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Modeling & Analysis of Elevated Water Tanks using Response Spectrum Method by Staad Pro. Software

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ABSTRACT

In this, we have used STAAD. Pro V8i software which is based on the application of Finite Element Method. This software is a widely used in the field of structural design and analysis. Then Models are analyzed for dead load, water load and seismic load. Dead load was designed according to IS: 875-1987(Part 1), Seismic load was designed using response spectrum method for earthquake zone III of India using IS: 1903-2002. Study on the modeling and analysis of water tanks Understand the design procedure for liquid storing structures in accordance with the IS-codes & Gain knowledge about the analysis viewpoint for economical and safe water tank design. Study the behavior of Moment, shear force, axial load on column, water pressure on walls, volume of steel and volume of concrete seismic zone and various loading conditions.

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INTRODUCTION

Water tanks are very important components of lifeline. They are very much critical elements in community water supply, firefighting systems and in many industrial facilities for storage of water. A RCC concrete tank is a useful structure which is meant for the storage of water, for swimming bath, sewage sedimentation and for such similar purposes. RCC overhead water tanks are used to store and supply safe drinking water. With the rapid speed of urbanization, demand for drinking water has increased by many folds. Also, due to shortage of electricity, it is not possible to supply water through pumps at peak hours. In such situations overhead water tanks become an indispensable part of life. As we know that trend for water demand is increasing in coming years.

Objectives

- To study Analysis and Design of Water tank under Climatic designed according to IS: 875-1987(Part 1)

RESULTS

COMPARISON BETWEEN RECTANGULAR AND CIRCULAR WATER TANK ON FOLLOWING BASIS

MOMENT

Table 1 Maximum moment on Rectangular Water Tank

			Horizontal	Vertical	Horizontal	Moment		
	Node	L/C	FxkN	FykN	FzkN	Mx N-m	My N-m	Mz N-m
Max Fx	1	3 DEAD	0.233	217.15	0.233	231.894	0	-231.89
Min Fx	8	3 DEAD	-0.233	217.15	-0.233	-231.89	0	231.893

Max Fy	5	5WATER LOAD	0	370.66	0.005	26.193	0	0
Min Fy	1	3 DEAD	0.233	217.15	0.233	231.894	0	-231.89
Max Fz	1	3 DEAD	0.233	217.15	0.233	231.894	0	-231.89
Min Fz	8	3 DEAD	-0.233	217.15	-0.233	-231.89	0	231.893
Max Mx	1	3 DEAD	0.233	217.15	0.233	231.894	0	-231.89
Min Mx	3	3 DEAD	0.233	217.15	-0.233	-231.89	0	-231.89
Max My	2	5 WATER LOAD	-0.005	370.66	0	0	0	26.193
Min My	4	5 WATER LOAD	0	370.66	-0.005	-26.193	0	0
Max Mz	6	3 DEAD	-0.233	217.15	0.233	231.894	0	231.893
Min Mz	1	3 DEAD	0.233	217.15	0.233	231.894	0	-231.89

Table 2 Maximum moment on Circular elevated water tank

			Horizontal	Vertical	Horizontal	Moment		
	Node	L/C	FxkN	FykN	FzkN	Mx N-m	My N-m	Mz N-m
Max Fx	4	13	14.562	321.522	0.843	952.338	260.746	-25356.7
Min Fx	4	15	-14.482	174.021	-1.347	-1463.04	- 260.744	25275.72
Max Fy	6	4	1.922	850.522	-6.565	-13377	2.38	-1920.49
Min Fy	1	1 EQX	-4.794	-49.243	-0.047	-554.279	- 169.437	11433.02
Max Fz	8	18	-1.347	174.021	14.482	25275.72	- 260.744	1463.038
Min Fz	8	7	1.153	625.125	-18.94	-33025.8	211.828	-1230.13
Max Mx	8	18	-1.347	174.021	14.482	25275.72	- 260.744	1463.038
Min Mx	8	7	1.153	625.125	-18.94	-33025.8	211.828	-1230.13
Max My	8	12	0.843	321.522	-14.562	-25356.7	260.746	-952.338
Min My	4	15	-14.482	174.021	-1.347	-1463.04	- 260.744	25275.72
Max Mz	4	15	-14.482	174.021	-1.347	-1463.04	- 260.744	25275.72
Min Mz	4	13	14.562	321.522	0.843	952.338	260.746	-25356.7

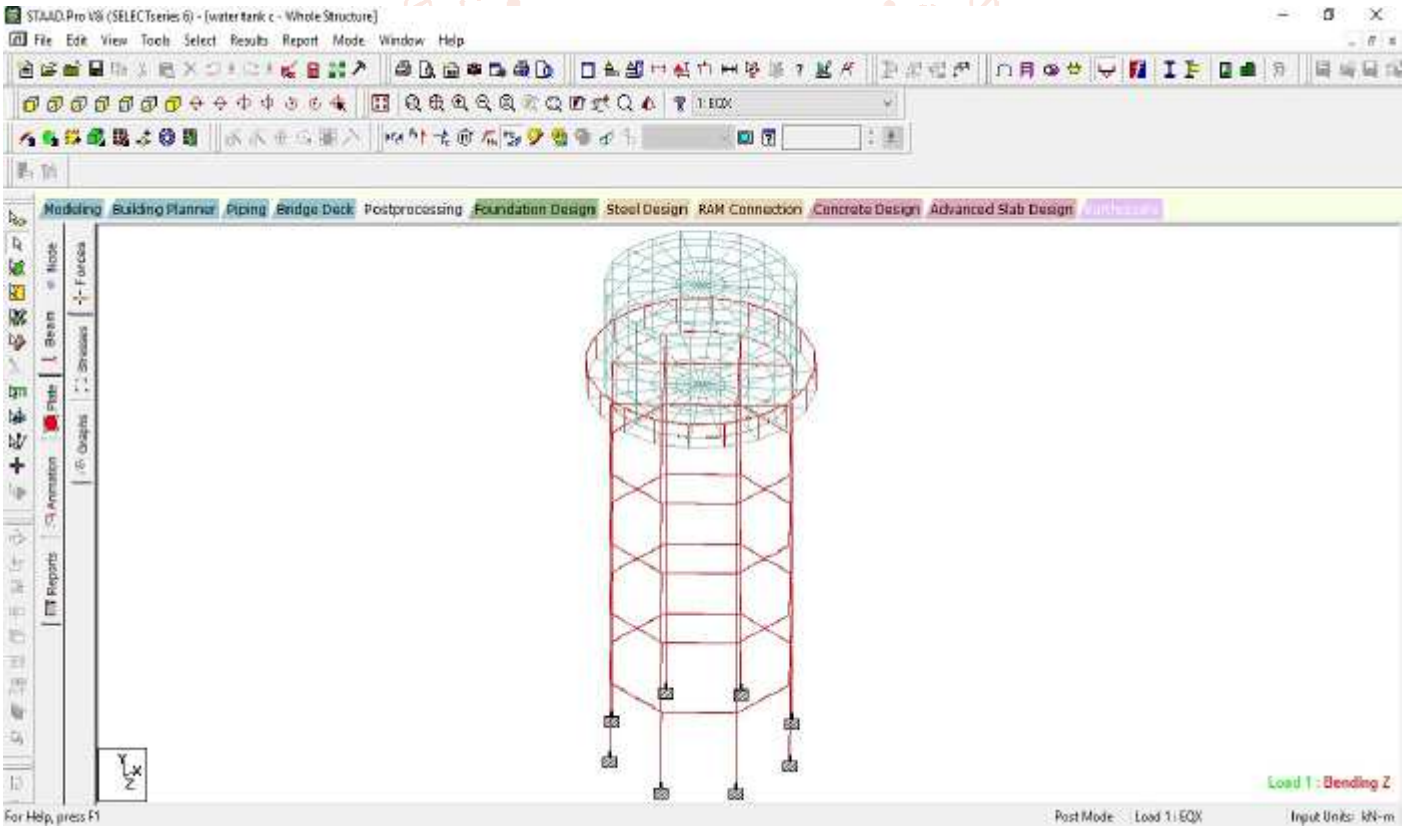

Fig 1 Maximum Bending Moment on Circular elevated water tank

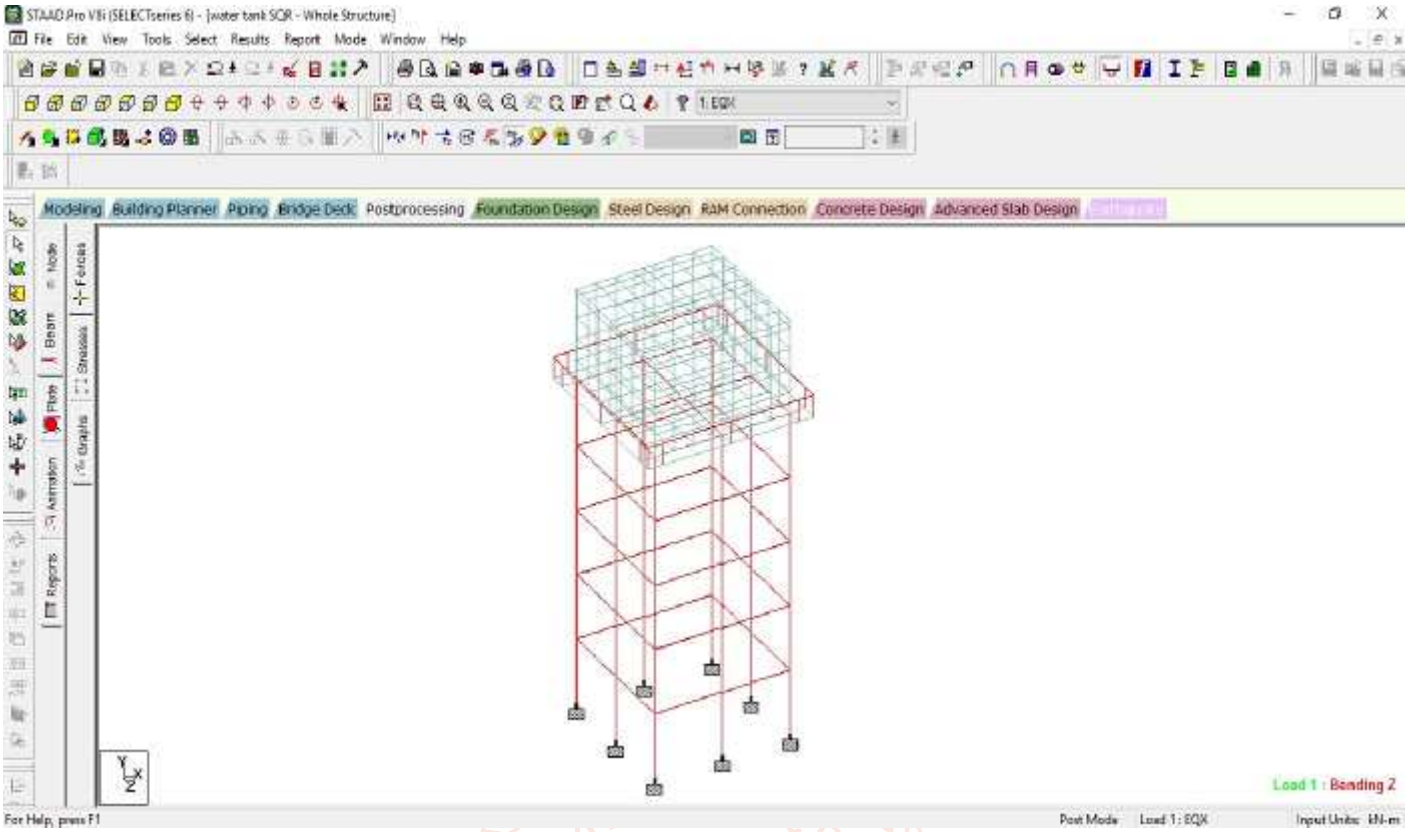

Fig 2 Maximum Bending Moment on rectangular elevated water tank

Conclusion-

- There is major difference in steel used. Steel for circular water tank is 1977.8 Kg and for Rectangular tank is 2428.0 kg. It causes more expenses compare to circular water tank.
- There are more chances of corner failure in Rectangular water tank. Also, may cause leakage from corner.

In circular column the ring beam is not straight and hence there is much moment seen comparison to straight ring beam on Rectangular water tank.

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