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Effect of Water Tank in the Seismic Response of RC Building

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Abstract: ***The influence of water tank in the seismic response of building structures is discussed through comparison of the computed seismic response for structures with and without water tank. Further, the water level in the tank is selected as half the height of tank and three fourth the height of tank. Response Spectrum Analysis and Time History Analysis is performed using ETABS 2015. The result shows that the storey displacement and base shear values reduces considerably in the presence of water tank. The values show reduction for the case with tank having water level as three fourth the height of tank than those with water level s half the height of tank.***
Keywords: Base shear, ETABS 2015, Maximum storey displacement, Response spectrum, Time history.

I. INTRODUCTION

Earthquakes cause complex and irregular ground motions which may damage the buildings in several ways. The damge will be predominant in the case of irregular buildings. There are several ways to reduce earthquake damage. Presence of water tank is proved to be successful in reducing seismic response. Moreover as water tanks form an integral part of any building, the use of water tank in reducing the seismic response is a cost effective method of reducing earthquake damage.

A. Response Spectrum Analysis

Response Spectrum Analysis is a linear dynamic method of analysis of buildings. It indicates the maximum response of buildings which are elastic in nature.

B. Time History Analysis

Time History Analysis is a step wise analysis of a structure to loads that will vary with time. It is a non linear dynamic analysis. It is a very powerful analysis method available for analysis of multi-storeyed buildings under seismic forces.

II. MODELLING AND ANALYSIS

A. Modelling of Building

For the current study, Sahyadri College of Engineering building which is situated in Adyar in Mangalore district of Karnataka is considered. The college building consists of G+4 storeys with a storey height of 3.5m. Response Spectrum and Time History analysis will be carried out for building having and not having water tank. Further the water tank is filled in 2 conditions, one with water level equal to half the height of tank and other equal to three fourth the height of tank.

TABLE 1 DETAILED DATA FOR DESCRIPTION

Particulars	Details
No. of floors	G+4
Zone factor	0.16
Building type	SMRF
Response reduction factor	5
Importance factor	1.5
Impose load	4kN/m^2
Beam dimension	450mm x 300mm
Column dimension	450mm x 300mm
Slab thickness	150mm
Concrete	M25

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C. Design of Water tank

Number of users = 4000
Water demand per capita = 45l/day
Total Volume of water = 4000 x 45
= 18000 l
= 180 m^3
Height of water = 2m
Provide 3 tanks (8m x 4mx 2m)
Design of long wall
Maximum bending moment = 13.33 kNm
Provide 16 mm ϕ @ 200 mm c/c.
Design of short wall
Maximum moment = 14.21 kNm
Provide 10 mm ϕ @ 80 mm c/c.

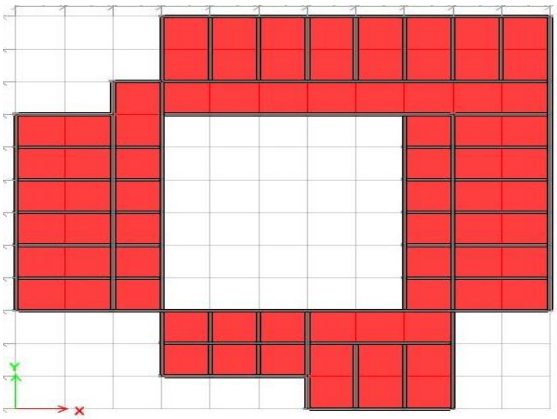


Fig 1 Plan of building

III.RESULTS AND DISCUSSIONS

The following models are used
Model 1 – Building without water tank
Model 2 – Building with water tank having water level equal to half the height of tank
Model 3 – Building with water tank having water level equal to three fourth the height of tank
Results discussed in the study are in terms of the following:

A. Maximum Storey Displacement

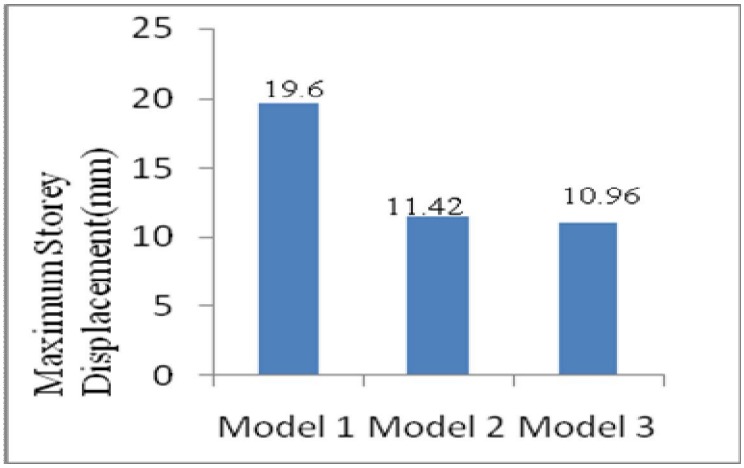


Fig 2 Max Storey Displacement for Response Spectrum Analysis

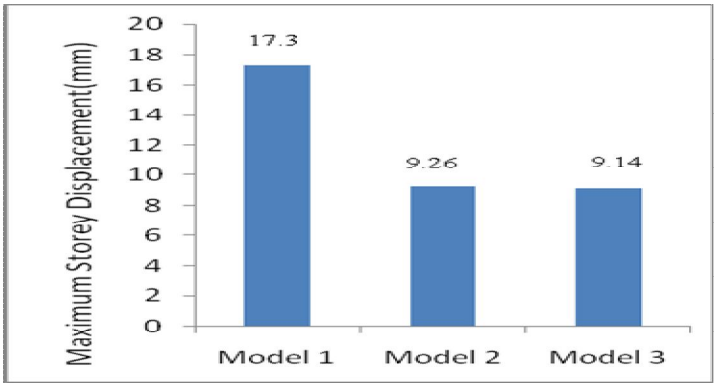


Fig 3 Max Storey Displacement for Time History Analysis

B. Base Shear

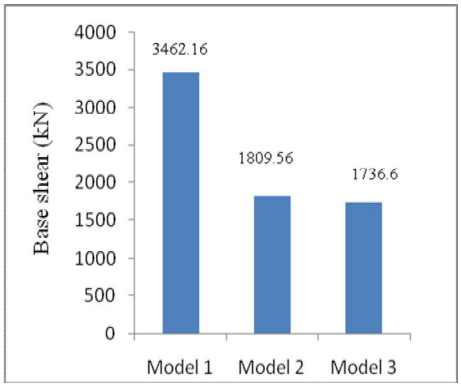


Fig 4 Base Shear for Response Spectrum Analysis

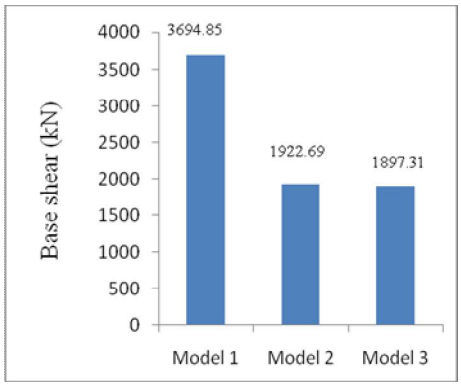


Fig 5 Base Shear for Time History AnalysiS

IV. CONCLUSIONS

In the present study, Response Spectrum and Time History analysis of Sahyadri College of Engineering is carried out. The following conclusions are drawn:

A. The analysis results show that the seismic response will reduce considerably with the presence of water tank for both Response Spectrum and Time History Analysi

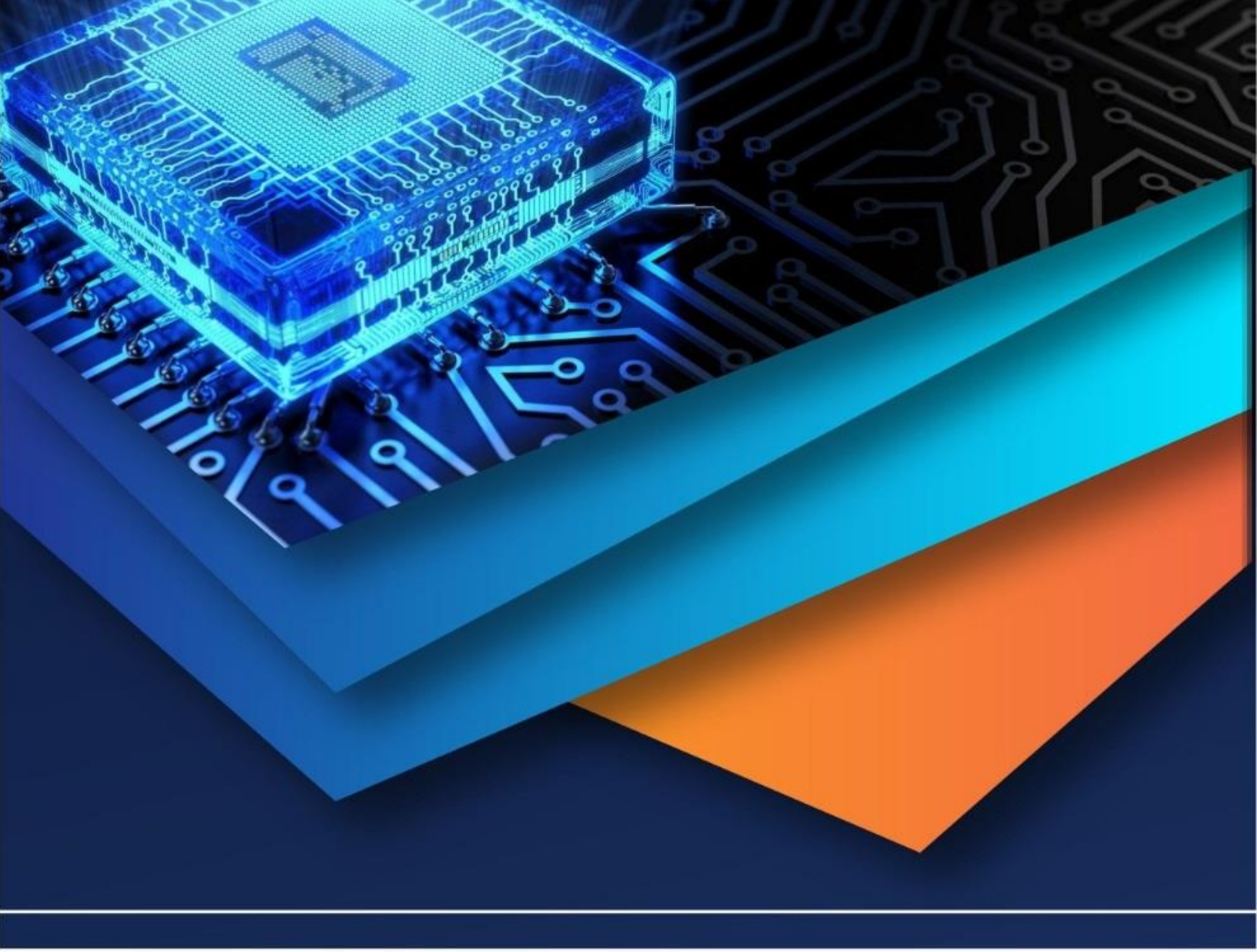
B. The building with water tank having water level as three fourth the height of tank shows reduction in values of both base shear and storey displacement than the case with water level kept half the height of tank

C. For Response Spectrum analysis, the model with water tank having water level kept three fourth the height of tank shows a reduction of 4.03% for both base shear and maximum storey displacement than the model with water level kept half the height of tank

D. For Time History analysis, the model with water tank having water level kept three fourth the height of tank shows a reduction of 1.3% for both base shear and maximum storey displacement than the model with water level kept half the height of tank.

REFERENCES

[1] Ashish, A.M and Patil, G.R, "Earthquake analysis of tall building with tuned mass damper" Journal of Mechanical and Civil Engineering, 2016, pp.113-122.
[2] Batool, W, Mohammed ,S and Adel, A " Seismic response improvement of existing prototype school buildings using water tank" Open Journal of Civil Engineering, vol. 6, 2016, pp.117-130.
[3] Chiding, A and Arunakanthi, E, "A seimic study on effect of water tank modelled as TMD", International Journal of Innovative Research in Science Engineering and Technology, vol.6, 2017, pp.1903-1910.
[4] Key, D.E, "The seismic performance of energy absorbing dampers in building structures", 3rdSouth Pacific Regional Conference on Earthquake Engineering, Wellington, pp.38- 46.
[5] Manjusha, M and Ver, S, "Analytical investigation of water tank as tuned mass damper using ETABS", International Research Journal of Engineering and Technology, vol.4, 2017, pp.1622- 1624.
[6] Panumas, S and Arthit, P, "A study on behavior of tuned mass dampers using water tank to reduce vibrations of buildings from earthquakes", 2ndInternational Conference on Advanaces in Civil Structural and Mechanical Engineering, 2015, pp.38- 42.
[7] Roshni, V.K and Ritzy, R, "Tuned liquid damper to control earthquake response in a multi storeyed building", International Journal of Engineering Research and Application, vol.5, 2015, pp.49- 56.
[8] Indian Standard Criteria for Earthquake Resistant Design of Structures, IS: 1893 (Part 1) 2002, General Provisions and Buildings (Fifth Revision).



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