ANALYSIS OF WATER TANK IN SEISMIC ZONE 4 AND 5

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Abstract **Water tank is a compartment which is utilized to store a lot of water. These compartment are either positioned on ground, underground placed on the tower. In raised water tank water is put away in certain tallness and water is flow under the impact of gravity which is utilized to satisfied residential or modern necessity. Because of the deficiency of power in the rural areas raised water tank become a significant part throughout everyday life. The enormous load of water at the head of water tank is profoundly influenced by seismic waves. Because of the impacts of earthquake some water tanks are collapse. In my previous research I did seismic analysis of elevated steel water tank in zone 2 and zone 3. India is an earthquake prone area the aim of this paper is to study the effect of earthquake in elevated water tank in zone 4 and zone 5 by using IIT-K guidelines. In this model base shear and peak displacement are obtained by analysis and comparison is done. In this research it is obtained that the base shear and displacement is more in zone 5 as compared to zone 4 in a same structure.**

Key Words**:***water tank, steel tank, seismic analysis, base shear, displacement, zone4, zone5*

INTRODUCTION

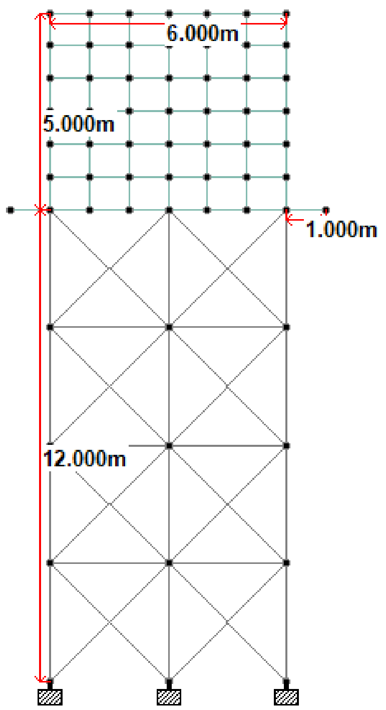
Elevated water tanks are exceptionally fundamental parts for water scheme conspire in both rural and urban zones. The fluid holding structures are consistently plan as a crack free structure to prevent leakage of water. The human population is expanding step by step that is the reason necessity of water tank is also increases. As indicated by IS 1893-2002 (Part 1) India is profoundly inclined to cataclysmic events like floods and earthquake. Because of earthquake the seismic waves profoundly influences the enormous structures which causes obliteration of property and death toll. Steel tank are more viable to oppose lateral load produce by earthquake since steel is more ductile than concrete and steel structures are lighter than rcc or concrete structure. Raised water tank is exceptionally prone to seismic waves since it contain huge measure of water at the head of the structure. Different types of bracing are used to in order to decrease the impact of earthquake.

EXPLAINATION OF MODEL

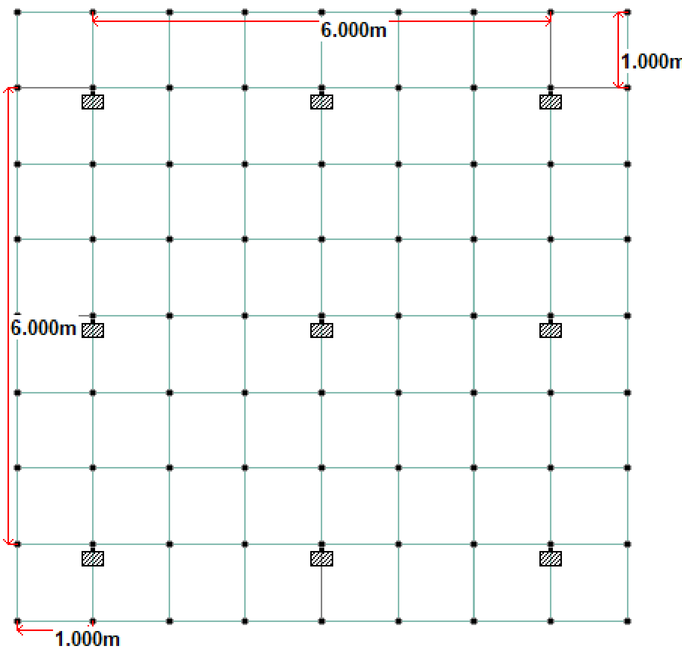
Elevated steel rectangular water tank model is used with the capacity of 172 kilo liter, which is mounted on a steel frame structure on the height of 12 meter supported by 9 columns in the vertical direction. The structure is made on a medium soil. The grade of steel is fe415. The static seismic analysis is done in seismic zone 4 and 5 in staad pro v8i sss6.

ELEVATED RECTANGULAR STEEL WATER TANK

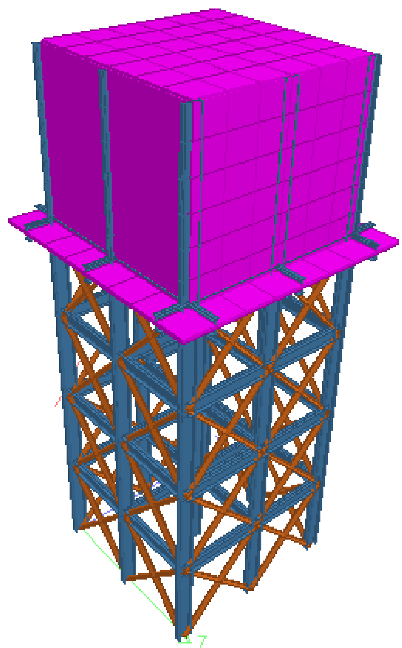
SIZE OF TANK	DIMENSION
Size of bracing	ISA 150*150*20
No. of bracing	24
No. of bracing level	4
No. of column	9
Size of column	IW450350*016
Size of beam	IW400300*016
No. of beam	8
Size of peak slab	0.12
Depth of wall	0.12



Elevation



Top View



3D view

Methodology

This method involves selecting the category of water tank and selection the dimensions of the section and done static seismic analysis by using IITK guidelines and IS 1893-2002 part 2.

Capacity of the tank

Volume of rectangular tank = L*B*H

= (6 * 6 *5) Meter

= 180m^3

Then volume of tank is 180 kilo liter

According to IITK guidelines allow a free board of 150mm

Then the height of water in which water is filled

= 5000-150

= 4850mm

Capacity of tank = (6*6*4.8) Meter

= 172 m^3

= 1,72,000 liter

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Live load

Consider live load is 1.5KN/m² on the top of the rectangular for the maintenance work.

Seismic load

Importance factor, field factor and seismic load are the factor which can decrease reaction factor. In zone 4 physical factor Z is 0.24 and in zone 5 physical factor Z is 0.36.

Water tank is an important structure that is why importance factor I is 1.5.

Response reduction factor R is 2.5. According to IITK guidelines Damping is 2% in steelstructure that is why damping coefficient is 0.02. And structure made on medium type of soil.

RESULT

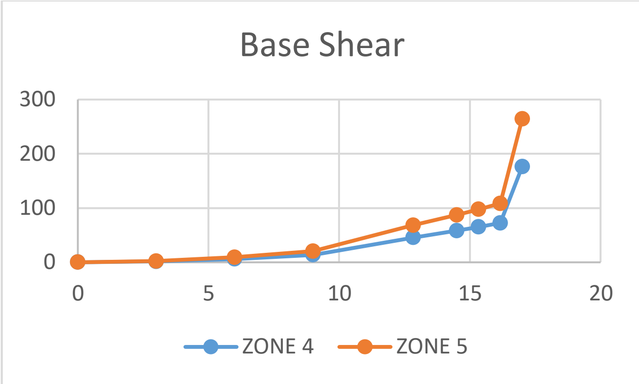
The various results are obtained by analysis of a model in zone 4 and zone 5. These results are written in graphical or tabular form in order to understand easily.

Base shear

At the base the base shear is always zero and it is directly proportional to the weight of the structure. Base shear is increases when the height of structure. And the maximum value of base shear is on the top of the tank.

The height of the tank is in meter and value in zone 4 and zone 5 are in KN

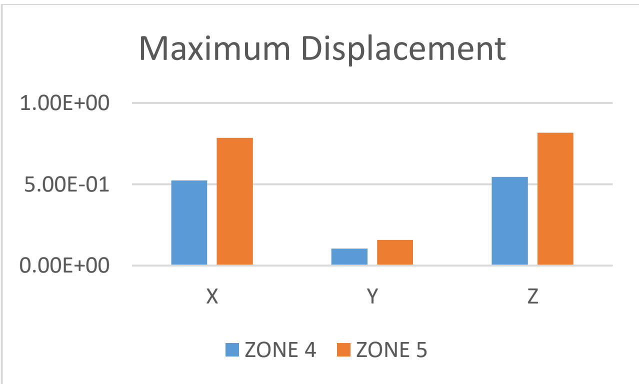
HEIGHT(M)	ZONE 4	ZONE 5
0	0	0
3	1.525	2.288
6	6.1	9.15
9	13.725	20.588
12.83	45.58	68.38
14.5	58.193	87.289
15.33	65.07	97.616
16.16	72.34	108.516
17	176.18	264.282



MAXIMUM DISPLACEMENT

It is the maximum movement of the structure produced by vibration due to seismic waves. The results are discussed in the form of maximum displacements. All the values are in m in the direction of X, Y and Z.

ZONE	X	Y	Z
ZONE 4	5.24E-01	1.05E-01	5.45E-01
ZONE 5	7.86E-01	1.58E-01	8.18E-01



CONCLUSION

- At the top of water tank base shear of zone 5 is approx. 1.5 times as base shear of zone 4.
- Displacement is more in seismic zone 5 as compared to zone 4.
- The value of time period is independent of seismic zones that is why time period is same in zone 4 and zone 5.
- The displacement obtained by zone 5 is much higher than zone 2
- The base shear increases with the height of structure and is highest in the top of zone 5.

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