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Comparative Analysis of RCC Water Tank

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Abstract: The Elevated Water Tanks are one of the most important lifeline structures in the earthquake regions. In major cities and also in rural areas elevated water tanks forms an integral part of water supply scheme. The elevated water tanks must remain functional even after the earthquakes as water tanks are required to provide water for drinking and firefighting purpose. From the graph it is found that the lateral displacement (X-direction) of the RCC square water tank is lower than the other shape of the water tank. From the graph it is found that the Drift (X-direction) of the RCC square water tank is lower than the other shape of the water tank.
Keywords: elevated, water tank, supporting structure, moment and hydrodynamic pressure

I. INTRODUCTION

In most cases the underground and on ground tank are circular or rectangular in shape but the shape of the overhead tanks are influenced by the aesthetical view of the surroundings and as well as the design. An Underground storage tank (UST) is a storage tank that is placed below the ground level. Underground storage tanks fall into three different types:

1) Steel/aluminium tank, made by manufacturers in most states and conforming to standards set by the Steel Tank Institute.
2) Composite overwrapped a metal tank (aluminium/steel) with filament windings like glass fibre/aramid or carbon fibre or a plastic compound around the metal cylinder for corrosion protection and to form an interstitial space.

II. REVIEW OF LITERATURE

Aware, R.J. et al [2] carried out investigation and the paper clearly speaks about the relation between the motion of water in the tank with respect to tank and motion of whole structure with respect to ground. He has considered three basic conditions for this analysis. He said that if water tank is fully filled i.e. without free board then the sloshing effect of water is neglected, if the tank is empty then no sloshing as water is absent.

Devadanam, B., et al [6] studied IS code provision for seismic design of elevated water tanks have been revised. It was seen that, due to absence of a suitable value of performance factor for tanks, the code provision for rather low seismic design force for these structure. Simple expressions are derived, which allow calculations of staging stiffness, and hence the time period, while incorporating beam flexibility.

Ekbote, P.S. et al [8] studied the basic plot behind this paper is to modify & suggestion in IS: 1893-1984. The major revisions suggested are: No provision for ground supported tanks with rigid & flexible walls in above IS code. This provision must be included in the seismic analysis. The single degree of freedom idealization of tank is to be replaced by two or three degree of freedom idealization. A performance factor (K) of 3.0 is suggested for all types of tank.

Khante, S.N. et al [10] studied the basic plot behind this paper is to modify and suggestions in IS: 1893-1984 & suggestion given by other authors. Above author considered all the suggestion given by other authors and added some extra suggestions: In the seismic analysis, the effect of accidental torsion must be included.

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III. MODELING

The modeling is carried out in the ETABS software, mentioned as follows.

Table No.1: Analysis data for Circular Water Tank

Capacity of Tank	200000 lit
Plane dimensions	8 m dia
Total height of Staging	20 m
Height of each storey of Staging	4m
Height of Water	4m
Free board	0.2m
Depth of foundation	1.5m
Size of tie beams	300 mm x 380 mm

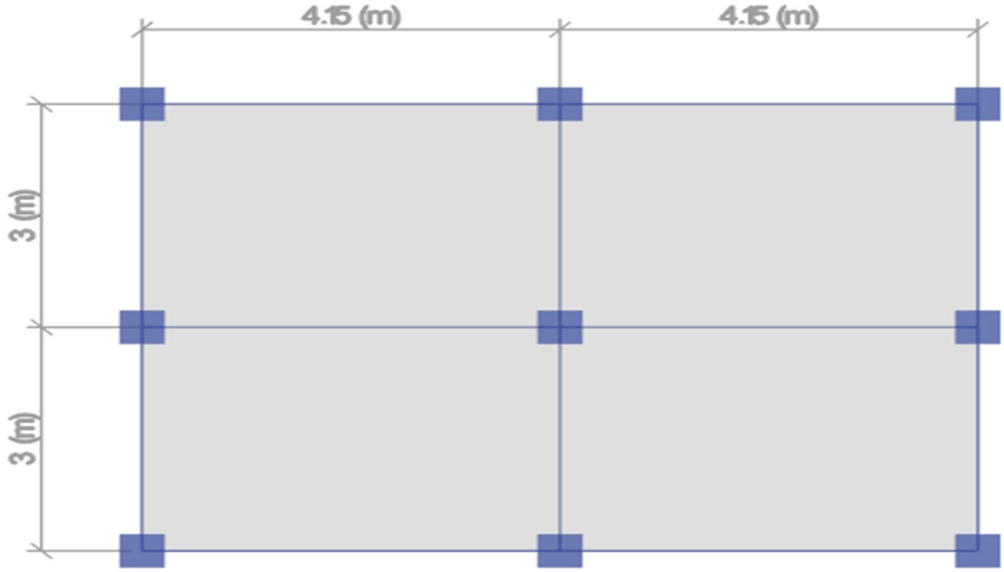
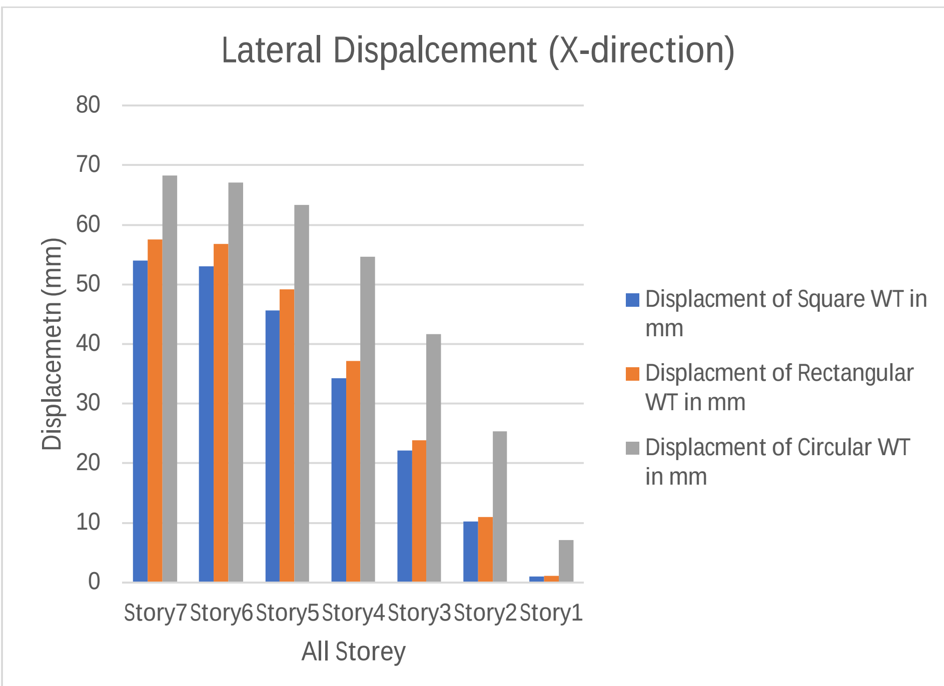


Fig. No.5.3: Plan of Rectangular water tank

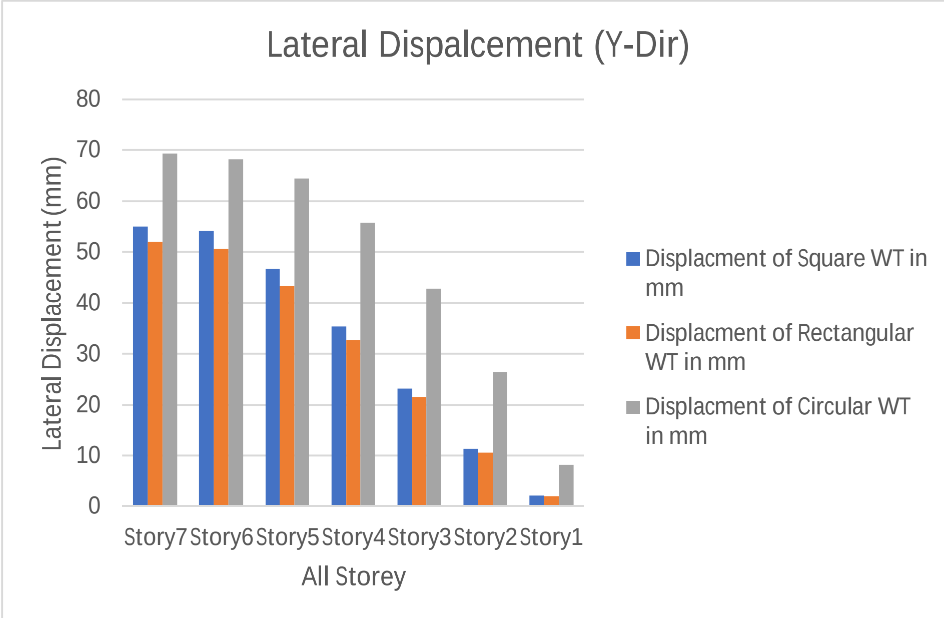
IV. RESULTS

The analysis is carried out in ETABS software and the results in terms of shear force, bending moment and other parameter is obtained as follows.



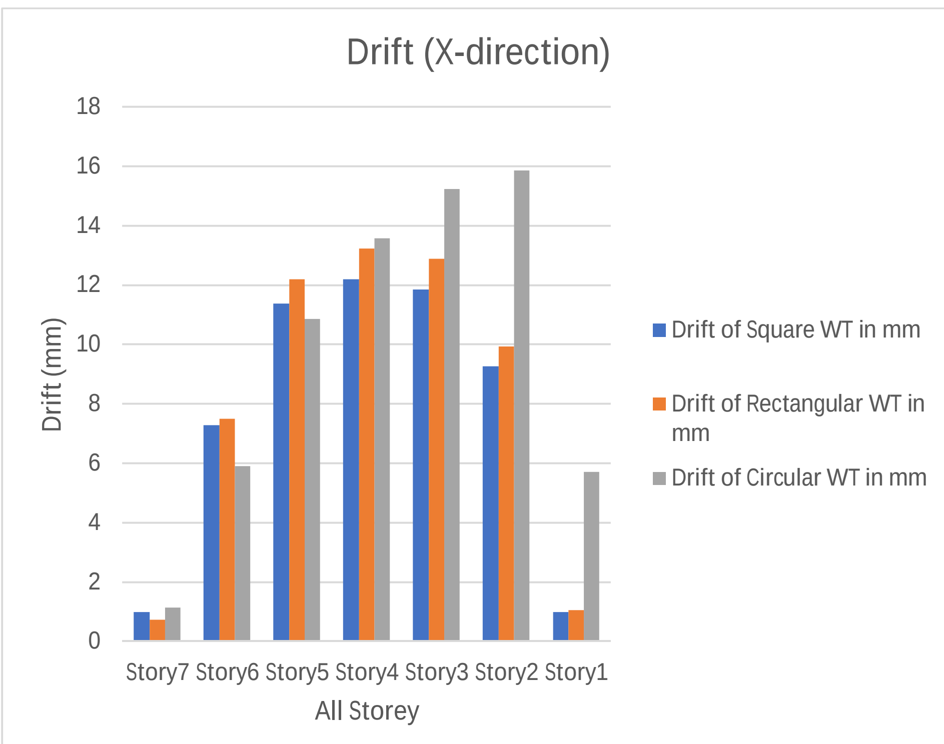
Graph No.6.1: Lateral Displacement (X-direction) for RCC water tank

From the above graph it is found that the lateral displacement (X-direction) of the RCC square water tank is lower than the other shape of the water tank.



Graph No.6.2: Lateral Displacement (Y-direction) for RCC water tank

From the above graph it is found that the lateral displacement (Y-direction) of the RCC rectangular water tank is lower than the other shape of the water tank.



Graph No.6.3: Drift (X-direction) for RCC water tank

From the above graph it is found that the Drift (X-direction) of the RCC square water tank is lower than the other shape of the water tank.

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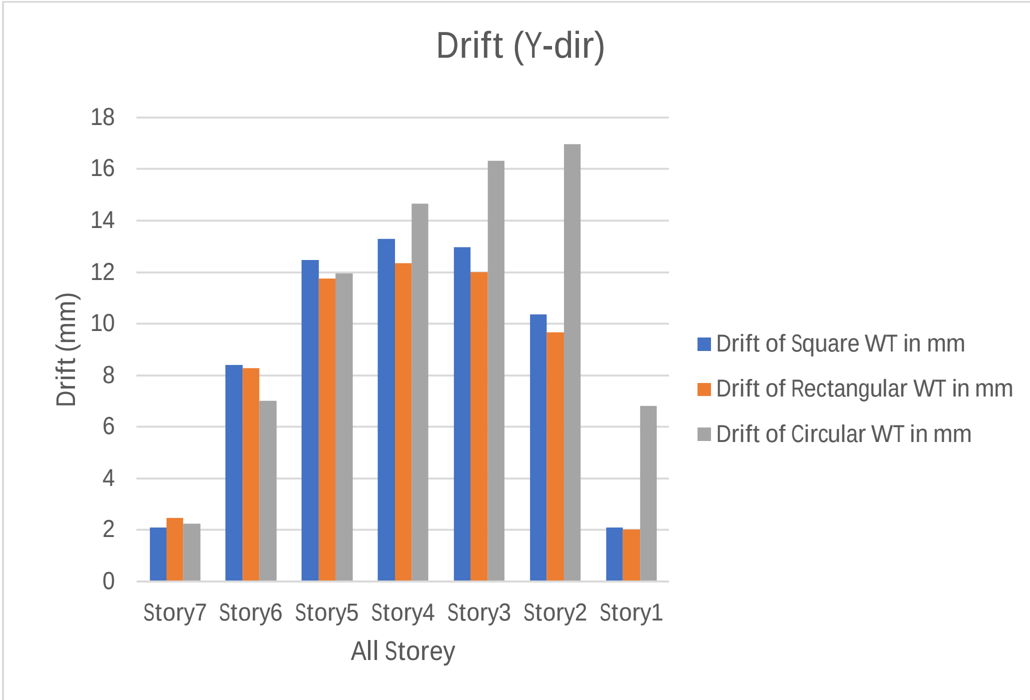
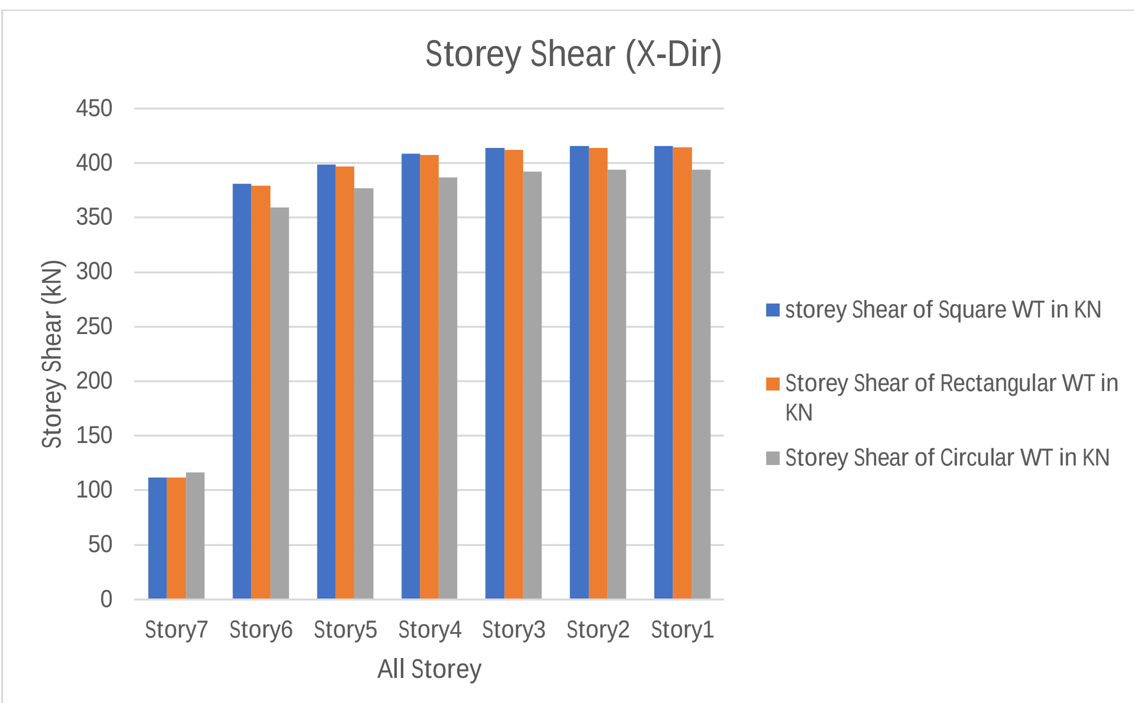


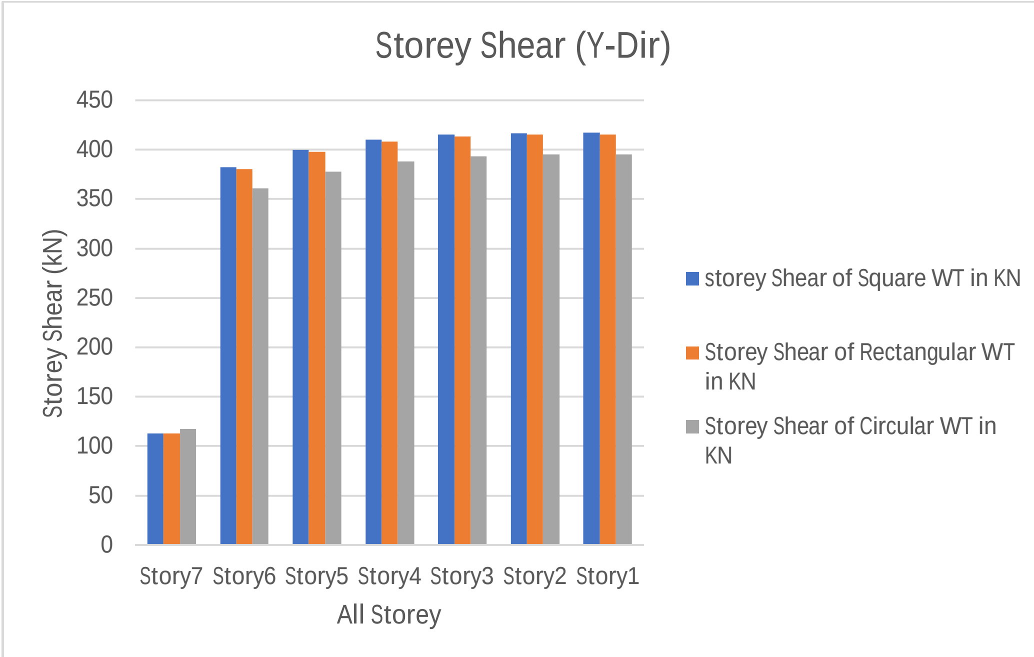
Graph No.6.4: Drift (Y-direction) for RCC water tank

From the above graph it is found that the Drift (Y-direction) of the RCC rectangular water tank is lower than the other shape of the water tank.



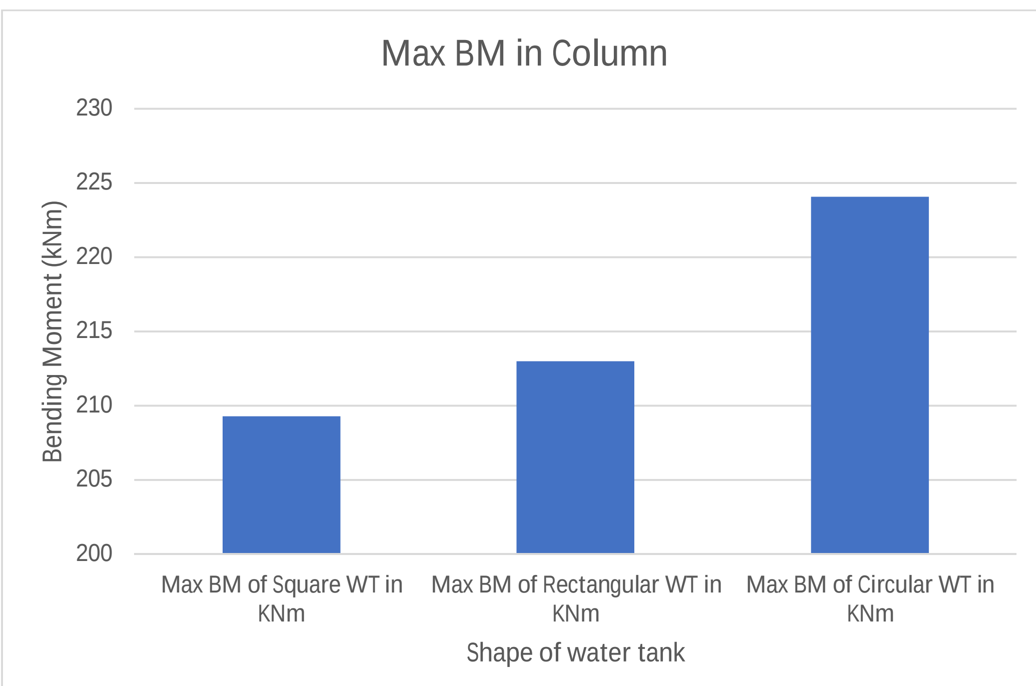
Graph No.6.5: Storey Shear (X-direction) for RCC water tank

From the above graph it is found that the storey shear (X-direction) of the RCC circular water tank is lower than the other shape of the water tank.



Graph No.6.6: Storey Shear (Y-direction) for RCC water tank

From the above graph it is found that the storey shear (Y-direction) of the RCC circular water tank is lower than the other shape of the water tank.



Graph No.6.7: Maximum BM in Column for RCC water tank

From the above graph it is found that the Maximum Bending moment of the RCC Square water tank is lower than the other shape of the water tank.

V. CONCLUSION

The conclusions from the above study are as follows:

A. From the graph it is found that the lateral displacement (X-direction) of the RCC square water tank is lower than the other shape of the water tank. The maximum lateral displacement of the circular water RCC water tank is found to be maximum having 70 mm value.
B. From the graph it is found that the Drift (X-direction) of the RCC square water tank is lower than the other shape of the water tank. The maximum Drift (X-direction) of the circular RCC water tank is found to be maximum having 16 mm value.
C. From the graph it is found that the storey shear (X-direction) of the RCC circular water tank is lower than the other shape of the water tank. The storey shear (X-direction) of the RCC Square water tank is found to be maximum having value of 400kN.
D. From the graph it is found that the Maximum Bending moment of the RCC Square water tank is lower than the other shape of the water tank. The Maximum Bending moment of the RCC Circular water tank is found to be maximum having value of 225 kNm.
E. From the graph it is found that the Maximum Shear Force of the RCC Square water tank is lower than the other shape of the water tank. The Maximum Shear Force of the RCC Circular water tank is maximum having value of 120 kN.

REFERENCES

[1] Addala, Algreane, G.A., Osman, S.A., Karim, O.K. and Kasa, A., 2011. Behavior of elevated concrete water tank subjected to artificial ground motion. EJGE, 16, pp.387-406.
[2] Aware, R.J. and Mathada, D.V.S., Seismic Performance of Circular Elevated Water Tank. International Journal of Science and Research (IJSR) ISSN (Online), pp.2319-7064.
[3] Barbosa, A.R. and Ramadhan, G., 2014. Seismic performance of a tall diagrid steel building with tuned mass dampers. International Journal of Innovations in Materials Science and Engineering, 1(2), pp.244-252.
[4] Braconi, A., Bursi, O.S., Fabbrocino, G., Salvatore, W.A.L.T.E.R. and Tremblay, R., 2008. Seismic performance of a 3D full-scale high-ductility steel–concrete composite moment-resisting structure—Part I: Design and testing procedure. Earthquake engineering & structural dynamics, 37(14), pp.1609-1634.
[5] Brunesi, E., Nascimbene, R., Pagani, M. and Beilic, D., 2015. Seismic performance of storage steel tanks during the May 2012 Emilia, Italy, earthquakes. Journal of Performance of Constructed Facilities, 29(5), p.04014137.
[6] Devadanam, B., Ratnam, M.K. and RangaRaju, U., 2015. Effect of Staging Height on the Seismic Performance of RC Elevated Water Tank. International Journal of Innovative Research in Science, Engineering and Technology, 4, pp.18568-18575.
[7] Duan, Q., Yang, L. and Lou, M., 2011, May. Study on effects of water depth on seismic performance of the aqueduct-Water coupling structure. In International Conference of Computational Methods in Structural Dynamics and Earthquake Engineering (p. 508).
[8] Ekbote, P.S. and Kori, J.G., 2013. Seismic Behavior of RC Elevated Water Tankunder Different Types of Staging Pattern. Journal of Engineering, Computers & Applied Sciences, 2(8), pp.23-29.
[9] El Damatty, A.A., Korol, R.M. and Mirza, F.A., 1997. Stability of elevated liquid-filled conical tanks under seismic loading, Part II—applications. Earthquake engineering & structural dynamics, 26(12), pp.1209-1229.
[10] Khante, S.N. and Meshram, R.S., 2016. Improved Seismic Performance of RCC Building Irregular in Plan with Water Tank as Passive TMD. In Seismic Behaviour and Design of Irregular and Complex Civil Structures II (pp. 323-332). Springer, Cham.
[11] Kim, N.S. and Lee, D.G., 1995. Pseudodynamic test for evaluation of seismic performance of base-isolated liquid storage tanks. Engineering Structures, 17(3), pp.198-208.