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Design And Analysis Of Hydraluic Water Tank By Using Staad Pro

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Abstract: Water tank is a structure used to store water for supplying to households as drinking purpose, for industries as a coolant and irrigational water for agricultural farming in some areas. Water tanks are classified on bases of their shapes and position of structure. Elevated water tanks are constructed in order to provide required head so that the water will flow under the influence of gravity the construction practice of water tanks is as old as civilized man. The water tanks project have a great priority as it serves drinking water for huge population from major metropolitan cities to the small population living in towns and villages**.**
This project is an application economy of the tank as an objective function with the properties of that optimization method to the structural Analysis and design of circular tank, water depth, unit weight of water and tank floor slab thickness, as design elevated water tanks, considering the total tank that are tank capacity, width and length. To considering dead load, live load, seismic load A computer program has been developed to solve numerical examples. The project is strictly in accordance with IS 456:2000 (plain and reinforced concrete), SP 16 (Design Aids for Reinforced Concrete), IS 801 (Design of cold formed steel) load calculations are done using STAAD Pro and Manual calculations are done through known data.The aim of the project is to apply seismic loading for different zones - II III, IV, V And assess the varying steel and concrete in seismic zones.

1. INTRODUCTION

The profile of water tanks begins with the application parameters, thus the type of materials used and the design of water tank was dictated by these variables:
Location of the water tank (indoors, outdoors, above ground or underground). Volume of water tank need to hold. What the water will be used for? Temperature of area where will be stored, concern for freezing. Pressure required delivering water. How the water to be delivers to the water tank. Wind and earthquake design considerations allow water tanks to survive seismic and high wind events.
Based on the location the water tanks are classified into three ways:

- Underground water tanks
- Tank resting on grounds
- Elevated or overhead water tanks.

Also, the water tanks are classified based on shape:

- Circular tanks
- Rectangular tanks
- Intez tanks
- Circular tank with conical bottom .
- Square tanks

2. EQUIVALENT STATIC METHOD

The equivalent static method is the simplest method of analysis because the forces depend on the code based fundamental period of structures with some empirical modifiers. The design base shear is to be computed as whole, and then it is distributed along the height of the building based on some simple formulae appropriate for buildings with regular distribution of mass and stiffness. The design lateral force obtained at each floor shall then be distributed to individual lateral load resisting elements depending upon the floor diaphragm action.
Inherently, equivalent static lateral force analysis is based on the following assumptions,

- Structure is rigid.
- Perfect fixity exit between structure and foundation.
- During ground motion every point on the structure experience same accelerations
- Dominant effect of earthquake is equivalent to horizontal force of varying magnitude over the height.
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In the past, structural engineers had the choice masonry building. Today multi-story buildings in India are constructed with R.C.C framed structure or Steel framed structure. Recently the trend of going towards composite structure has started and growing in us. But the failure of many these buildings due to earthquake have forced engineer to look for the alternative method of construction. Use of composite or hybrid material remains the particular interest, due to its significant potential in improving the overall performance through modest changes in manufacturing and constructional technologies. In India, many consulting engineers are reluctant to accept the use of steel-concrete-

composite structure because of it infamiliarity and complexity in analysis and design. But literature shows that if properly configured, steel-concrete-composite system can provide economical structural systems to resist lateral load with high durability, rapid erection and superior seismic performance characteristics. As comparatively new and no updated design codes are available for the same[1], there is a need to study the composite analysis and design of the multi-story buildings keeping in view of the rapid development in this field. Hence same can be studied in Indian context.

In the past, for the design of a building, the choice was normally between a concrete structure and a masonry structure. But the failure of many multi-storied and low-rise R.C.C. and masonry buildings due to earthquake has forced the structural engineers to look for the alternative method of construction. Use of composite or hybrid material is of particular interest, due to its significant potential in improving the overall performance through rather modest changes in manufacturing and constructional technologies. In India, many consulting engineers are reluctant to accept the use of composite steel-concrete structure because of its unfamiliarity and complexity in its analysis and design. But literature says that if properly configured, then composite steel-concrete system can provide extremely economical structural systems with high durability, rapid erection and superior seismic performance characteristics. A need to study the composite design of the multi-story buildings keeping in view of the rapid development in this field. In India, it is comparatively new and no updated design codes are available for the same.

3. LITERATURE REVIEW

- Issar Kapadia et al., had done the "DESIGN, ANALYSIS AND COMPARISON OF UNDERGROUND RECTANGULAR WATER TANK BY USING STAAD PROVI8 SOFTWARE". This paper includes the study of UG Rectangular tank that how the shape deflected and what are the actions will be produced when tank empty or full by using STAAD Pro software is discussed.
- B.V. Ramana Murthy, M Chiranjeevi had done the "DESIGN OF RECTANGULAR WATER TANK BY USING STAAD PRO SOFTWARE". In this paper he said that this mini project is conducted for a period of 15 days from 21-05-2010 to 07-06-2010 to have complete practical knowledge of various techniques and problems faced in the field. A different topic like Construction Aspects, Design Parameters, Details of Formwork, Details of reinforcement, Process of Water Treatment Plant and Execution have been dealt with in the course of our mini project.
- Thalapathy .M et al., had done "ANALYSIS AND ECONOMICAL DESIGN OF WATER TANKS". In this paper he said this project gives the detailed analysis of the design of liquid retaining structure using working stress method. This paper gives idea for safe design with minimum cost of the tank and give the designer relationship curve between design variable. This paper helps in understanding the design philosophy for the safe and economical design of water tank

4. PROGRAMMING PROCEDURE

***Per Capita Demand*:-**

Q/P*365lit/day

Where Q=Quantity of water required in liters /min

P=Population of the town in thousands.

Domestic use	-135 litres/capita/day
Industrial	-40 litres/capita/day
Public use	-25 litres/capita/day
Business	-15 litres/capita/day
Losses ,wastage and thefts.	-55 litres/capita/day

1.Arthimetical Increase Method:-

Pn =P+n.C

Where

c = constant

pn = population after n decades

n=number of years in decades

Design of capacity based on population:-

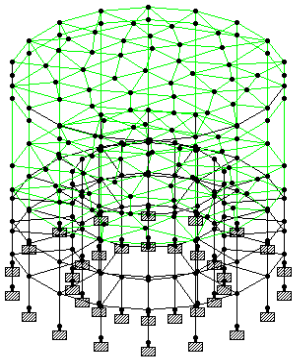
year	population	Increase in population
1990	5000	-
2000	6000	1000
2010	7000	1000
		Average=2000/2=1000

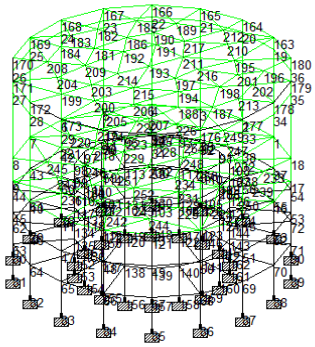
year	Population
2020	7000+1*1000=8000
2030	8000+1*1000=9000
2040	9000+1*1000=10,000

According to manual calculation height h = 9mts
similar calculation diameter d = 14mts
Circumference = $2\pi r$
$= 2*\pi*7$
87.96

LOADS :-

Slab load = $\pi r^2*0.25*24kn/m^2$
$= \pi(7)^2*0.25*24$
$=923.62kn/m^2$
Wall load =dia *9m*0.25*24
$=14*9*0.25*24$
$= 756kn/m^2$
Roof load =0.5*14*0.25*24
=42
Dead load =slab load +wall load +roof load
=923.62+756+42
$=1721.62kn/m^2$
Live load =13,50,000/1000
$=1350kn/m^2$
Combination of loads =1.5(d.l+l.l)
=1.5(1721.62+1350)
$=4,607.43kn/m^2$





Step 1: Design of tank by using the radius 7 mts (external radius) and taking the (inner radius) which is 6.5 mts.

Step 2: Supports are taken as fixed supports.

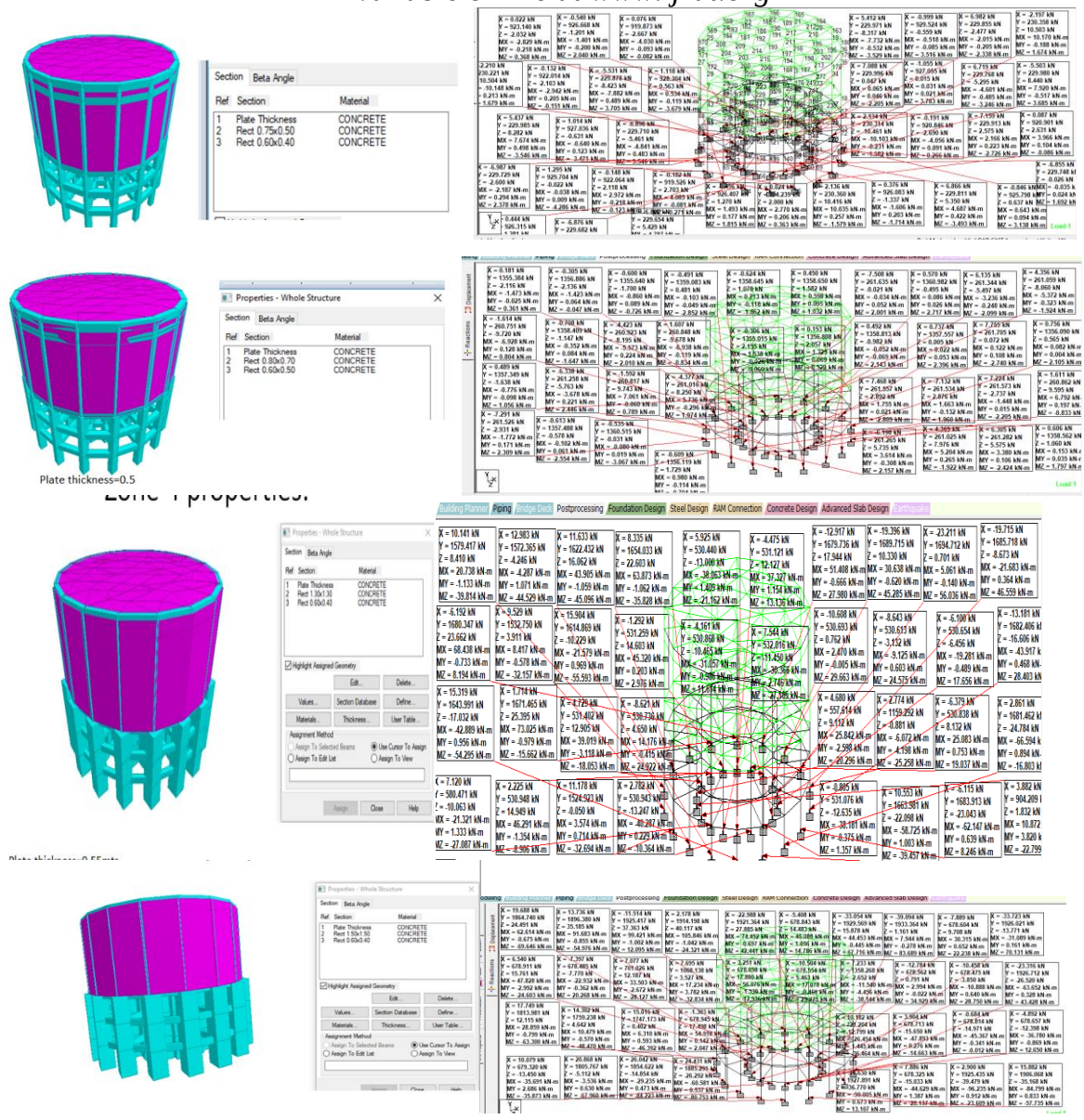
Step 3 : Properties Plate thickness , column , beam dimensions

Step 4 :Load case detailsApplied dead load, live load, combination of loads and seismic loads are applied in different zones like **II III, IV, V.**

Step 5: According to IS(Indian Standard) 456is 1893-2005,sp16 the concrete and earthquake proporties are assigned. They are Clear cover

Fck, f main, f sec , Min main, max main, fe415.

Plan- zone II, III, IV, V



5. RESULTS

Reactions	Zone2 max	Zone2 min	Zone3 max	Zone3 min	Zone4 max	Zone4 min	Zone5 max	Zone5 Min
X	7.159	-6.987	7.755	-7.29	15.90	-19.1	26.04	-33.72
Y	929.70	229.76	1360.9	260.8	1694	530.6	1929.5	678.325
Z	10.41	-10.50	9.743	-9.72	23.66	-24.7	37.36	-39.47
Mx	10.17	-4.056	5.204	-6.93	68.43	-66.5	105.84	-96.23
My	0.498	-0.188	0.265	-0.13	2.746	-3.81	3.78	-4.45
Mz	3.705	-4.286	2.717	-3.06	56.03	-55.8	83.68	-84.22

6. CONCLUSION

Regarding our study about the project we found the following conclusions.

Design of water tank in zone V is highly expensive. Expect zone V , zone II III, IV have the same similar dimensions for plate thickness , column , beam dimensions with little changes. Other than zone 5 regions, zone 4 can applicable easily for any region of the country. Throughout India these zones are applicable everywhere . Sometimes zone V is also taken in consideration due to high Richter scale values in that area.

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