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Estimation of Intze Water Tank by User Graphical Interface

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Abstract - *Water tank situated either on the ground surface or below the ground surface causes great problems such as seepage of unhygienic water to the underground water tank and also generally its capacity is low in comparison to the elevated tank. Nowadays because of many advantages elevated water tanks are suitable for large projects. Before taking up the design, the designer should first decide the most suitable type of staging of tanks and correct estimation of loads shall be made. In this research, estimation of Raft Foundation and Top Dome component of Intze water tank by MS excel programming is made by user graphical interface and we acquire desired output by putting design mix and other dimensions as input values.*

***Key Words*: Intze water tank, MS-excel programming, Design Mix, User graphical interface.**

1. INTRODUCTION

In developing countries like India, the safe supplying of portable water and enough water are most significant needs. Storage reservoirs and overhead tank are used to store water, liquid petroleum, petroleum products and similar liquids the development of the human civilization has introduced many different types of water storage tank. All tanks are designed in order to have a crack free structures so as to eliminate any leakage from it. The walls and retaining slabs of these tanks and reservoirs are made up of reinforced concrete with adequate cover to the reinforcement. India has been able to cover about 84% of its urban population with safe drinking water supplies. For an adequate water supply scheme various system are required for collecting, transporting and treating the water Water supply scheme consists of intakes and reservoirs, a water treatment plant, elevated tanks and stand pipes which provide storage to meet peak demands occurring for limited periods, also consists valves hydrants etc. Elevated tanks are very important component of water supply scheme. Efficient design and estimation of elevated tank (Intze tank) increases the efficiency and reduce the overall RMO (running, maintenance and operation) cost induced in water tank.

Water Tank Classification:

The classification of a reservoir is based on the location on which it is to be built and also on the shape of the reservoir

Based on the location the water tanks are classified into three ways:

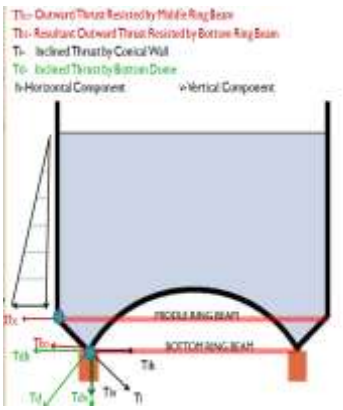
1. Underground water tanks
2. Tank resting on grounds
3. Elevated or overhead water tanks.

Also, the water tanks are classified based on shape:

a) Circular tanks
b) Rectangular tanks
c) Intze tanks
d) Circular tank with conical bottom
e) Spherical tanks.

1.1 Concept of Intze Water Tank

In the cases of large diameter tanks an economical alternative would be to reduce its diameter at its bottom by conical dome. Such a tank is known as Intze tank and it is commonly used. The main advantage of such a tank is that the outward thrust from the top of the conical part is resisted by the ring beam at the bottom of cylindrical wall while the difference between the inward thrust from the bottom of conical dome and the outward thrust from the bottom dome are resisted by ring beam at the bottom of conical dome. The proportions of the conical dome and bottom dome are so arranged that the outward thrust from bottom dome balances the inward thrust due to the conical dome.



1.2 Structural components of INTZE water tanks:

1. Top spherical dome
2. Top ring beam
3. Circular side walls

4. Bottom ring beam

5. Conical dome

6. Bottom spherical dome

7. Bottom circular girder

8. Foundations

9. Tower with columns and braces

2. Literature Review

In this chapter the background referring to the need of tank for possible used by the study; elevated water tank with different criterias and conditions. The available published literature on analysis of elevated water tank is also briefly reviewed

- Ankita D. Katkar, Sanjay K. Bhadke(2019) says that,Water is life line for every kind of creature in this world. All around the world liquid storage tanks are used extensively by municipalities and industries for water supply, fire fighting systems, inflammable liquids and other chemicals. The analysis conducted as per the specifications of IS 3370, IS 800:2002, IS 875, IS 1893. Design of tank by the dome, Ring beam supporting the dome, Cylindrical walls, Ring beam at the junction of the cylindrical walls and the conical wall , Conical slab, Floor of the tank, The ring girder, Columns, Tower with bracings, Foundations as per IS 3370 -Part III will be done by using 2-Dimensional STAAD model for different 2,50,000 Litres capacity tank .Different loads such as Dead Load, Live Load, Wind load, Earthquake Load will be applied on STAAD model at appropriate location as per codes used for Loading [1]

- Tiruveedhula Chandana, S.V. Surendhar (2019)studies that, an elevated overhead water tank is a storage structure constructed at a certain elevation to hold water and supply safe drinking water. It is a time-consuming task to design and cost estimation of overhead water which have needs lot of expertise. These elevated water tanks are especially vulnerable to horizontal forces such as wind and earthquakes. Tanks of various shapes are considered in the present study. Circular, Rectangular and Intze Elevated water tanks are modelled in STAAD.PRO software. Gravity analysis, Seismic analysis and wind analysis are performed on the modelled structure. From the analysis results, the seismic parameters such as displacements, base shear and over turning moments are examined deeply and compared and cost analysis is performed for all the three water tanks and compared. The study deals with the performance of elevated reinforced concrete overhead water tanks to seismic & wind forces [2]

- Saurabh Agarwal, Vishnu Sharma(2018) investigated that Intze Tank, Circular Tank, Rectangular Tank modeling is carried out by using finite element analysis base software STAAD PRO. Evaluation of tanks is about the analysis and design of sub structure and super structure. Elevated water tanks are one of the most essential inside the daily requirement. The Paper concerned with the overall performance in cost of water tank under seismic load as in keeping with IS 1893(part1):2002 ZONE II. The consequences acquired from the analysis are as compared and the conclusions are drawn[3]

- Akshit Lamba and L.P.Shrivastava(2017) briefly survey that, importance of maintaining safety norms of such tanks against seismic loads cannot be neglected and taken lightly. Indian seismic code IS 1893:1984 showed very limited provisions on seismic design of both elevated and underground tanks. Compared to present international practice, those provisions of IS 1893:1984 are highly inadequate. The study dealing with the whole design analysis and parametric study of structural analysis of circular and rectangular water tank to avoid stresses and cracking. Modal analysis of tank will be done to define the mode shapes of tank under self-weight[4]

- Issar Kapadia, PuravPatel, Nilesh Dholi a, Nikunj Patel (2017) analyse and design Intze water tank and investigated that ,Water tanks are important public utility and industrial structure. The design and construction methods in reinforced concrete are influenced by the prevailing construction practices, the physical property of the material and the climatic conditions. Before taking up the design, the designer should first decide the most suitable type of staging of tanks and correct estimation of loads including statically equilibrium of structure particularly in regards to overturning of overhanging members shall be made [5]

3. Methodology and Software designed

Estimation is done in the way to find the required materials for a particular concreting of any component. As Nowadays, it is required to calculate the materials manually which is called as rough estimation. These processes are very lengthy to perform as well as time taken. There should be a rapid calculator of concrete materials, which saves time. There are some software are available to estimate but they are very complex and cannot perform a particular task. Now come to the point of our project, our project is to develop a general program to estimate any INTZE water tank through excel. In this program the user will provide the required inputs from

the drawing and desired output can be received. By this software we can estimate:

1. Foundation
   a) Pile foundation
   b) Raft foundation
2. Columns
3. Braces
4. Bottom ring beam
5. Bottom dome
6. Cone wall
7. Middle ring beam cum balcony
8. Vertical wall
9. Top ring beam
10. Top dome
11. Stairs.

In this paper estimation of Raft Foundation and Top Dome component of intze type water tank manually and by using MS-excel- programming sotware for estimating purpose has been done.

With the help of that graphical user interface we can acquire desired output by putting the design mix values and other input values (such as No. of Bulbs, Size and Dimension of Column, Dia. Of Top Dome, height, thickness etc)

In this Paper also the efficiency of designed software and site data are verified (i.e. estimated data by using software designed compared to the water tank data which is situated at VDA Colony, Varanasi 2200KL OHT staging at 20 mt)

Following is the screenshot fig.of Pile Foundation and Top Dome Component of Intze Water Tank:

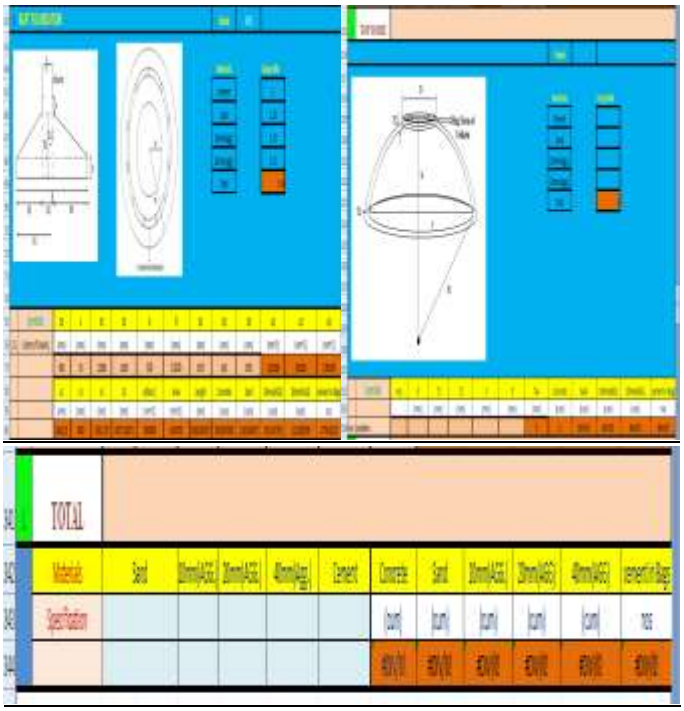
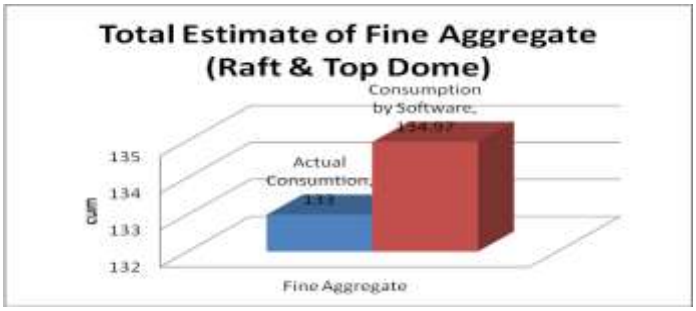
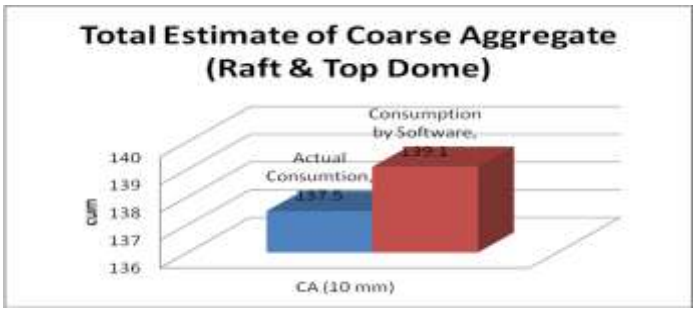
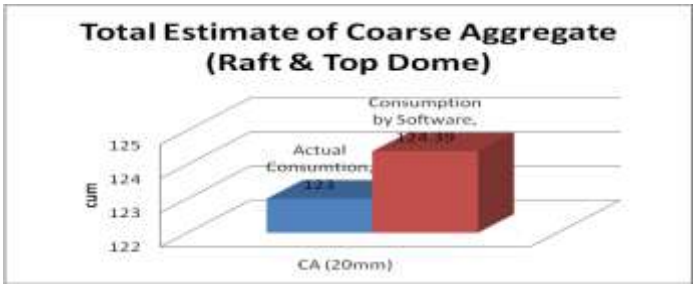


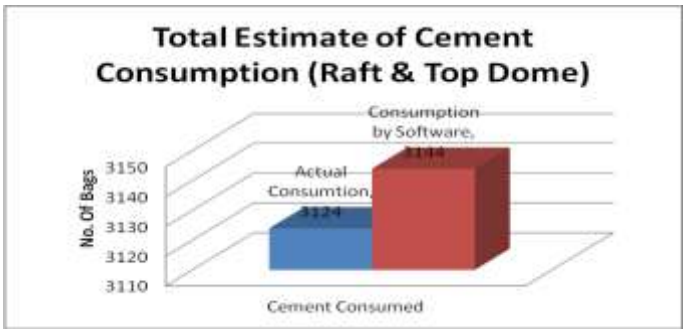
Table -1: ***Estimation of 2200KL Intze Water Tank (at Site)***

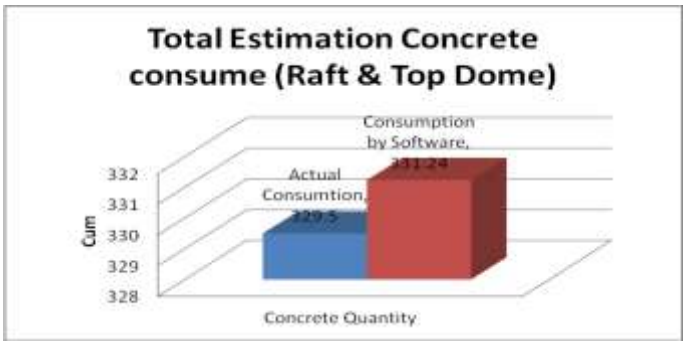
Actual Estimation for Raft foundation and Top dome									
S.N	Description	Qtty (cum)	Material Consumed						
			Cement(in Bags)			CA			FA
			Concreting	Slurry	Touc hup	10 mm	20 mm	40 mm	
1	Raft	289.5	2755	16	3	121	108	0	117
2	Top Dome	40	369	7	8	16.5	15	0	16
Estimation for Raft foundation and Top dome By Using Software									
S.N	Description	Qtty (cum)	Material Consumed						
			Cement(in Bags) {In Totality}	CA					FA
				10 mm		20 mm		40 mm	
1	Raft	291	2755	122		109.1		0	118.4
2	Top Dome	40.72	389	17.10		15.29		0	16.57











4. CONCLUSIONS

This research paper is aiming at the water supply scheme; design of INTZE WATER TANK & a general user interface estimation of concrete materials by excel programming. Here explore to only Raft Foundation and Top Dome stages of water supply scheme has been done to evaluate quantity of concrete materials

For checking the effectiveness of program we carry out the data of 2200KL INTZE water tanks (From Varanasi site) which are completed and compare it with our program

Description of materials	Estimation analysed by software	Actual Site Consumption
Fine Aggregate	134.97	133
10mm Aggregate	139.10	137.5
20mm Aggregate	124.39	123
40mm Aggregate	0	0
Bags of Cement	3144	3124
Concrete Quantity	331.24	329.5

- All materials consumption in cubic meters(cum)

$$Efficiency\ of\ program = \frac{consumed}{estimated} * 100$$

=(329.5/331.24)*100

= 99.33%

Result: We have prepared this program, enter the values and conclude that our program effectiveness is really acceptable with an efficiency of greater than 99% and is easier to work out concrete consumption by simply entering the data of each component by user.

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