



DESIGN OF INTZE WATER TANK BY USING STAAD PRO FOR HATHIPUR VILLAGE

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Abstract: An Intze type water tank is actually an surface water tank used to supply water to a home. This important water structure must withstand different types of natural loads i.e., earthquake loads, wind load, snow load, rainfall load, extreme temperature variations, etc. Previously these types of water tanks were designed in the form of operational stress provided by IS: 3370- 1965 Indian Standard APPLICATION CODE FOR KEY SIGN STRUCTURES PART II TRUE SERVICES in this way we get thick and thick sections. Build in the form of a border given IS: 3370 -2009. This activity will give you an idea of how a water tank is made. We are building a water tank in a small rural area (Hathipur) in the Kanpur district of Uttar Pradesh based on relevant local data. First we will do the weather forecast and then follow the design of the tank. We will list all the types of loads coming to the building. Before taking up the design, the most appropriate type of tank configuration and the appropriate load rating including building dimensions especially in relation to the scattered joints are made. The design is done taking into account the possible combination of loads, times and shekels from direct loads and horizontal loads that work in any direction where the tank is full and empty. In this project by doing an analysis of the Intze tank, diversification due to hydrostatic pressure and stress, etc. it is analyzed. A water tank can be defined as a structure used to store water. The importance of this structure has arisen since the development of rivers, thus contributing to the same theme of water conservation in various streams such as drinking, firefighting, irrigation, agricultural agriculture, both crops and livestock, food preparation, chemicals. Production and many other applications. These buildings must be of good quality and be proof of leak. It should also be taken seriously that the concrete in these structures should not be cracked on the surface of the water and should have a high suction capacity and low porosity.

Index Terms - Intze Water Tank, Water Need, Loads, Hydrostatic Pressure, Staad Pro.

1. INTRODUCTION

Normally no cracks are allowed to occur in any part of the R.C.C tank structures that store liquids and make water solid by using a rich mixture (not less than M20) of concrete. In addition, sometimes waterproofing materials are used to make the tanks stronger. The durability of concrete is directly related to the water content of cement. The combination that should be used with vibrators should be done to achieve non-corrosion. Cement content from 330 Kg / m³ to 530 Kg / m³ is recommended to keep the weight down. Leaks have a high head and it has been noted that a head up to 15m does not cause a leak problem. It is recommended to use high grade 415 curved bars to construct fluid storage structures. Proper placement of reinforcement, use of smaller sizes and the use of disabled bars lead to distinct cracks. Split width of 0.1mm is accepted as the allowable value for liquid storage structures. When designing fluid storage structures the recommendations of the "Liquid Code Practice Code- IS3370 (Part I to IV)" should be considered. This is an example of a paper format only please use this format and follow this structure according to your requirement.

A water tank is a container for storing water.

- The boundaries of the water tank include the general design of the tank, the choice of building materials, and the following.
- The location of the water tank (inside, outside, above or below ground) determines the color and characteristics of the construction.
- The capacity of the water tank will need to hold to meet the design requirements.
- The purpose for which water will be used, the use of people or industries determines concerns about things that do not have negative effects on people.
- How water will be delivered to the point of use, in and out of the water tank i.e. pumps, gravity or water storage.

2. PURPOSE

- Learn the different energies that work in a water tank. Understand the most important factors that play a role in the design of a water tank.
- Read guidelines for water tank design according to IS code and design inspection.
- Knowledge of the design philosophies for the construction of a water tank.
- Improving the design of an economical and safe water tank, which provide proper steel reinforcement for concrete and learning its safety in accordance with various codes.
- Every day there was a shortage of water in Hathipur, so we decided to find a solution so that the first thing that came to mind was an Intze water tank.
- Conduct research on the analysis and design of water tanks.
- Conduct research on the design guidelines for liquid storage structures in accordance with the IS Code.
- Knowledge of the philosophy of designing a safe construction and saving of a water tank.
- Implement plans to design a flexible water tank with a solid foundation and a subterranean tank to avoid annoying statistics.
- Finally, plans are verified by the results of the manual manipulation provided in the Visual Structure manual.

3. INTZE WATER TANK STRUCTURE COMPONENTS:

The various components of the Intze-type tank structure include the following:

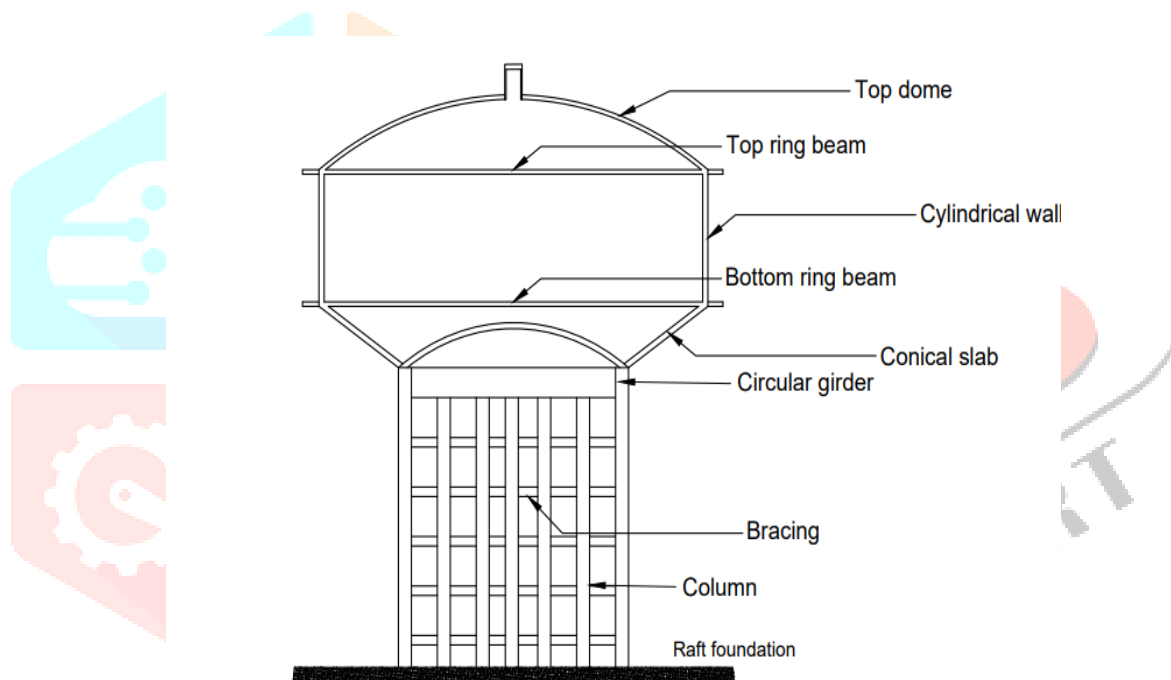


Fig.1 Structural Components of Intze type water tank

1. Top spherical dome
2. Top ring beam
3. Cylindrical side walls
4. Bottom ring beam
5. Conical Slab
6. Bottom circular girder
7. Column
8. Column Bracing
9. Foundations

4. LITERATURE BOOK REVIEW

- I. **Animesh Gaurav, et.al (2021) [5]:**- Water storage tanks and overhead tanks used for water storage. All tanks are designed as a free structure to eliminate any leaks. Water tanks are essential for public use and industrial construction. The design and construction of the reinforced concrete is influenced by the existing construction method, material structures, and climate. Before making this design, the designer must first determine the most appropriate type of tank size and the correct load rating that includes the existing size of the building especially with respect to the spacing of the prominent part to be made. The design should be based on the worst combination of loads, times and beards from straight veins and horizontal load that works on both sides when the tank is full and empty. In this study by performing an analysis of the Intze tank,

what is the deviation structure due to hydrostatic pressure and then pressure, etc. Updated. In this project the pressure method is used to design the INTZE Tank and the components of the INTZE tank design of the state border route.

- II. **Vaseem Akhtar, et.al (2021)** ^[9] - This project provides a brief, theoretical behind the design of a liquid storage facility. Water tanks are water storage containers. High water tanks were built to provide the head needed for water to flow under the influence of gravity to build the old water tanks as a civilized man. The water tank system is a priority as it provides drinking water to many people from the big cities to the few people living in cities and valleys.
- III. **Javed Ahmad, et.al (2020)** ^[7] - Due to the great need of the general public, water should be stored and provided according to its needs. The need for water does not change throughout the day. It changes from hour to hour. In order to supply more water regularly, we need to store water. Therefore, in order to meet the general demand for water, a storage tank must be built. Storage tanks and overhead tanks usually store water, liquid petroleum, petroleum products and similar liquids. The analysis of the capacity of ponds or tanks is about the similarity regardless of the chemical nature of the commercial product. All tanks are designed as crack-free structures to eliminate any leaks. This project provides a brief, in-depth view of the layout of the liquid storage structure (elevated circular storage tank with a solid-roofed roof) using the operating pressure method. Elements are designed in a stressful way of working.
- IV. **Akshit Lamba, et.al. (2017)** ^[4] - Liquid storage tanks whether underground or above or above are commonly used in chemical storage industries, petroleum products, bulk such liquid, etc. and maintenance. water in public water distribution systems. The Indian seismic code IS 1893: 1984 showed very limited provisions for earthquake construction of both high and low tanks. Compared to current international operations, those provisions of IS 1893: 1984 are not sufficient. In addition, the code failed to cover the grounded tanks. In 2002, a revised Part 1 of IS 1893 was introduced to the market by the Bureau of Indian Standards (BIS) to maintain safety issues in these tanks.
- V. **Neha. S.Vanjari, et.al(2017)** ^[8] - Water is the most important element in life on earth. It is a liquid that covers about 71.4% of the earth's surface. It is something that is found throughout the human body. Water is used at about 20,000 200 liters per head / day. Water is also important for agriculture and industry. The need for water is one of the key issues in the water supply system. To overcome this issue, current water tank designs need to be modified. The surface water tank is a very efficient storage space used for domestic or even industrial purposes. The designs and methods of construction on reinforced concrete are influenced by existing construction processes, physical location and weather conditions, membranes, soil conditions i.e. soil type, soil carrying capacity etc. This paper provides the overall design process. Overhead Circular Intze tank uses LIMIT STATE METHOD from IS-3370: 2009. In IS-3370: 2009, a two-dimensional boundary mode system primarily limits metal pressure and cracks.
- VI. **Hemish Kumar Patel, et.al. (2016)** ^[6] have the use of an improvement approach in Building Analysis and the design of Intze's high water tanks, considering the entire tank economy as a function aimed at tank structures that are tank capacity, tank width and length. rectangular tank, water depth is round, water unit weight and thickness of tank floor slab, according to design variation. A computer program has been developed to solve numerical examples. The results show that tank capacity has taken over the small economy of Intze tank. The size of the tank floor slab has taken up a small tank economy. The water weight unit in the tank has taken over the small economy of the Intze tank.

5. METHODOLOGY

Daily Water Demand

Sr. No.	Types of Consumption	Normal Range (lit/capita/day)	Average	%
1	Domestic Consumption	70-200	135	35
2	Industrial and Commercial Demand	30-50	40	30
3	Public including Fire Demand Uses	11-90	50	10
4	Losses and Waste	45-100	70	25

Table 1

5.1 Population Forecast

It is given by:

$$P_{20} = P_0 (1+r/100)^{20} \dots\dots\dots \text{(By: Geometric Progression)}$$

Whereas:

P_{20} = Population after 20 Years

P^0 = initial population (8988)

R= rate of annual growth (2.5%)

On putting all values:

P=8988(1+2.5/100)²⁰.....1

On calculating with help of above equation1

We got P₂₀=14727.88~ 14730 People

So, we are going to design the water tank for the population of 14730 people for the 20 years till 2042.

5.2 Soil Investigation

Water Content (w):

Moisture content is the ratio of the mass of water contained in the pore spaces of soil To the solid mass of particles in that material, expressed as a percentage. We dry it by oven at 105⁰c for 24 hours. Our value of water content is given below:

w = 10.34%

Density of soil:

Density tells how dense the soil is. Dense soil is good for construction. We perform this test by core cutter method. The values of our test are given below:

- 1) Bulk density = 17.43KN/m³
2) Dry density = 15.8KN/m³

5.3 Calculation of Height of Cylindrical Portion:

Height of the cylindrical portion of tank is given by the below formula

Volume= (π/4) D²h + (πh₀/12) (D²+D²₀+DD₀) - (πh²₂/3) (3R₂-h₂)

We had taken diameter of tank = 15m

On calculation we got the height of cylindrical portion:

h= 4.6m

5.4 Site Location



Fig.2 Google Image

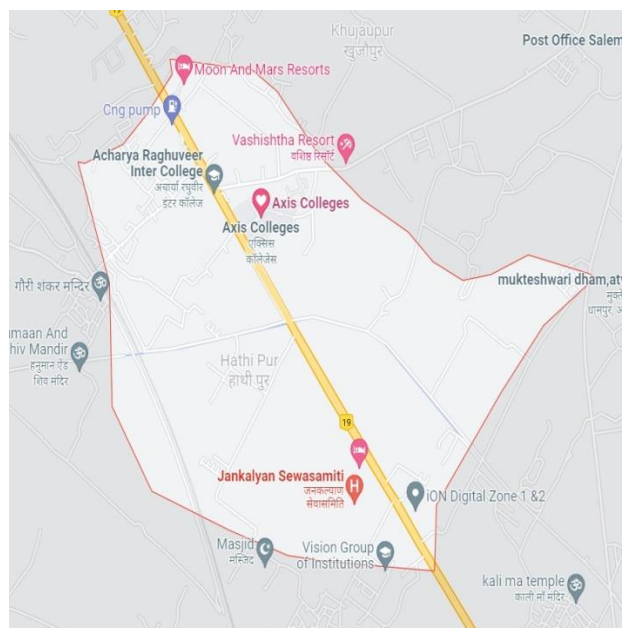
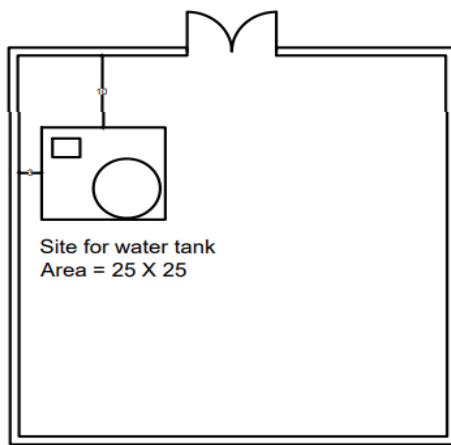


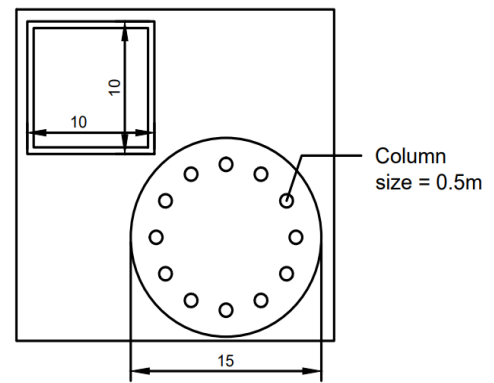
Fig.3 Google Map Image

5.5 Site Plan



Total area of park

Fig.4 Plan area of Park



Plan

Area of Water Tank Site = 25m*25m

Area of Pump House = 10m*10m

Fig.5 Plan of Tank Site

5.3 Software used

5.6.1 AutoCAD

AutoCAD is a computer-aided enterprise (CAD) project and software that is still being developed. Developed and marketed by Autodesk, AutoCAD was first launched in December 1982 as a desktop application running on microcomputers with internal image controllers. Prior to AutoCAD was introduced, most CAD trading systems were operated on mainframe computers or small computers, with each CAD operator (user) operating in a separate graphics area. AutoCAD is also available as mobile and web applications.

5.6.2 Staad Pro

STAAD (or STAAD.Pro) is a summary of Structural Analysis and Design. STAAD.Pro is a computer program originally developed by Research Engineers International in Yorba Linda, CA in 1997. It was purchased by Research Engineers International in late 2005. STAAD.Pro today is the most widely used software tool in the field of civil engineering.

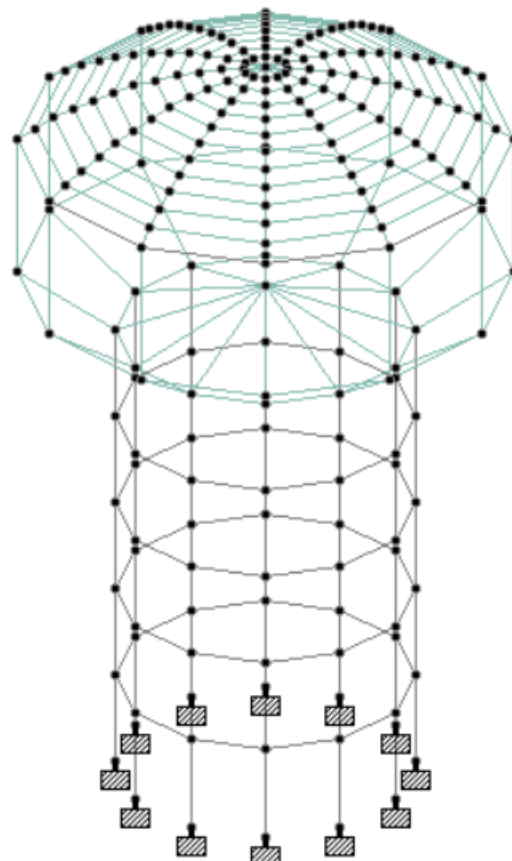


Fig.6 Staad Analysis of tank

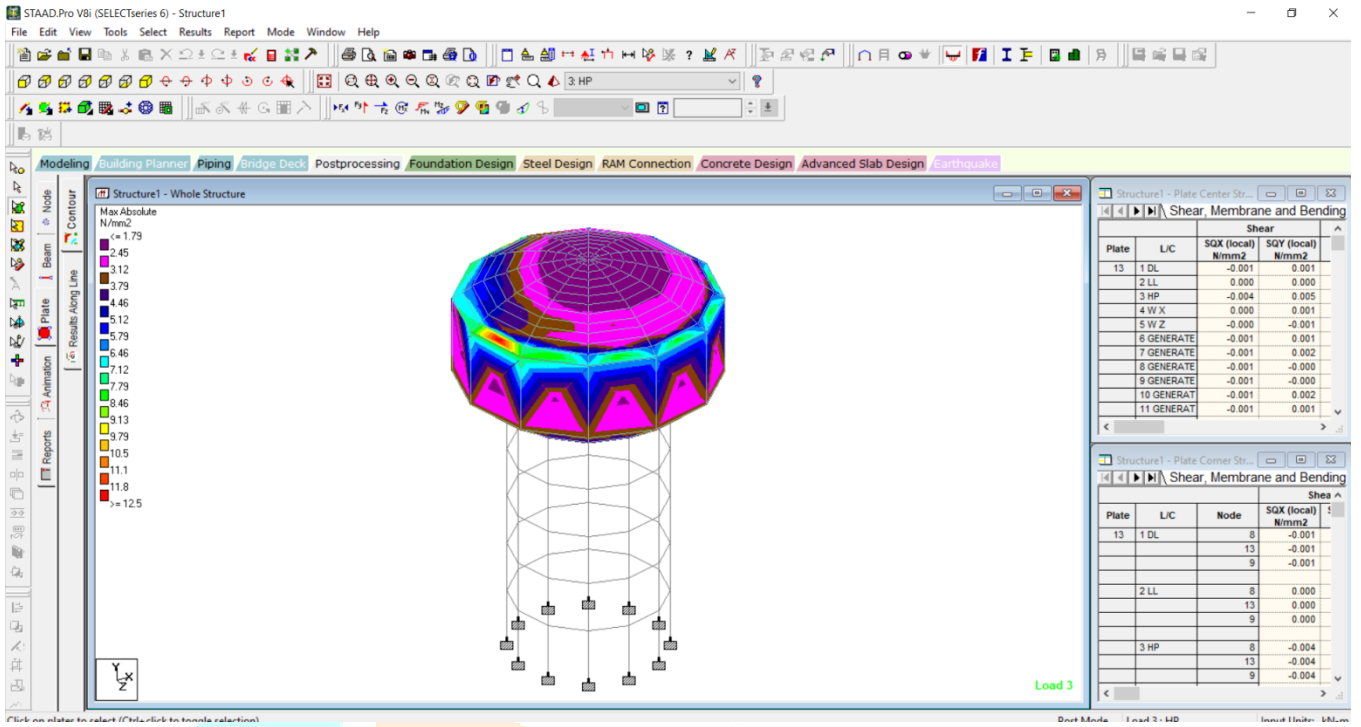


Fig.7 Max Absolute Pressure

5.7 Reinforcement Detailing

5.7.1 Cross Section of Tank

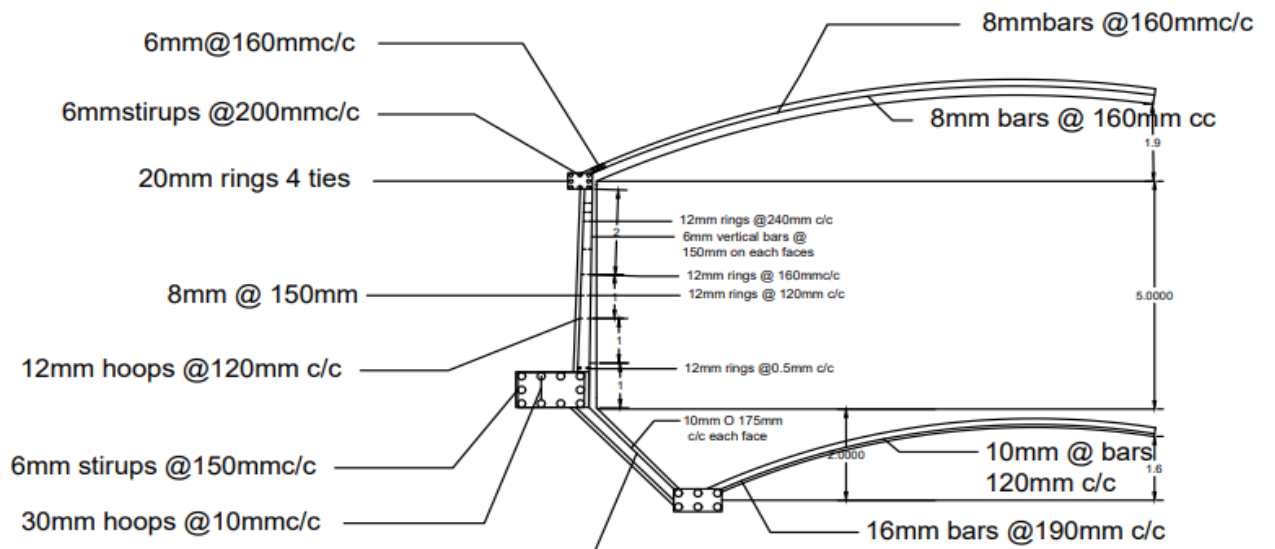
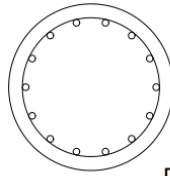


Fig.8 Cross Section of Intze Tank

5.7.2 Cross Section of Column



Design Load		Design Parameter	
Load	5	Size (m)	0.5
Location	End 1	Fy(Mpa)	500
Pu(Kns)	-0.25	Fc(Mpa)	30
Mz(Kns-Mt)	1.13	Bar size(mm)	12
My(Kns-Mt)	2.1	Bar no.	14

Fig.9 Cross Section of Column

5.7.3 Cross Section Of beams holding columns

ALL the beams which hold the columns

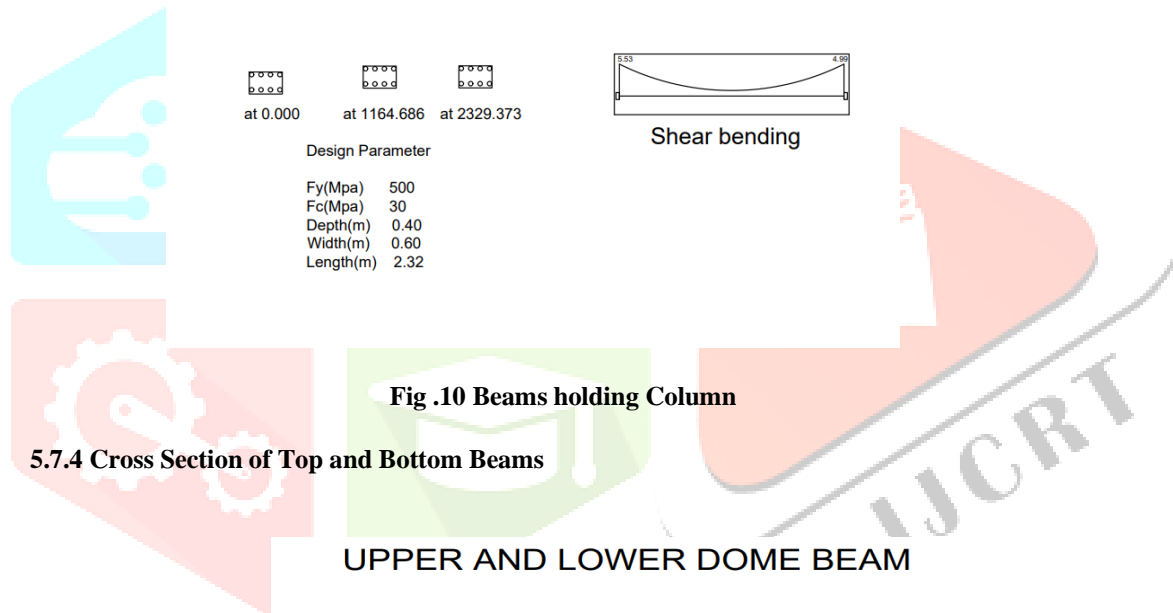
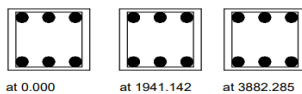


Fig.10 Beams holding Column

5.7.4 Cross Section of Top and Bottom Beams

UPPER AND LOWER DOME BEAM



Design Parameter	
Fy(Mpa)	500
Fc(Mpa)	30
Depth(m)	0.34
Width(m)	0.34
Length(m)	3.88

Fig.11 Upper and lower Beam

6. DIMENSIONS OF TANK

- Tank width (D) = 15 m
- Low Ring Beam Width (D0) = 15 × 0.6 = 9m
- High dome height (h₁) = 2.5m
- Lower dome height (h₂) = 1.5m
- Length of conical dome (h₀) = 2m
- Cylinder wall height (h) = 4.6m

7. DESIGN PARAMETERS

- Fe 500
- M30
- Carrying Ground Capacity =157KN/m²
- Water content = 10.34%
- Bulk density = 17.43KN/m³
- Dry density = 15.8KN/m³

8. CONCLUSION

The storage of water for drinking and bathing tanks, agriculture, and sanitation is increasingly becoming increasingly important in modern life. With less energy we travel in rectangular water tanks, and with more energy we provide round water tanks. Intze is a modified round tank. The Intze tank was built to reduce project costs because the low dome in this construction is resistant to horizontal targets. The construction of the Intze water tank is a very tedious process. The entire structure is hand-crafted with the M30 grade concrete in mind. Detailed drawings are provided in the AutoCAD software, which is displayed accordingly. The platform is designed with high safety and effects due to seismic strength and wind power are also considered. Therefore, in general, this project can be implemented in a specified area, namely, Hathipur.

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