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Behaviour of R.C. Elevated Water Tank by Staad - Pro

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Abstract: ***Water tank is a structure used to store water for supplying to household 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. In this paper, we had discussed about the design of water tank of elevated water tank of circular shape are designed and analysed using staad pro. From the analysis result concluding about the influence of shape factor in design loads and how shapes of tanks play predominant and in the design and in stress distribution and overall economy.***
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 weigh of water and tank floor slab thickness, as design elevated tank, considering the total tank that are tank capacity, width and length.to considering dead load, live load, seismic load, hydrostatic pressure. A computer program has been developed to solve numerical examples. The project is strictly in accordance with IS code 456:2000 and IS 3386:1987 and load calculation are done using STAAD Pro and manual calculation are done through data. The aim of the project is to apply seismic loading for different zones and assess the varying steel and concrete in seismic zones.
Keywords: ***Water tank, staging system, staad pro, structural design and analysis, loading application, soil condition, shear force, shear moment, displacement.***

I. INTRODUCTION

A. Structural Approach of water Tank

For the elements of every society need five important things to survive in the world that are food, water, shelter, energy and education. The water is the only things behind life of living things on earth. The water is extensively used by societies and these societies uses storage reservoir. Thus in the community the tanks are available with different storage capacity and shapes. The municipality uses concrete long life water tank to provide water to public and industries. The municipality builds overhead concrete water tanks based on population and gravitational force to provide water supply for longer distance with constant flow. The storage reservoirs tank usually designed with different parameters and characteristics with respect to the Category of liquid. While designing and implementation of tank it becomes prime requirement to take care of leakages. It is found that petroleum product such as petrol; diesel, kerosene etc. usually get leak through concrete tank therefore such tank required special care for leakages. Thus special leakage preventing sheets are used inside the petroleum concrete tanks. The peoples also use the underground tanks for water storage by considering foundation with soil conditions. At petrol pumps the tank with special care are build under earth surface to store petroleum products useful for vehicles.

II. OBJECTIVES

A. Analysis & design of elevated water tank with the reference of IS 3370-2009.
B. To prepare model of elevated water tank using software STAAD- PRO.
C. To study effect of height on the seismic performance of elevated water tank.
D. To study effect of variation of earthquake / seismic zones.
E. To study effect of variation of soil type/condition

III. DESIGNING OF WATER TANK

A. Designing of Water tank involved following parts

1) Manual design of the RC elevated water tank
2) Study of seismic behavior of R.C elevated water tank with following variations.

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a) Manually design of the RC elevated water tank includes the following components:

- Top dome
- Top ring beam
- Tank wall
- Base slab
- Bottom ring beam

b) This report describe designing of RC elevated water tank with following input data

- Tank capacity = 4.5 lakh
- Diameter Of tank = 12m (assume)
- Height Of tank = 4m

B. Cases considered for overhead tanks for various parameters:

1) Base Shear

2) Base Moment

3) Displacement

4) Time Period

a) Case 1: Considering Seismic zone

- *A*: Zone II → Soil type – medium & height – 4.0 m
- *B*: Zone III → Soil type – medium & height – 4.0 m Case 2: Considering Soil Condition
- *A:* Soft Soil → zone III & height – 4.0 m
- *B:* Medium Soil → zone III & height – 4.0 m
- *C:* Hard Soil → zone III & height – 4.0 m Case 3: Considering Height of Staging
- *A:* height – 3.0 m → zone III & Soil type – medium
- *B:* height – 3.5 m → zone III & Soil type – medium
- *C:* height – 4.0 m → zone III & Soil type – medium

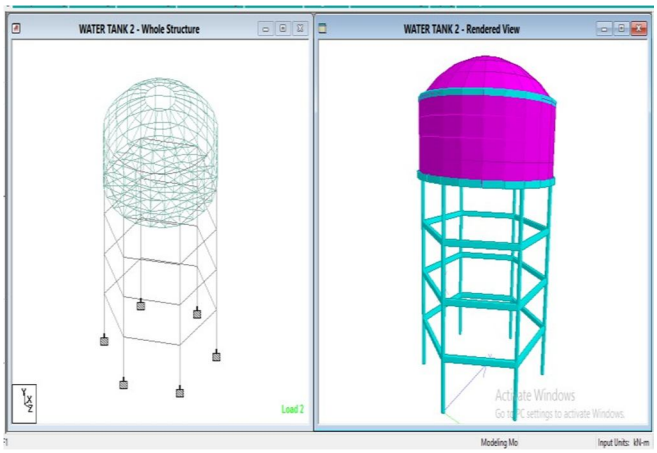


Fig.2.1 Water tank whole structure & rendered view

[source: STADD-PRO]

IV. MODELLING AND ANALYSIS

Response spectrum method is carried out for two seismic zone. Seismic load parameter are considered as per (IS: 1893 (Part-1): 2016), Zone-III and Zone- II

Z= 0.16 for Zone-III & Z= 0.1 for Zone-II Soil Type Hard, Medium and Soft

Important factor I= 1.5 & Response Reduction Factor R = 5

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V. DATA CONSIDERED

Type of water tank = Circular Elevated
Diameter of tank = 12.0 m
Height of top dome = 2.4 m
Height of Cylindrical Portion = 4.0 m
Diameter of Opening at top= 3.290 m
Thickness of Wall = 0.2 m
Thickness of Base slab = 0.35 m
Size of bottom Ring Beam = 0.6 X 0.3 m
Height of column above plinth (h) = 16.0 m

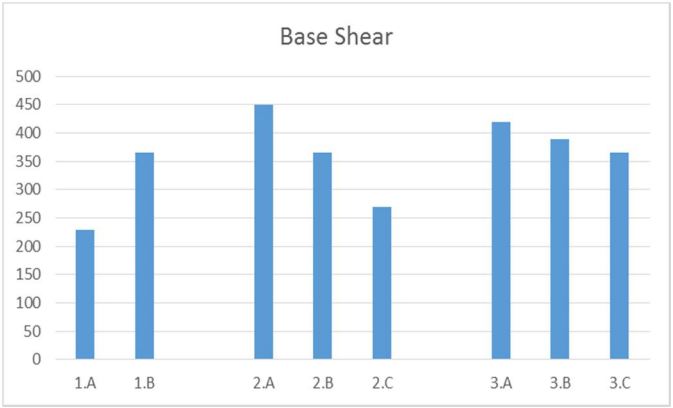
VI. RESULT

	Cases			Base shear	Base Moment	Time Period	Displacement
	Zone	Soil	height				
1.A	II	Medium	4	228.9	3652	3.67	94.603
1.B	III	Medium	4	365.75	5835.3	3.67	151.161
2.A	III	Soft	4	449.24	7215.59	3.67	186.916
2.B	III	Medium	4	365.75	5835.3	3.67	151.161
2.C	III	Hard	4	268.5	4213.81	3.67	109.306
3.A	III	Medium	3	418.8	5154.69	2.54	85.159
3.B	III	Medium	3.5	389.87	5518.83	3.09	116.232
3.C	III	Medium	4	365.75	5835.3	3.67	151.161

Fig.2.2 Result chart

A. Graphical representation of Result

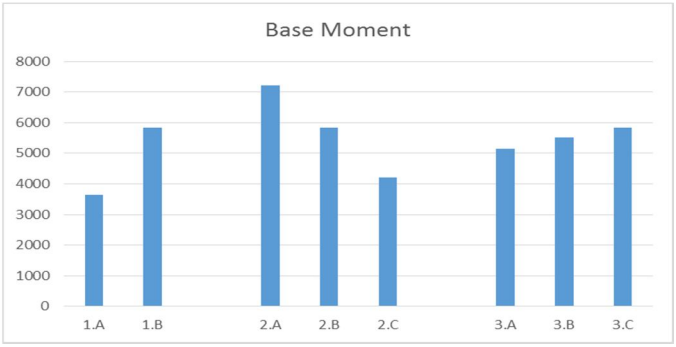
1) Base Shear



Maximum base shear is seen at the Case 2.A, this case includes soft soil and staging height of 4m in zone III. Water tank is safer for least base shear in Case 1.A, this case includes medium soil and staging height of 4m in zone II.

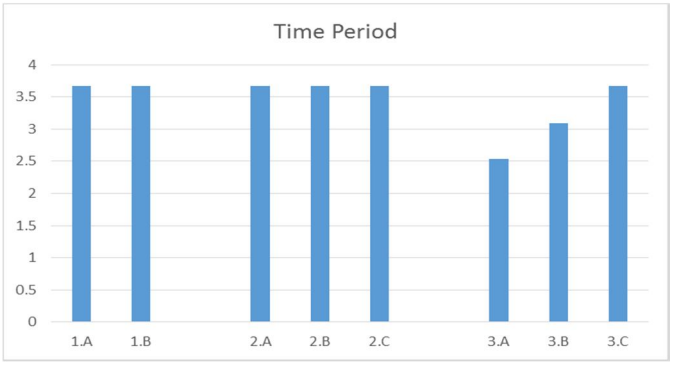
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2) Base Moment



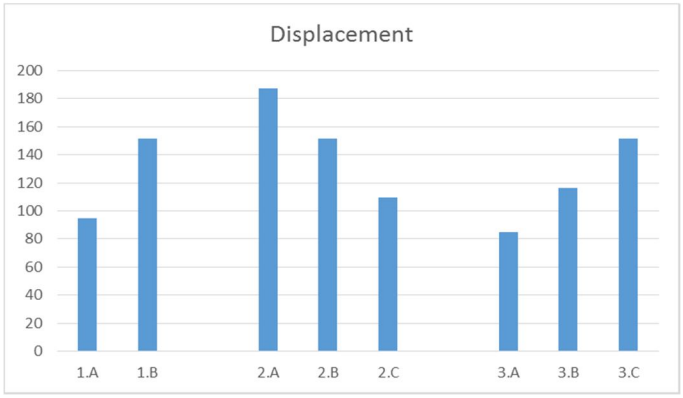
Maximum base moment occurs at Case 2.A.This case includes soft soil and staging height of 4m in zone III. Least base moment is at Case 1.A, this case includes medium soil and staging height of 4m in zone II.

3) Time Period



Maximum time period occurs at Case 1.A, Case1.B, Case 2.A, Case 2.B, Case 2.C, Case 3.C. This case includes soft soil and staging height of 4m in. Least time period700+ is at Case 3.A, this case includes medium soil and staging height of 3m.

4) Displacement



Maximum base moment occurs at Case 2.A.This case includes soft soil and staging height of 4m in zone III. Least base shear is at Case 3.A, this case includes medium soil and staging height of 3m in zone III.

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VII. CONCLUSION

Depending on the number of topics, this topic number may change from 5 to something else. Briefly explain the summary of your project here.
It is observe that:

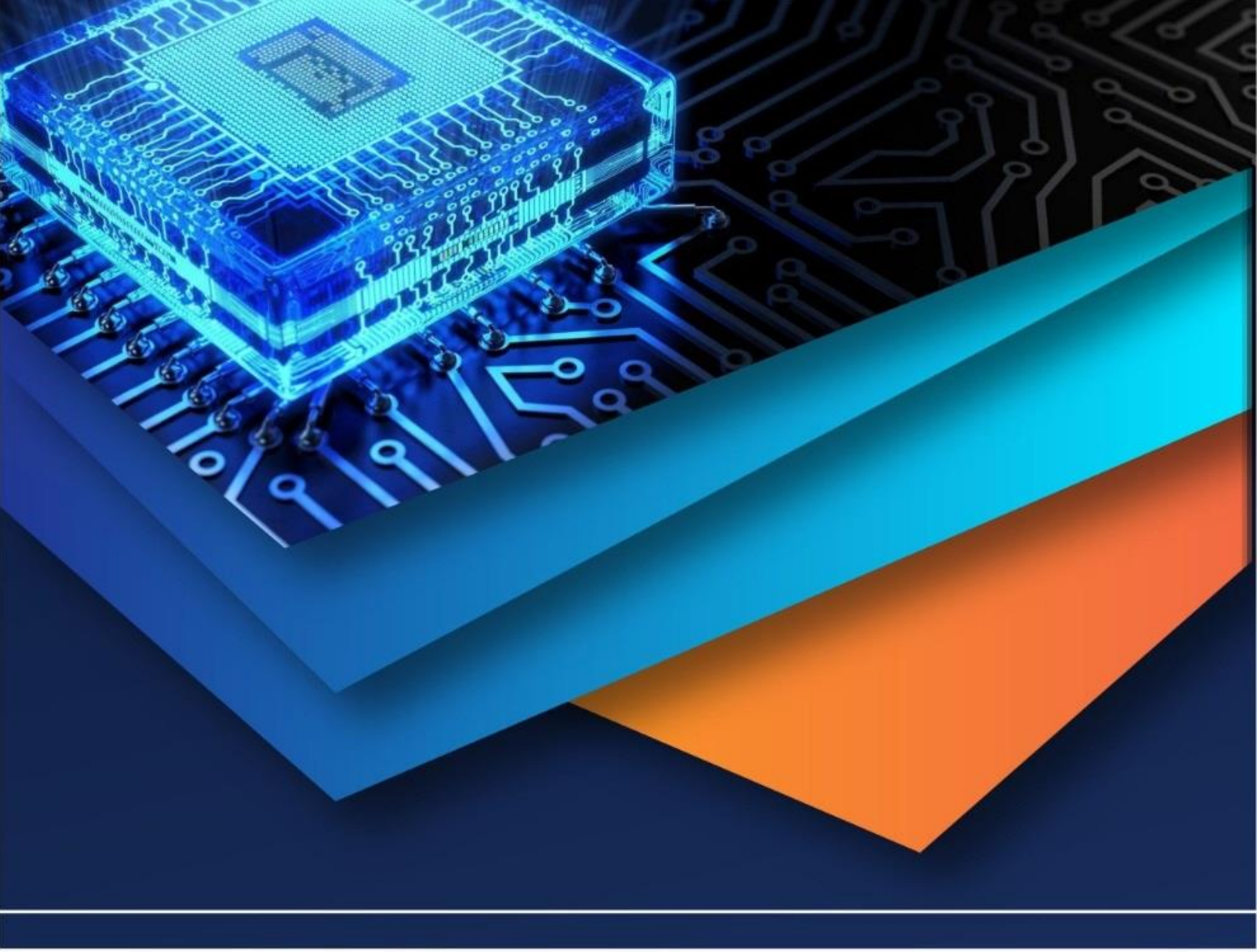
A. Base shear and base moment is maximum in soft soil.
B. Time period is maximum in all the cases having 4m staging height.
C. Displacement is more in soft soil and lesser staging height.

From the above tables and graphs it can be concluded that one has to accept that as we Increase the number of stages the base shear and base moment get increased. Also for same thank if we increase zone from zone 2 to zone 3 there is increase in base shear and base moment and it is maximum in zone 3.
Also displacement increases in soft soil and hence proper hard strata is essential for the safety of water tank.

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