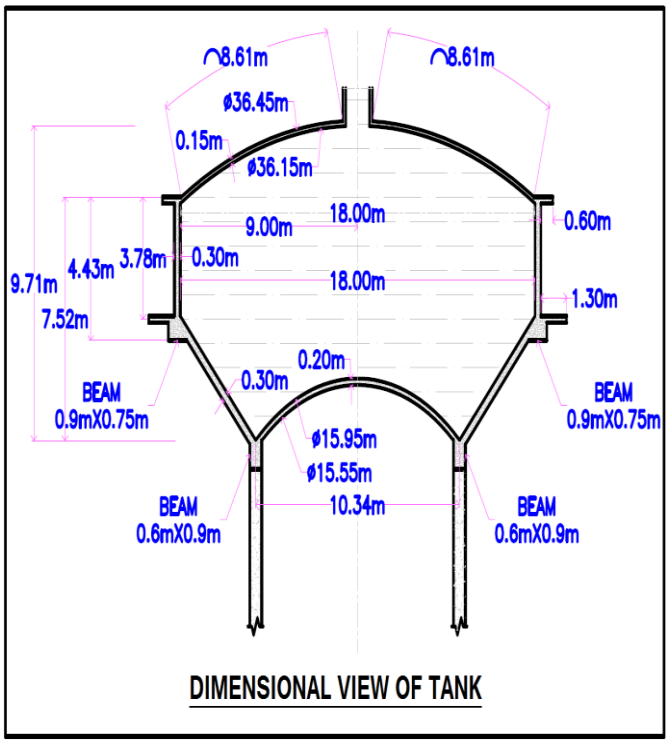

Chart -1: Dimensional View of Tank

4. RESULTS

Table -2 Base Shear in KN

Base Shear in KN				
Seismic Zones	II	III	IV	V
Empty	271.70	434.72	652.08	978.13
Half Full	339.59	543.34	815.00	1222.51
Full	686.50	1098.40	1647.60	2471.40

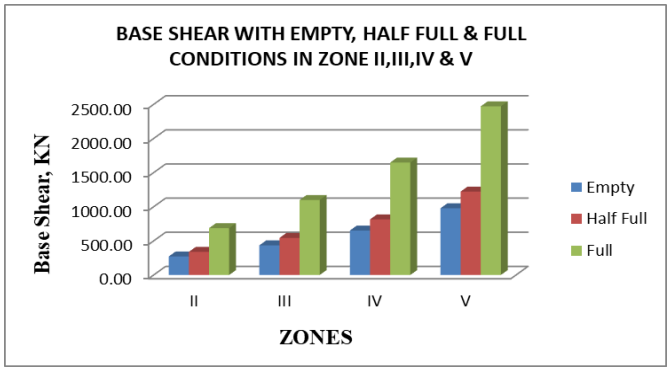

Fig -1: Base Shear with Empty, Half Full & Full Conditions in Zone II, III, IV & V

Table -3 Interstory Drift in mm

INTERSTORY DRIFT IN MM (CUMULATIVE)					
Storey level in m	**Condition**	**II**	**III**	**IV**	**V**
19.05	Empty	13.381	14.548	20.456	28.6533
	Half Full	13.5862	14.686	20.588	32.9
	Full	15.569	21.649	29.9348	44.9957
17.4	Empty	13.3135	13.451	18.853	28.462
	Half Full	13.527	13.686	19.153	30.747
	Full	13.58	20.042	27.5438	41.4087
16.76	Empty	11.1035	12.592	18.388	27.583
	Half Full	11.509	12.732	18.627	29.957
	Full	11.936	19.483	26.7098	40.0637
15.43	Empty	6.6535	11.786	17.222	25.834
	Half Full	7.609	11.825	17.575	28.38
	Full	11.248	18.278	24.9168	37.3747
9.95	Empty	4.1935	7.788	11.403	17.105
	Half Full	5.485	7.87	11.437	17.775
	Full	7.58	12.318	16.0528	24.0787
7.65	Empty	4.127	6.707	9.822	14.733
	Half Full	4.869	6.87	9.949	14.025
	Full	6.538	10.625	15.801	23.701

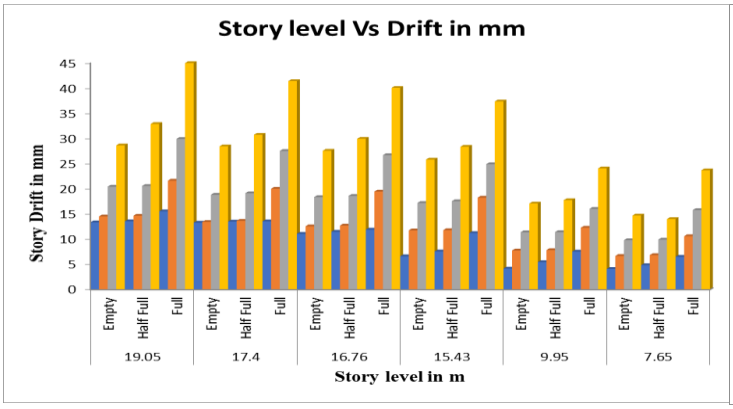

Fig-2: Interstory Drift in Mm (Cumulative)

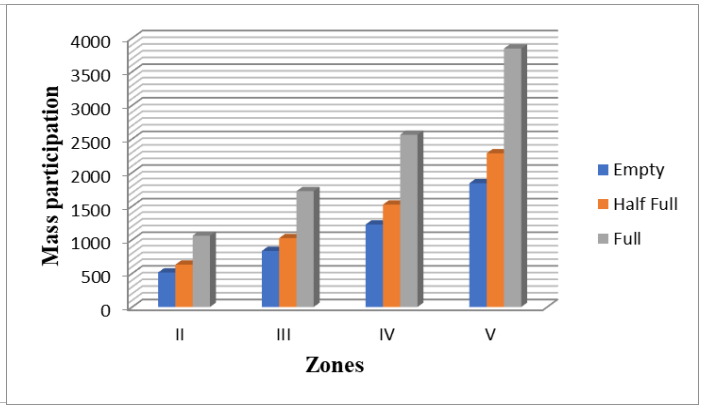

Fig-4: Mass Participation Factor CQC Method

Table -3 Support Reaction

Support Reaction at Foundation Level in KN	
Water Level	Support Reaction, KN
Empty	19653.4
Half	20091.4
Full	20867.7

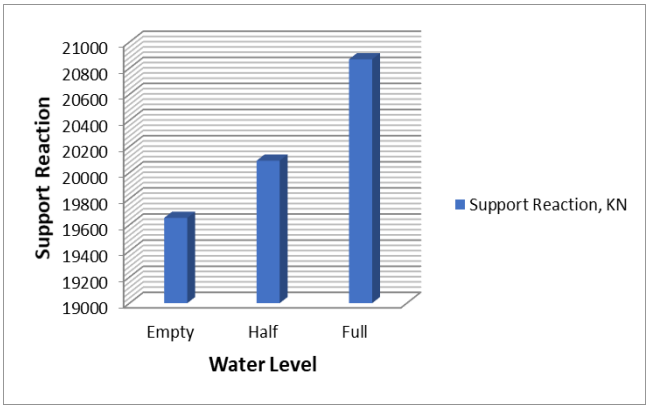

Fig -3: Support Reactions for Empty, Half and Full Condition

Table -4 Mass Participation Factor C Q C Method

Mass Participation Factor CQC Method				
Zones	**II**	**III**	**IV**	**V**
Empty	513.52	834.47	1227.42	1841.13
Half Full	630.46	1024.49	1523.6	2285.4
Full	1060.46	1723.25	2562.78	3844.17

5. CONCLUSIONS

Following are the conclusions based on the Seismic Analysis of Elevated Water Tank are as follows:

1. Base shear of zone II, III, IV and V for Empty water tank has increased by by an average of 37.5%, For Half water tank it is 33.33% and for Full water tank are increased with 33.33% because of zone factor, response reduction factor etc. while considering seismic analysis.

2. Base shear in full condition tank is slightly higher than Half and empty tank due to absence of water or hydro static pressure.

3. Inter story drift for zone II,III,IV and V for empty condition tank has increased by an average of 28.4%. For half full condition it is 29.4% and full condition it is 32.2 %.

4. Peak shear for zone II,III,IV and V for empty condition tank has increased by an average of 33.9%. For half full condition it is 34.8% and full condition it is 36.8 %.

5. Total Support reaction with respect to empty tank has increased by 2.18% for half filled condition and with respect to half filled condition it has increased by 3.72% for full condition.

6. Mass participation factor with respect to CQC method for empty condition there is an increase of an average 34.6%, for half-filled and full condition it is 34.85%.

7. Mass participation factor with respect to ABS method for empty condition there is an increase of an average 37.5%, for half-filled and full condition it is 34.85%.

8. Mass participation factor with respect to SRSS method for empty condition there is an increase of an average 31.2%, for half-filled and full condition it is 34.85%.

9. For zone II,III,IV & V frequency has increased between 0.8% 1.1%% when compared the tank in empty condition with that of half-filled condition and increased

between 5.4%to 5.7% when compared half-filled tank with full tank.

10. Similarly period has increased between 2.9% & 3.05% when an empty tank is compared with half-filled tank and between 4.79% & 4.9% when compared half-filled tank with full tank.

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