



Analysis of elevated water tank by considering slab wall and capacity in seismic Zones

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KEYWORDS

Concrete, Elevated Water tank, Shear Stress, Base Slabs, Seismic Zones.

ABSTRACT

Elevated water tanks subjected to dynamic loads supported on RC framed structure and concrete shaft structure with varying capacity and located in different seismic zones. The history of the earthquake demonstrates that it has inflicted numerous losses to the life of people in its active time. Also, post-earthquake time had made people suffer owing to damages caused to the public utility services. In urban or rural locations, elevated water tanks are a crucial element of the water supply infrastructure, thus their operation pre- and post-earthquake remains equally important. To determine out which raised water tanks' structural parts operate in the presence of wind, researchers used a large-scale computer simulation. These buildings are particularly sensitive to horizontal wind pressures because of the considerable mass concentrated at the top of the narrow supporting structure. The structural parts of the elevated water tank have been subjected to rigorous computational testing in order to establish how well they function when subjected to wind loads. These structures are particularly sensitive to horizontal wind pressures because of the considerable mass concentrated at the top of the small supporting structure. Four raised water tanks were modeled using finite element analysis and examined in the cloud. An axial load variation investigation of the columns with various staging heights will be conducted after completion of the analysis. Results from this research will help us better understand raised water tanks and how to construct them so that they can withstand wind loads. Elevated water tanks in high susceptibility to an earthquake are one of the greatest structures of support system. These structures have a large concentration on slender support structures and are at risk of horizontal forces due to the earthquake in specific. They are essential elements in municipal water deliver hearth combating structures and in many commercial centres for garage of water. Hence increased water tanks ought to continue to be functional even after the earthquake. In this study guide seismic analysis of improved square water tank is achieved according with IS: 1893-1984 (i.e. Lumped mass version) and IS: 1893-2002 (Part-2) draft code (i.e. Two mass version). The structures are analysed with

INTRODUCTION

The elevated water tanks are mostly damaged during earthquake. Because water tanks contain a huge load on their top portion and their safety performance is critical in earthquakes. They must not fail during earthquake to provide of drinking water to the society. Severely damaged water tank in past earthquake due to lack of design efficiency. reported that the dominant failure of water tank is due to earthquake forces. Tanks are the containers used to store crucial liquids and other important items, such as grains, which is why water is so important to human life. Because of this, the volume of the tank is also important. For liquid storage, there are a variety of tanks that can be found in practice, such as those that are either elevated or submerged in water. Among the various types of tanks, elevated tanks are the most important because of their high tank capacity and their ability to meet demand from the public or industry. [1]. Water tanks play an important part in public utility and industrial structures, as they are essential for providing a steady flow of water over an extended distance with appropriate static head Reservoirs that hold water and other liquids are located on the ground and in the air. Reservoirs and tanks have a similar force analysis regardless of the chemical composition of the product. To prevent leaks, all tanks are constructed with no cracks or crevices. If the reinforcement is well maintained, reinforced concrete can be used to build walls and slabs for the storage of water or petroleum products. [2] A additional treatment is needed on the concrete surface since water and petroleum react with it. Concrete tanks can be used to collect and handle industrial waste, with a few exceptions. Special membranes must be installed in tanks to prevent leakage of petroleum products such as diesel fuel. Structures used for liquid storage are commonly called reservoirs. They can be located above or below ground. Generally, reservoirs built below ground level are designed to hold a considerable amount of water at a given time. However, overhead distribution systems are often lower in size because they rely on gravity to distribute products. The process comprises the simulation of a 100mm³-liter water tank. These overhead water tanks are analyzed at staging heights of 15, 18, 21, and 24, accordingly. I'm

observing a wind speed of 44 m/s. It is done using the Staad.Pro software for wind load dynamic analysis. The design of the water tank must be able to endure earthquake loads, which increases as the seismic zones increase.

II METHODOLOGY

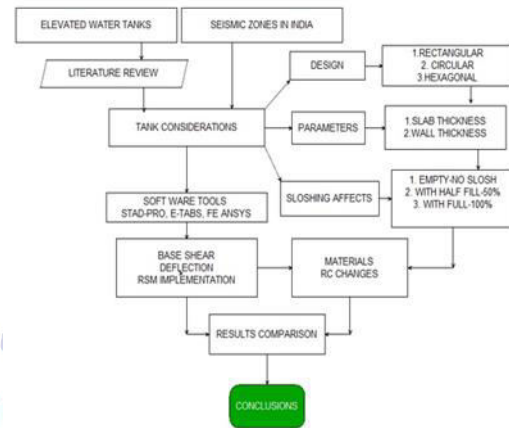


Figure: Research flow chart

III RESULTS AND DISCUSSIONS

An earthquake response spectrum analysis is based on factors such as zone factor, significance factor, response reduction factor, and response reduction factor, among others. Seismic zones II and V are defined by IS Code 1893:2002 as having zone factors of 0.10 and 0.36, respectively. Tanks used to hold drinking water, non-volatile materials, low-inflammable petrochemicals, etc., are assigned a factor of 1.5. The type of frame utilized affects the response reduction factor. Moment-resisting response is thought to be reduced by 1.8 for frames that are not ductile designed. It is utilized in zone II. It is utilized in zone V for frames that have ductile detailing, which means they have a unique moment-resistance response reduction of 2.5.

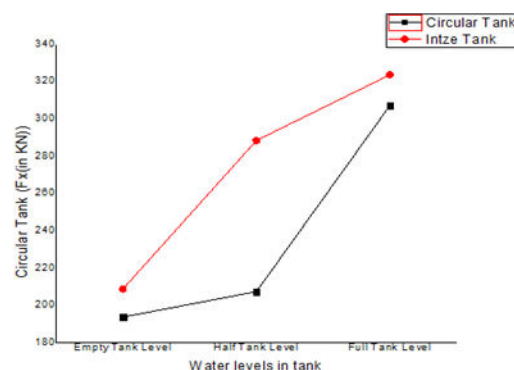


Chart: Base shear values for circular tank and H- intake

Tanking zone

Table: Base Shear Values for Zone II

Base Shear Values for Zone- II,		
Water level sin tank	Circular Tank	H- intake Tank
	Fx(inKN)	Fx (inKN)
Empty Tank Level	75.31	81.15
Half Tank Level	81.13	112.17
Full Tank Level	98.14	125.88

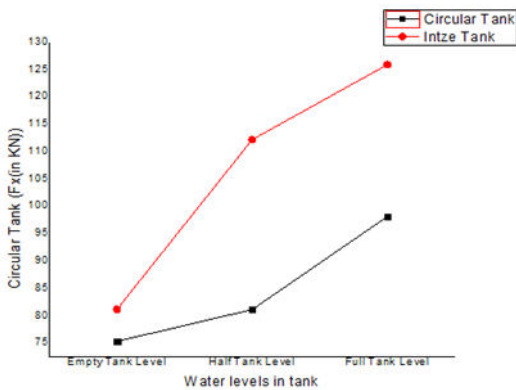


Chart: Bases hear values for circular tank and H- intake tank in zone II

A. Nodal Displacement:

For circular and H-intake models at various water levels, response spectrum analysis from the staad.pro software under seismic zones II and V produces displacement data.

Table: Displace mint sin circular tank in zone V

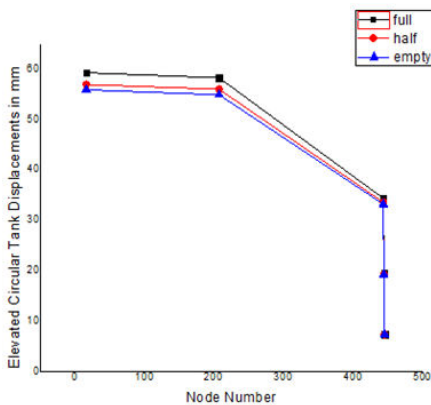


Table: Displace mint sin circular tank in zone II

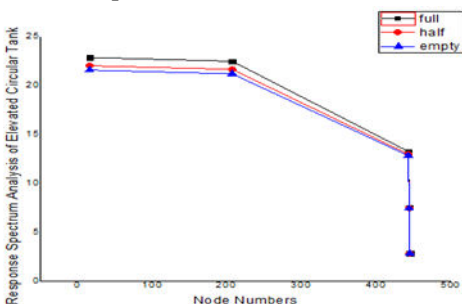
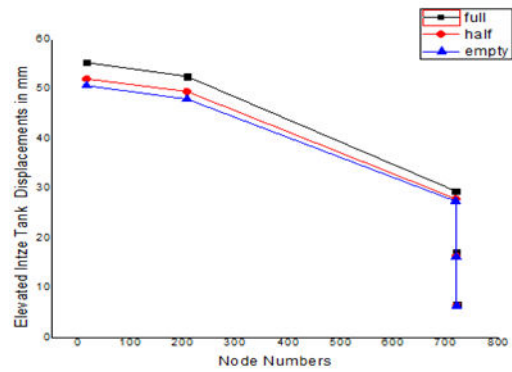


Table: Displacement sin Intake tank in zone



Fineness modulus = 705.56 / 100 = 7.05

3.1.3 FINE AGGREGATE

Locally accessible River Sand confirming to IS: 383 was utilized as Fine Aggregate. The Physical properties of Fine Aggregate were explored. The details are given on Table 3.2 and Table 3.4.

IV TEST RESULTS

As mentioned earlier in section 3.5 the details of Permeability test, the Results and Analysis of Test are talked about in this section. The permeability test was done on different Mix Cases of Micro Silica and Steel Fibers as describe in Table 3.7. To determine the Coefficient of Permeability, the quantity of water percolating, Area of Specimen, time for which permeability test was done, pressure head and thickness of specimen were observed

Graph: Response Spectrum Analysis of Elevated H-intake Tank

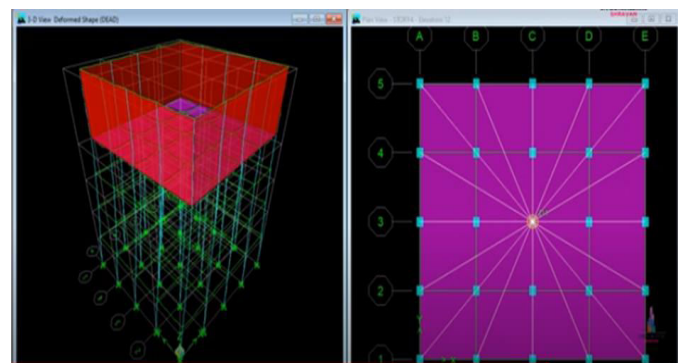


Figure: shows different gravitational conditions with full tank loading on frame with seismic addition for 100mm slab

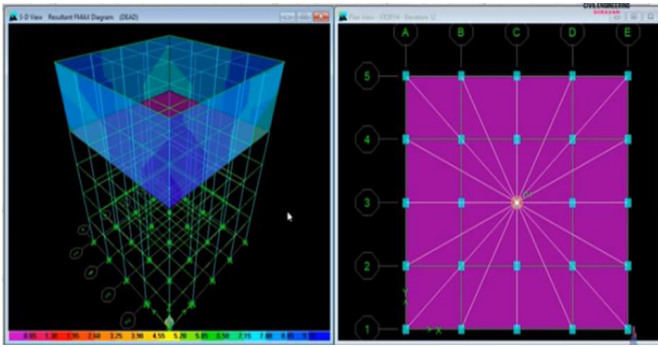


Figure: shows different gravitational conditions with full tank loading on frame with seismic addition for 200 mm slab

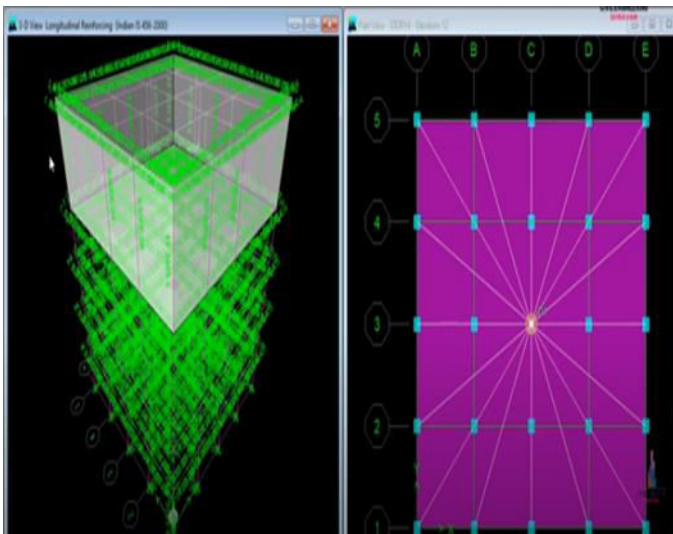


Figure: shows different gravitational conditions with full tank loading on frame with seismic addition for 200 mm slab response load

V CONCLUSION

Many good innovations and developments have been produced for the capacity of water in various designs and forms for water tanks, which are highly significant for open utility and modern structure. The following are the results of the Seismic Analysis of the Elevated Water Tank:

1. Because of the zone factor, response reduction factor, etc., the base shear of a full water tank and an empty water tank are both increased in seismic zone II-V.
2. Base shear in perfect working order the tank is slightly higher than an empty tank because to pressure difference or the absence of water.
3. Because of the zone factor, response reduction factor, etc., the displacement of a full water tank and an empty water tank are enhanced in seismic zones II-V.
4. When the tank is full, the wall of the tank has the maximum and smallest nodal deformations.

5. Comprehensive and empty water tanks are subjected to higher shear and bending moments due to the zone factor, response reduction factor, etc., in seismic analysis.
6. In a full tank, the shear force and bending moment are slightly larger than in an empty tank because of the lack of water or hydrostatic pressure.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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