



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 13, Issue 7, July 2024

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.423

 9940 572 462

 6381 907 438

 ijirset@gmail.com

 www.ijirset.com

Study and Analysis of Elevated Storage Reservoir with Various Staging and Bracing Systems in Seismic Zones

Mr. Nilesh Fulzele, Mr. Indrajeet Singh Chouhan

Student, Department of Civil Engineering, Sushila Devi Bansal College of Engineering, Indore, India

Professor, Department of Civil Engineering, Sushila Devi Bansal College of Engineering, Indore, India

ABSTRACT: Elevated water tanks are essential Civil Engineering framework that is regarded as compulsory community services in a lot of urban areas. Because of storage of clean water, it may be utilized within important needs as drinking in addition to quenching fires. Recently, there's been an elevated interest focused on the seismic protection of lifeline framework like elevated tanks to come down with seismic region. A number of elevated water tanks suffered collapse and damage to the staging of theirs in deep earthquakes, consequently the safety performance of theirs is a crucial concern throughout effective earthquake. Within the existing work, four support patterns viz. easy brace, cross brace, rectangular brace as well as radial brace connected with various staging heights (fifteen m, twenty m, along with twenty-five m) are analyzed for seismic zone II, III and IV for tank wearing empty tank and condition loaded problem. Probably the most affordable as well as secure, Intze style tank of thousand kiloliter capacity continues to be considered. When it comes to the evaluation of Intze container, 72 designs are constructed with STAAD.ProV8i Software, by which 36 models are analyzed for clean out state as well as an additional 36 models are analyzed around tank loaded problem. Each and every seismic zone has 12 models as well as every brace has three distinct staging rises. Different types of lots as well as the combinations of theirs are utilized to each of the tanks as well as reaction spectrum evaluation has become performed. Different parameters are obtained for different brace method for the long time serviceability of theirs, safety and stability.

KEYWORD: Intze container, Earthquake effect, Tank staging with brackets, STAAD.Pro.V8i.

I. INTRODUCTION

Elevated water tanks are among the most crucial public utility constructions because they form an important aspect of the water distribution process. Governing administration of India has to pay the maximum interest to the water source pattern to help make the consuming water readily available for equally urban and rural public. Elevated water tanks are an overhead framework built with an adequate level to pressurize a normal water source process for division of water that is sufficient and it is utilized the place that the ground storage tanks can't be constructed because of not enough adequate natural elevation. Elevated water tanks cause pressure in the outlet of 1psi a 2.31 feet of elevation

1.1 Shape of Elevated Water Tank

The form of elevated water tank is frequently governed by the container of its as well as container governed by the capability. Capacity will be the volume of water which is able to keep between the complete level minimizing degree of supply as the design and style [2]. The shape of the water tank additionally plays a crucial economic role within the overall structure. Probably the most typical form of containers that are put to use i.e. rectangular, circular, conical as well as Intze As per IS: 11682 - 1985, for water storage space capacity of up to 50 m³ rectangular container are chosen. Within the assortment somewhere between 50 m³ to 200 m³ capability circular container as well as for capability above 200 m³ as well as such as 800 m³ the tank might be conical or circular, Intze type [3]. For just about all above capability, we've make use of Intze type container. The Intze type container comprises of a conical dome introduce in between the cylindrical wall structure as well as bottom part dome to be able to decrease the hoop stress within the bottom part ring beam. The primary element of Intze type container is top dome, top ring beam, vertical cylindrical wall structure, center ring beam with balcony, a conical dome, bottom dome, along with bottom ring beam.

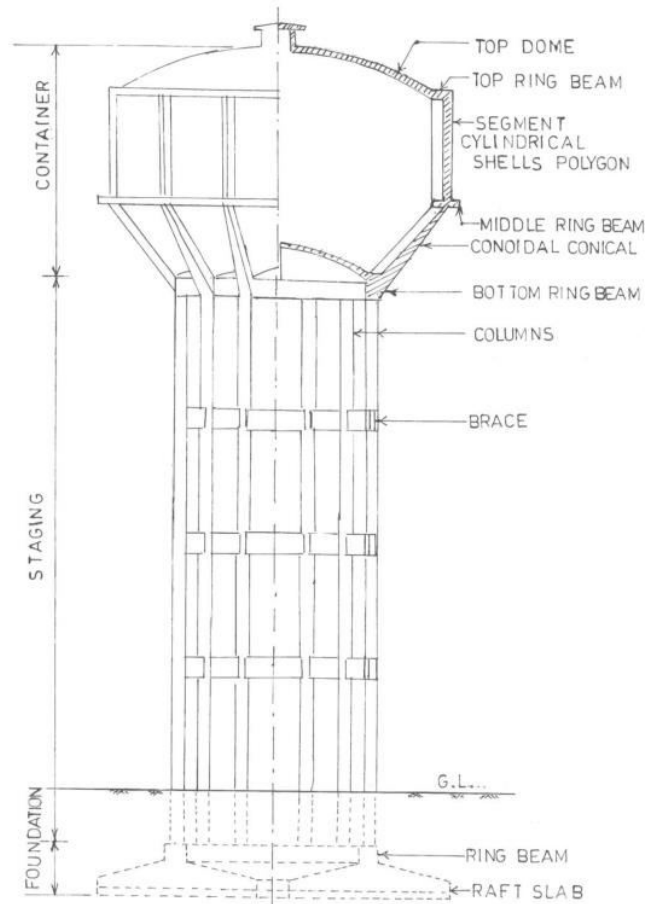


Fig.1.1 Typical information of Intze water tank

1.2 Dynamic Behavior of Elevated Water Tank

The elevated water tank is top heavy structures & consequently the structure could be assumed as an individual degree freedom program. The weight of staging (braces and column) might be sits in the C.G. on the tank, and also the whole load on the pot shall be transferred towards the floor on the tank and that plays a role in every column [4].

Inside tanks, a lot are sustained by the horizontal column and braces. Diagonal braces aren't generally provided. The activity on staging as a result of loads is bending, twist, shear, and axial. Damping becomes varied within the tank because of non-linearity of free and concrete vibrations provide a preliminary quantity of displacement on tanks. Stiffness of staging differs because of the severances of horizontal forces. During rising horizontal brace stiffness, the end result have a consistent distribution of forces i.e. shear and moment .

1.3 Layout of Elevated Water Tank

The affordable size and shape of an elevated water tank are depended on a few purposeful needs like as:

- Tank capacity;
- The optimum level for water;
- Staging heights;
- Number of braces as well as their frame type;
- Allowable bearing capability of foundation;
- Seismic zone as well as Site conditions;

1.4 Problem Statement

Elevated water tanks are prominently in public view and visible from near as well as long distances. They often become landmarks on the landscape [6]. It is therefore important that the shape and form of the container and the supporting structure must receive due attention from the point of aesthetics. Innovations in the shape and form should be encouraged when they improve the ambience and enhance the quality of the environment

II. LITERATURE SURVEY

2.1 General

Elevated water tanks are an essential component of water supply layout within huge cities as well as within the countryside region. Of history years, a selection of elevated water tanks has collapsed in various places across the world because of the diverse dynamics of loadings. Failure of water tanks is definitely an exterminatory threat on property and life. The seismic analysis is important but a lot of complex for strengthening the elevated tanks. This particular chapter deals having a short overview of recent and past research of seismic result on the balance of elevated water tanks

2.2 Review of the Previous Study

Significant research information of previous 43 yrs. is summarizing inside paragraphs. Each paper is discussed with the effective results of it's as well as things that impact the overall performance of elevated water tanks

Tokhi Ajmal et.al (2019) (1) has analyzed the seismic evaluation as well as comparability of overhead intze water tank, circular water tank as well as rectangular water tank as well as getting RCC frame staging in zone III as well as V in the course of unoccupied, 50 % as well as completely loaded state by reaction spectrum technique by using STAAD Pro V8i SS6 software program observing Is actually: 1893 2002 (part one IS1893- and) 2002 (part 2).

Fiore et. al.(2018) (2) this particular papers learn the seismic actions of spherical stress boat that contains butane was examined. A limited component type of spherical container along with a simple single-degree-of independence inverted pendulum design had been applied as well as sloshing consequence as well as soil system interactions are accounted for impact. **Mr. Shivkumar Hallale et al. (2018) (3)** has worked on the subject the Seismic Behaviour of Overhead Circular Water Tank with Shear Wall applying STAAD PRO software program. Throughout the study of his, he thinks radial staging process, the two-fold strut staging process along with a shear wall structure on six sides of the paper while in half filled, complete loaded as well as clean out state together with several height 5m, 10m, as well as 20m.

Jure Radnic et. al (2018) (4) Liquid storage tanks are popular structures in industry. The safety of theirs throughout an earthquake is essential because harm to or maybe the collapse of the components are able to lead to substantial material damage as well as human losses. **Dhanya Johnson & Dr. M. Sirajuddin et.al (2018) (5)** the effective goal on this paper is studying the overall performance of reinforced concrete heightened water tank at less than powerful load. Additionally, the deviation of powerful replies including base shear, overturning time

Prashant A. Bansode et al. (2017) (6) has review the Seismic Analysis of Elevated Water Tank with as well as while not bracing with frame staging. The various forms of bracing are cross bracing as well as diagonal bracing with zone III by reaction spectrum strategy as per Is actually 1893 (Part II) 2014 as well as Seismic a lot are given as per Is actually: 1893:2002 (Part II) applying STAAD Pro V8i 2007 application.

Ayush et al. (2017) (7) has analyzed the Performance research of various Staging Patterns on Elevated Intze Tank experiencing RCC frame as well as shaft staging contained zone IV by reaction spectrum technique as well as the actions of the staging methods are examined as a Is actually 1893 (Part II) 2014 as well as Seismic a lot are given as per Is actually: 1893 (Part I) in STAAD Pro V8i SS6 software for evaluation.

Raj Kumar & Shivaraj Mangalgi et.al (2017) (8) In this particular existing analysis twelve variety of heightened circular as well as Intze water tanks of 2L litres capability supported on RCC frame staging under earthquake loads as per draft code Part II of Is actually 1893: 2002 are believed to be from what six models are Intze sort as well as 6 versions of circular sort. Response spectrum analysis for heightened circular as well as Intze water tanks with

unoccupied, full and half-filled state within seismic zones II as well as V is carried through working with STAAD Pro V8i SS6.

Kamila Kotrasova et.al (2017) (9) Liquid containing tanks are accustomed to keep number of fluids. This particular effort thinks the theoretical history of seismic result of liquid storage space ground supported tanks, i.e. hydrodynamic impact of fluid on good wall structure of rectangular constantly lengthy container repaired to strict base. For numerical evaluation of hydrodynamic pressure was utilized Finite Element Method (FEM).

Shubham Gautam et. al (2017) (10) The reason behind harm on the water tank is a result of not enough expertise concerning staging or even bracing element of the tank that play essential component in the course of earth quake. The staging or even bracing plays a really crucial function that provides a lot more safety and stiffness to framework plus also to manage the storey displacement of the entire framework.

Urmila Ronad et al. (2016) (11) has analyzed the seismic evaluation of circular heightened tank by response spectrum method as well as evaluation by using ETABS 9.7.1. Software program as per is actually 1893:2002. Studies have been completed for frame staging together with the hexagonal strategy during full and empty toilet tank state under smooth, hard soil condition and medium & in zones II, III, IV, and also V with zone element 0.1, 0.24, 0.16, 0.36.

Prasad S. Barve et al. (2015) (12) has analyzed the parametric analysis seismic actions of intze container supported for a shaft to evaluate the outcome of deviation of height/diameter (h/d) ratio of tank pot as well as container capabilities. This particular study is based on Is: 1893 2002 (part 2). Throughout the study of his, the capability of tank contemplated was 500 to thousand m³ as well as height/diameter (h/d) ratio 0.4 to 0.8.

Kaviti Harsha et. al (2015) (13) The goal on this dissertation is usually to shed light on the Intze water tank designed thinking about the earthquake forces based on Indian regular code: 3370 2009 and also draft code 1893 Part two, (2005) thinking about 2 mass modal i.e. convective and impulsive method programs. Intze tank supported on frame staging, Also this particular article contains evaluation by STAAD Pro for wind as well as seismic forces.

Nitesh J Singh & Mohammad Ishtiaque et.al (2015) (14) Most of the designers think about the wind result as well as overlook the seismic impact on the structure. The Indian Standard Code Is actually 875(Part 3) 2003 and it is 1893 2000 for Wind & Seismic outcome is utilized within this specific research. The Elevated Structure is created for different Wind forces i.e. thirty nine m/s, forty four m/s, forty seven m/s & fifty m/s and also the exact same is cross examined with various Seismic Zones.

Neha N. Walde et al. (2015) (15) produced an attempt on the research of seismic evaluation of circular water tank thinking about the impact on period of time. Stiffness examination is carried through working with Sap 2000 at staging level 12m, 21m, 18m, 15m, 24m as well as 27m of zone V owning medium and soft soil quality.

III. RESEARCH METHODOLOGY

3.1 General

This particular chapter works with materials as well as technique that can be used within the existing analysis "Seismic Analysis of Intze Water Tank with different Bracing Configurations." Furthermore, the chapter additionally consists of loading state, a short formula detailing on the subject of the Intze water tank. To handle the analysis, IS: 1893 (Part 2) as well as IS: 11682 1985 has been utilized to evaluation of elevated water tank.

3.2 Categories of Loads

3.2.1 Dead Load

The fixed load and that is usually continuous for just about any structure is known as dead load. If of overhead water tank, dead load has most fixed element for example column, bracing, bottom ring beam, top ring beam, cylindrical walls, top dome, bottom dome weight that required on ground. This weight consumed accordance with IS: 1911 1967.

3.2.2 Imposed Load

When a lot are modifying on an equivalent structure coming from moment to time period, the load is known as enforced or maybe live load. This particular load arises through the planned utilization of occupancy or structure of all of the structure. When it comes to the evaluation as well as design and style function on the structure including living load, IS: 875 (Part 2) - 1987 Indian Standard code employed. For overhead water tank, hydrostatic stress within cylindrical walls what about bottom dome is a result of development of waves in the course of seismic outcome.

3.2.3 Wind Load

In almost any framework, load by the speed of wind and the density of it is known as wind load. In order to fight the result of breeze load, constructions are intended accordance IS: 875 (part 3) - 1987. Throughout examining the stresses, wind load with tank clear and also wind flow load with tank full condition shall be looked at.

3.2.4 Seismic Forces

Seismic forces are one of the primary parts of force each time a system is examined as well as created. As seismic outcome leads to shacking of the ground, therefore the framework on it is able to additionally stay in motion through the base of its.

3.2.5 Load Combination

Different load mixture of elevated water tanks is offered to protect the crucial condition during design and analysis. Is 1893 (part one): 2016 is utilized for load combinations, this particular code deals with effects and loads of loads. In addition, it likewise consists of load combination guidelines. The next load combinations with a suitable factor of safety might be pushed based on Indian standard format.

- 1.2 (DL + IL + EL)
- 1.2 (DL + IL- EL)
- 1.5 (DL + EL)
- 1.5 (DL - EL)
- 0.9 DL + 1.5 EL
- 0.9 DL - 1.5 EL

Where, DL = Dead Load LL=Live Load EL= Earthquake Load

3.3 Parcel and Part of Intze Tank

A container is utilized to storage of water for a lot of uses (drinking clean water, sprinkler system farming, fire suppression etc.). Based on different code provisions we've been performed different element designs

3.4 Materials used for Elevated Water Tanks

In order to make a leak-proof container, a rich and well graded mix having low porosity and high tensile strength is suitable. As per IS: 3370 the minimum grade of concrete required for construction of water tower is M20 for plain concrete, M30 for reinforced cement concrete and M40 for prestressed cement concrete and as per IS: 1786-2008 Fe 415 have been used as reinforcement for water tanks.

3.5 Seismic Analysis Method

Inside India, nearly all almost all of the components in various zones are comprised of RCC that is seismically examined for a regular earthquake. It provides the estimation of reaction produced by the framework in the course of earthquake. System subjected to earthquake is examined by various approaches to seismic evaluation. Within the powerful procedure of earthquake system is put through the specified analysis.

- I. Response Spectrum Analysis.
- II. Time History Analysis.

3.6. Bracing Pattern on Intze Tank

Later tower without brace would've natural balance from pressure used in each course (all three axes; left correct, up down, backward and forward) but there's nothing at all regarding this particular set up which would efficiently avoid bent, rotation, or perhaps twisting around the structure's vertical axis. Therefore the framework requires braces for

supporting them in all of the circumstance. As stated by Is actually: 11682 - 1985 When the level of staging is in excess of 6m previously cosmetic foundation, the column shall require of horizontal bracing. Within this study we're planning to make use of 4 kinds of brace with staging process. Figures indicate the 2 dimensional perspectives of braces in STAAD.ProV8i. as uses.



Fig. 3.1 2D and 3D simple type brace staging model

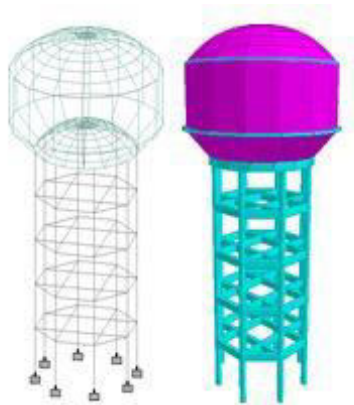


Fig 3.2 2D and 3D cross type brace staging model

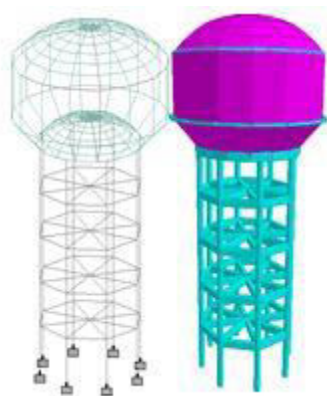


Fig 3.3 -2D and 3D radial type brace staging model



Fig 3.4 2D and 3D rectangular type brace staging model

IV. RESULT AND DISSCUSSION

4.1 General

The chapter works with discussion and results of all of the research of "Seismic Analysis of Intze Water Tank with different Bracing Configurations". The evaluation contains variables for easy, rectangular, radial and cross style braces connected with three distinct staging heights i.e. 15 m, 20 m as well as 25 m within seismic zones II, III and IV. Various tables & charts are indicating the different details as displacement, shear force, axial force, torsion, bending moment as well as foundation shear were drawn.

4.2 Results and Discussion

4.2.1 Displacement

Displacement within elevated water tanks suggests moving of tank element out of the original position of its of stablesness to the next position within the horizontal path. The specified final results present the maximum displacement values get as a result of the evaluation on the water tank which may occur at condition that is extreme. Outcomes are examined about the bases of most tank problems i.e. clean out as well as loaded, with various kinds of braces in staging for several heights that evaluation for seismic zones II, III and IV.

Table 4.1 Displacement values during the empty state of tank in seismic zones II, and III IV

Braces on tank	Height of staging (m)	Maximum Displacement (mm)		
		Zone II	Zone III	Zone IV
Simple brace	15m	14.807	23.391	34.922
	20m	26.287	41.787	62.530
	25m	41.483	66.116	99.031
Rectangular brace	15m	13.891	21.879	32.625
	20m	24.744	39.750	58.550
	25m	38.595	61.449	92.007
Cross brace	15m	14.029	22.094	32.944
	20m	24.595	39.022	58.354
	25m	38.411	61.146	91.546
Radial brace	15m	14.062	22.145	33.018
	20m	24.592	39.015	58.341
	25m	38.327	61.007	91.336

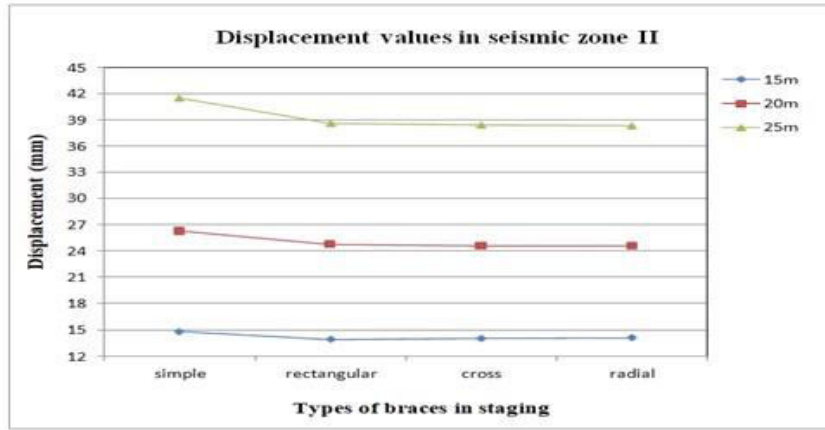


Fig. 4.1 Displacement graph for various kinds of braces in staging during the empty situation of tank in seismic zone II

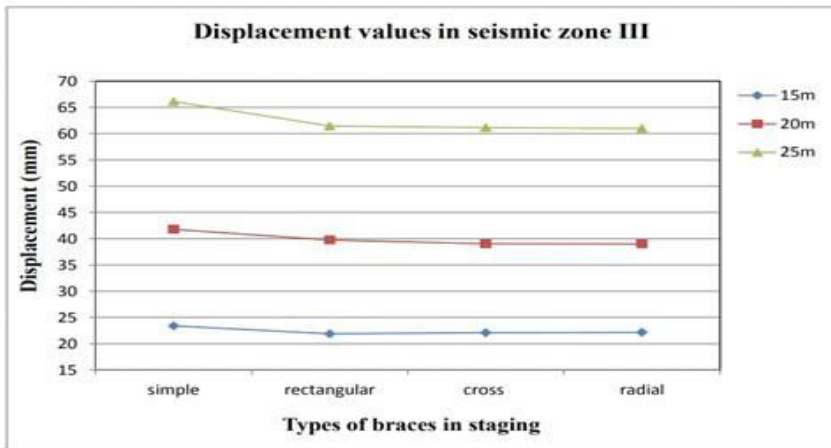


Fig. 4.2 Displacement graph for various kinds of braces in staging during the empty state of tank in seismic zone III

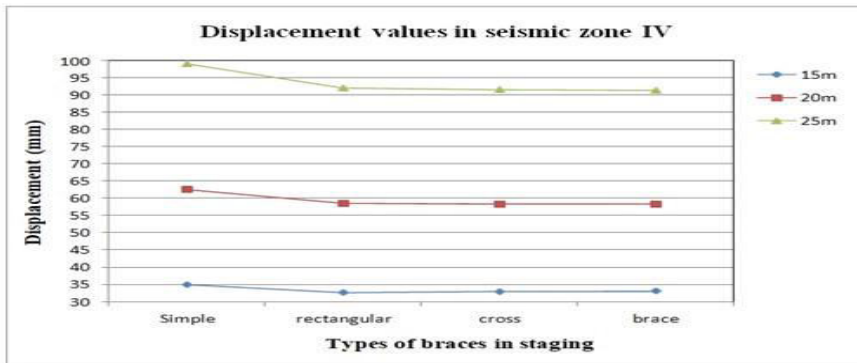


Fig. 4.3 Displacement graph for various kind of braces in staging during the empty situation of tank in seismic zone IV

Table 4.1 reveals the horizontal displacement by tank staging on the time of empty state of tank. Fig. 4.1, 4.2 as well as 4.3 are plotted for seismic zones II, III and IV respectively, in the middle of displacement (mm) as well as kinds of braces in staging for 15 m, 20 m as well as 25 m staging rise. Within seismic zones II, III and IV, the highest horizontal displacement for 15 m staging level is shown through the simple type brace staging and also moves on dwindling for radial category brace staging as well as subsequently for cross category brace staging and also the minimum displacement is shown by rectangular category brace staging. For 20 m as well as 25 m staging heights, the optimum displacement is displayed by basic category brace staging and also moves on dwindling for rectangular category brace staging as well as subsequently for cross category brace minimum value and staging of displacement is shown by radial category brace staging within just about all seismic zones.

V. CONCLUSION

Out of the outcomes as well as conversation provided in chapter 5, we are able to conclude the next areas.

1. All of the analyzed designs have demonstrated a good response for most sorts of loads as well as the combinations of theirs. The designs have conventional action as well as viewed inside a consistent way on the expert system. The analyses of most designs are healthy.
2. For all of the designs, the analysed importance of variables are a smaller amount for reduced seismic zones severeness plus it moves on boosting for increased seismic zones severeness with tank all problem empty as well as loaded. The values are growing relatively as a result of the expansion inside the severeness of seismic zones.
3. Since the level of staging improves, the variables viz. displacement, shear force, axial force, torsion as well as bending moment are increases for equally empty as well as a loaded problem of all of the tank.
4. The tanks lessen base shear within clean out state as when compared with loaded condition. The minimum base shear is within type that is simple brace staging as well as maximum is within radial category brace staging simply because how many beam components are expansion for various brace patters as well as a result of beam components, the weight of tank boost therefor the base shear of tank likewise grow.
5. The displacement great is reduced relatively because of horizontal braces in deep staging. The bracing pattern of staging provides connectivity to columns as well as adds to the balance and also stiffness on the tank staging. The maximum displacement is displayed by basic category brace staging and also the least displacement is shown by radial type brace staging for a number of staging heights within just about all seismic zones i.e. II, III and IV.
6. The axial force has least values to come down with type that is simple brace staging along with the optimum great is within rectangular category brace staging when connected with tank for each unoccupied as well as a loaded state within seismic zones II, III and IV.
7. The maximum importance of shear pressure is displayed by rectangular category support staging and also the importance of least shear force for braces style is shown by radial category brace staging for most staging heights 15 m, 20 m as well as 25 m within just about all seismic zones for equally unoccupied as well as a loaded problem of tank.
8. The optimum importance of torsion in deep staging is bigger for that rectangular category brace staging as well as minimum is perfect for cross category brace staging as well as subsequently for radial category brace staging simply because the beams inside braces style have link with one another plus it lessen the twisting impact of tanks within just about all seismic zones.
9. The bigger importance of bending time is displayed by rectangular category brace staging and also the reduced importance of bending moment is displayed in radial category brace staging for the tank equally loaded as well as clean out state within seismic zones II, III and IV.
10. Rectangular category brace staging has optimum worth for torsion, shear as well as bending and that isn't risk-free as well as a stayed away from within seismic zones II, III and IV.

11. Seismic lots possess some impact in Radial category brace staging for tank and also the replies of staging with radial type brace provide good balance as examine to various other brace staging. Consequently, it is able to reduce the risks of collapse on the water container within seismic zones II, III and IV.

VI. FUTURE-SCOPE

1. Analysis of almost all kind of brace patterns is necessary to work out for wind load problems.
2. The water tank might be analyzed utilizing software obtainable such as SAP, ETABS etc.
3. The evaluation could additionally be completed for that rectangular column in seismic condition and various winds as well as likewise are in contrast to the circular column.
4. Economical developing of water tank with effective bracing might be completed for seismic forces and various wind with such as the foundation.
5. The staging patterns have to evaluate for the different capacity on the tank container and also the variation of benefits might be analyzed.
6. The water tank with vertical braces might additionally be examined of the study of numerous parameters.

REFERENCES

1. Ajmal Tokhi, & Sahil Arora, "Seismic comparison and analysis of overhead intze drinking water container, circular drinking water container as well as rectangular drinking water tank as well as reaction spectrum analysis", International Journal of Civil Technology and Engineering, vol.10, Issue: three March 2019, pp. 2519 2527
2. Fiore, A., Demartino, C., Greco, R., Rago, C., Sulpizio, C., and Vanzi, I. (2018) . Seismic performance of spherical liquid storage tanks: a case study. International Journal of Advanced Structural Engineering, 1-10.
3. Mr. Shivkumar Hallale, Tushar Deshmukh, Swapnil Manjramkar, Riyaj Sayyad & Digvijay Makode, "Seismic Behavior of Overhead Circular Water Tank with Shear Wall applying STAAD PRO", International Journal for Research wearing Science that is applied & Engineering Technology, vol.4 Issue: five, June. 2018, pp. 112 119
4. Jure Radnić, Nikola Grgić, Marina Sunara Kusić & Alen Harapin (2018). Shake dining room table tests of a receptive rectangular drinking water gas tank with h20 sloshing.Elsevier.81 (2018) 97?115
5. Dhanya Johnson & Dr. M. Sirajuddin (2018).Behaviour of Elevated Water Tank under Seismic Load Feedback Overseas Research Journal of Technology and Engineering (IRJET).5(5), 3196 - 3200
6. Prashant A. Bansode & V. P. Datye, "Seismic Analysis of Elevated Water Tank with different Staging Configuration", MAT log, vol.3 Issue: one, Oct. 2018, pp. 01-05
7. Ayush & Dr. Amritpal Singh, "Performance research of different Staging Patterns on Elevated Intze Tank based on Is actually 1893 (Part II) 2014", Journal of Civil and mechanical Engineering, vol.4, Feb. 2018, Issue: 02, pp. 01-11
8. Rajkumar & Shivaraj Mangalgi (2017). Effect Spectrum Analysis of Elevated Circular as well as Intze Water Tank. Overseas Research Journal of Technology. and Engineering four (ten), 214-220
9. Kamila Kotrasová (2017). Research of hydrodynamic strain on wall structure of tank.Elsevier.190 (2017), two six
10. Shubham Gautam, Ashish Yadav & Susanta Kumar Sethy . Seismic Analysis of Intze Water Tank for Different Bottom Dome Deviation Angle & Bracing . Overseas Journal of Advance Engineering as well as Research Development . four (twelve), 411 418
11. Urmila Ronad, Raghu K.S & Guruprasad T.N, "Seismic evaluation of circular heightened tank", International Journal of Research found Technology and Engineering, vol. three Issue: nine, Sept. 2016, pp. 9
12. Prasad S. Barve & Ruchi P. Barve, "Parametric analysis to recognize the seismic actions of intze container supported on shaft", International log of engineering sciences & investigation Technology, vol. four (version seven), Jul. 2015, pp. 161 168
13. Kaviti Harsha, K. S. K Karthik Reddy & Kondepudi Sai Kala (2015).Seismic Analysis as well as Design of INTZE Type Water Tank . Overseas Journal of Science Technology & Engineering. Two (three), 11-24
14. Nitesh J Singh & Mohammad Ishtiyaque (2015) . Style evaluation & comparability of Intze style drinking water toilet tank for various blowing wind quickness as well as seismic zones as per Indian codes. Overseas Journal of Research found Technology. And Engineering four (nine), 291 300
15. Neha N. Walde, Sakshi Manchalwar, Amey Khedikar, "Seismic evaluation of h20 container looking at impact on precious time period", International Journal of Research found Technology and Engineering, vol. four Issue: six, June. 2015, pp. 284 288.

16. Ayazhussain M. Jabar, H. S. Patel “Seismic Behavior of RC Elevated Water Tank Under Different Staging Pattern and Earthquake Characteristics” International Journal of Advanced Engineering Research and Studies , IJAERS/ Vol. I/ Issue III/PP 293-296, April-June,2012.
17. Manish N. Gandhi, Prof. A. Rajan “Necessity of Dynamic Analysis of Elevated Water Storage Using Different Bracing in Staging” International Journal of Research in Advent Technology, Vol. 2, No. 2, PP 1-4, February 2014
18. Raghavendra. G, KeerthiGowda B. S Gururaj M. H “Dynamic Analysis of Overhead Water Tank Under Shaft Staging” International Journal of Advanced Scientific and Technical Research Issue 4, Volume 3, PP 505-511, May-June2014.
19. Keyur Y. Prajapati, Dr. H. S. Patel, Prof. A. R. Darji “Analysis of Hybrid Staging Systems for Elevated Storage Reservoir” Indian Journal of Research Volume: 3, Issue: 6, PP 71-76, June 2014.
20. Bojja. Devadanam, M. K. MV Ratnam, Dr. U. RangaRaju “Effects of Staging Height on the Seismic Performance of RC Elevated Water Tank” International Journal of Innovative Research in Science, Engineering and Technology Vol. 4, Issue 1, PP 18568-18575, January 2015.
21. Mr. Dixitkumar. B. Patel “Response of Overhead Water Tank Staging Considering Fluid-Structure-Soil Interaction” International Journal of Advance Engineering and Research Development Volume3, Issue4, PP 65-79, April-2016.
22. Mor Vyankatesh K. ,More Varsha T. “Comparative Study on Dynamic Analysis of Elevated Water Tank Frame Staging and Concrete Shaft Supported” IOSR Journal of Mechanical and Civil Engineering, Volume14, Issue 1, Ver. 1, PP 38-46, Jan.-Feb. 2017.
23. Sonali M. Pole, Amey R. Khedikar “Seismic Investigation of RC Elevated Water Tank for different Types of Staging Systems” International Journal of Innovative Research in Science, Engineering and Technology Vol. 6, Issue 7, PP 13793-13806, July 2017.
24. A. H. Shrigondekar, G. D. Parulekar, V. R. Kasar “Behaviour of RC Overhead Water Tank Under Different Staging Patterns” International Journal of Engineering Research and Technology, Vol. 6 Issue 04, PP 538-541, April-2017.
25. Mr. Santosh Rathod1, Prof. M. B. Ishwaragol “Analysis of Overhead Water Tank with Different Staging Height and Base Width” International Research Journal of Engineering and Technology Volume:05 Issue:06, PP 471-474, June-2018.



INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  ijirset@gmail.com



www.ijirset.com

Scan to save the contact details