Analysis of Water Tanks Considering Loading Using Analysis Tool: A Review

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Abstract- *In India, mainly Overhead water tanks are used at water supply system. Different materials are used for the construction of water tank but the most common site is a RCC water Tank. Albeit, throughout the timeframe, R.C.C. Structure begins crumbling because of inside and outer causes and along these lines necessity of safe construction emerge. Prior, demolition of existing R.C.C. overhead water tanks happen, trailed by development of new design, which is extravagant and tedious. In this paper we have reviewed articles related to water tank, and tools used for analysis.*

Keywords- Staad.Pro, Axial Force, Storey Displacement, Shear Force, Bending Moment

I. INTRODUCTION

As the term suggests, a water tank is used for storage of water in urban areas for different applications such as drinking, water for household and industrial applications, and for rural use for irrigation, agriculture and farming. Construction of water tank in a general design with various shape, capacity and different choice of materials as per the requirement. As discussed before, different materials are available for preparation of water tanks namely, fiberglass, concrete, stone, steel and highly durable plastics. Such water tanks are most popular in developing cities to meet the needs of water storage. RCC Water tanks are generally designed as per IS IS 3370: 2009 (Parts I – IV) and design rely as per the locations in different forms as elevated , ground water tank and underground storage water tank in different shapes as per the application as circular and rectangular

II. FUNDAMENTAL OF CONCRETE WATER TANK DESIGN

- The mostly used construction material concrete needs additions reinforcement in order to resist tensile stresses.
- Calculation of tensile strength with concrete is not considered in order to guard against structural failure.
- Permissible stresses of steel are used to gain reduced values in any structural design.

III. LITERATURE REVIEW

D. Yuvaraj et.al (2022) research paper analyzed the load-bearing capacity of a steel building with different systems. A 40-story residential building was designed and measured under the wind load conditions. The structural properties of the steel building were investigated using different types of bracing such as X Bracing, Chevron Bracing and V Bracing, and structural analysis was performed using TEKLA software. This analysis assumes wind speed as a zone of 50 m/s.

Based on the real period (sec), it was estimate that the chevron model has the lowest natural period value (sec), which is a more efficient model than other models. Time taken in first mode was based on Chevron braced structure and in other all with respect to braced structure, 61. 00% more without braced, 22. 33% more in K-braced and 3. 83% and more in V-braced structure. Displacement is minimum in Chevron braced structure and in other all with respect to braced structure, 152. 21% more without braced, 49. 89% more in Chevron braced and 14. 02% more in V-braced structure. Based on the Story Drift (mm), it is estimated that the chevron model has the lowest Story Drift value (mm), which is a more efficient model than other models.

K. Senthil Kumar (2022) the research was limited to reinforced concrete (RC) multi-storied commercial building with FOUR different zones II, III, IV & V .The analysis was carried out the help of FEM software ETABS. The building model in the study has ten storeys with constant storey height of 3m. Different values of SEISMIC ZONE FACTOR are taken and their corresponding effects are interpreted in the results.

Results stated that displacement increases by more than 628% if seismic ZONE changes from II to V. The displacement of building models increases with the increasing number of seismic Zones. The displacement was high at the roof and very low at the base. The displacement increased by more than 250% from wind speed 33 m/s to 50 m/s. The displacement of building models increases with the increasing number of seismic Zones. The displacement was high at roof

and very low at the base. The storey drift increases by more than 666% when compare to ZONE II to ZONE V. The storey drift increases with the increasing of seismic zone factor and the maximum storey drift was available at ZONE V. The storey shear increased by more than 238%. The Storey Shear decreased as height of the building increased due to wind pressure and reduced at top floor in all the building models. The storey shear is maximum at the base.

P. Venu Madhav et.al (2022) in the research paper, model was subjected either by one or a set of loads employing several sorts of forces which includes dead load, Imposed load, seismic load, and wind load. The commercial structure was built using ETABS (Extended Three-Dimensional Analysis of Building System) software, this facilitates the generation of much more systematized storeys in a concise manner. Analysis and Design of G+9 Commercial Building using ETABS was done on a step-by-step process for designing this G+9 commercial building, so for this G+9 Storey limit state process has been regarded, along with the design of each and every structural component has been performed manually in full compliance with IS 456: 2000 standards, of drawings and detailing done in Autocad.

Using ETABS software and manually confirmed the design of a G+9 commercial building in accordance with Indian Standard Code Book (IS456). The Extended Three-Dimensional Analysis of Building System programme is superior to other software in terms of efficiency and timeliness.

Abhishek K. Patil et.al (2021) author used Equivalent Static method to analyse G+5 storey structure to repel earthquake forces using Staad pro software. The analysis was performed as per the specification of IS codes IS 1893, IS 875, IS 456:2000. Results stated that the bending moment and shear force of seismic and non-seismic structure is same while there is difference between axial force and displacement.

Anurag Kumar Pandey and Anjali Rai (2021) research paper investigated regular commercial buildings with two different slab arrangements Waffle Slab and Normal conventional slab.

Results stated that maximum story displacement for normal conventional slab was 0.828% higher than flat slab. The maximum time period of normal conventional slab was 0.2% higher than flat slab. The maximum story drift of conventional slab was 0.5% higher than flat/waffle slab. The base shear of flat slab was 26.92% higher than the conventional slab. Instead of having high base shear building was safe in Flat slab.

S. Bhaskar, et. al. (2006), research shows that number of tests should be done to evaluate the degree of destress and to gauge the quality/strength of cement, prior to going to up any maintenance lengths. These tests can be of either Non Destructive Type (NDT) or Partially Destructive Type (PDT). Research further stated, the evaluation of 30 years of age overhead Reinforced Cement Concrete (RCC) supply by NDT and PDT techniques. This paper feature the significance and meaning of various test strategies utilized to evaluate the current state of RCC structure. Concentrate on reasoned that A point by point orderly procedure in leading the condition evaluation of overhead RCC supply. This incorporates visual perception and documentation, ultrasonic testing on segments and support radiates for surveying the uprightness of cement, center examining and testing for assessing the compressive strength and water assimilation. Half-cell potential estimations were likewise done for surveying the presence of consumption movement. The experimental outcomes have been deciphered, lastly evaluated the general substantial quality and trustworthiness. In view of the experimental outcomes, it was observed that the troubling of the supporting construction was for the most part because of voids, honeycombing and carbonation of cement. Fundamental fix measures are recommended to work on the strength and execution of the construction in a subjective way.

AsariFalguni and M.G. Vanza (2012).study shows the behavior of RCC elevated water tank has been studied with using friction damper (FD). For FD system, the main step is to determine the slip load. The obtain results shows that performance of Elevated water tank with FD is better than without FD.Study shows optimum slip load is between 6% to 18% base shear of structure more effective to reduce storey drift acceleration, base shear and time period.From results of Nonlinear time history Analysis; friction damper is significantly reduces the dynamic response of structure in terms of tip acceleration, tower drift base shear and Time period.Using friction damper performance of water tank is better than without FD.Friction damper also improve ductility in structure.

Ettore Faga, et. al. (2012), Study concludes that concentrically Braced Supporting Frames, significant over-sizing, principally due to an overestimation of the actions induced by the earthquake during the preliminary design of the tanks supporting structures. The reason for this overly conservative initial estimate of the internal actions has been mainly related to the use of highly simplified models. In particular, non-linear analyses allow reproducing the buckling behaviour of braces well, which is crucial for the estimate of the column internal actions. The actions on the columns were more severe than predicted by the linear analyses. The

structures designed with the proposed method showed a response similar to that observed for concentrically braced frames designed according to the provisions of Eurocode 8, despite a 15% savings of the material employed. The comparison between the different geometric configurations considered, shows that the solutions with three and four storey's are characterized by a better lateral behaviour and by a lighter structure than the two storey configuration. Future developments will involve the use of more sophisticated methods of analysis for the evaluation of the dynamic interaction between the fluid and the containment structure.

M. S. Mhetre and G. R. Patil (2015), Raised tanks are constructions of high significance which are considered as the principle help components. for example activity during and after quakes. Concentrate on shows conduct, investigation, and seismic plan of tanks, especially ground tanks. From the extremely disturbing encounters of not many seismic tremors, as Bhuj quake (2001) in India R.C.C raised water tanks were vigorously harmed or imploded. Concentrate on shows the conduct of various arranging, under various stacking conditions and fortifying the customary sort of organizing, to give better execution during seismic tremor. Thirteen models are utilized for computing base shear and nodal relocations for arranging. In the wake of working out base shear and nodal removals of thirteen models for vacant, half filled and full condition. Thirteen distinctive sort of propping frameworks have been broke down base shear and nodal uprooting of raised water tank determined by utilizing STAAD Pro V8i. This gives more precise upsides of base shear and nodal dislodging as contrast with manual technique. Study concluded that the permissible value is observed for alternate diagonal bracing in both directions in zone II. Similarly for zone III, zone IV and zone V are alternate cross bracing in both direction, alternate cross bracing and alternate v type bracing in staging respectively.

Dona Rose, et. al. (2015), research states that the reaction of the raised roundabout sort water tanks to dynamic powers isn't indistinguishable. Overhead water tanks consist of immense water mass at the highest point of a slim organization which are the most basic thought for the failure of the tank during seismic tremors. The pinnacle relocations and base shear got from the investigation were contrasted with comprehending the conduct. This review reasoned that, The pinnacle removals from the time history examination under El Centro quake records are beneath the greatest passable dislodging for various water levels. The pinnacle dislodging from the time history investigation increments with arranging statues. In any case, the dislodging first abatements and afterward increments with limits. The removal for half filled tanks is lesser than the dislodging for tanks with full limit. The base shear esteems from time history examination were increments as arranging stature increments. Likewise, the base shears diminishes and afterward increments with limit. Base shear for half limit tanks are lesser than that for full limit tanks under the same organizing condition.

Rajesh D Padhye and Anand H Shrigondekar (2016), Research stated that the momentum plan of supporting design of Elevated water tanks is enormously powerless under parallel powers because of a seismic tremor. Water tanks and particularly the raised water tanks are designs of high significance which are considered as principle help components that ought to be fit for keeping the normal presentation for example activity during and after seismic tremors. Some main features of this study are, Base shear decreases as bracing level decreases for different types of bracings. Base Shear is higher for Octagonal and Radial bracing compared to other type of bracing. Storey displacement goes on decreasing as level of bracing increases. Octagonal and Radial bracing is experiences less Storey displacement as compared to other type of bracing. Maximum bending Moment at bottom of column decreases as level of bracing increases for all bracing patterns. Base Shear, Storey displacement and max BM at base are increases when water level is full as compared to half full and empty.

IV. CONCLUSION

Past researches suggested the use of a finite element modeling of the water tanks. Implementation of FEM is found beneficial in order to develop a relation between software and practical condition.

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