



Evaluating the Spectral Acceleration Amplification Effects on the Seismic Response of Elevated Steel Water Tanks

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ABSTRACT

Water Tanks are amongst the most important structures which are used for storage and providing the water needed on the pick usage time in water supply networks. The Seismic behaviour of such special structures is the main objective of current research, which was motivated by raising demands for design and construction of elevated water tanks. Hence, two structural models of steel elevated water tanks in Armneia, with capacities of 134m³ and 160m³, demonstrating a height of 24m and 30m respectively are selected as shown in Figure 1. Each model is considered to be empty, 50% and 100% full and is designed according to Armenian SNIP II-6.02 seismic code for all filling strategies, taking into account the spectral acceleration level equal to $S_a=0.40g$. On each model, the information of Convective mass, Impulsive mass and the spring stiffness of the convective and impulsive masses are added, due to the Housner's Equivalent Mass-Spring theory, considering Soil-Structure Interaction (SSI) effects at the meantime. Earthquake Analysis procedures of the whole fluid-tank systems are completed by the means of Time History Analysis method, using 3 horizontal components of selected accelerograms, recorded on soil categories of Rock, Dense Soil and Loose Soil respectively, scaled to spectral acceleration levels of $S_a=0.2g \sim 1.0g$. Finally, the seismic response is computed for the filling strategy of Empty, 50% full and 100% full conditions for both models.

Keywords:

Soil-Structure Interaction, Time Histoy Analysis, Mass-Spring Theory, Water Tanks, Spectral Acceleration.