

## Dynamic Response of Cylindrical Water Storage Tanks Made by ECC Compared to Normal Concrete

Pouria Sheikhabaei, Farhad Behnamfar, Abdorreza Kabiri Samani, June 2018

One of the important structures used in residential water supply systems and industrial installations is water storage tank. Also, water storage tanks are used for supplying water in a region stricken by an earthquake. Seismic damages of these tanks can cause financial and vital injuries. Therefore, it is important to evaluate the dynamic behaviour of tanks and use effective methods to reduce the seismic vulnerability. In spite of numerous researches done, damages observed in the water storage tanks in recent earthquakes indicate the inadequacy of ordinary methods of construction of this type of reservoirs, so changing the materials and the designing methods of this kind of structures are important. Also, The assumption of the linear behaviour of concrete in existing design codes causes seismic vulnerability of the reservoirs. Considering the effect of cracking and crushing of concrete in nonlinear analysis, leads to the exact evaluation of the dynamic behaviour of the storage tanks. It can reduce the seismic vulnerability of this type of structures. In this study, ANSYS software is used for nonlinear analysis of reservoirs. In order to evaluate the ability of this software in nonlinear analysis of reinforced concrete structures under cyclic loadings, the hysteresis diagram of a reinforced concrete beam was extracted and the results were compared with a laboratory work. In this research, 10 cylindrical tanks with different height and diameters have been selected and are designed based on ACI standard. The results obtained in ANSYS software indicate that the terms exist in ACI standard are inadequate, which cause the vulnerability of the reservoirs during an earthquake. In this study, the role of using ECC in reducing the damages of reservoirs is investigated. Special characteristics of ECC include high tensile strength, tensile strain capacity about 300 times the ordinary concrete and acceptable durability in different environmental conditions. One of the factors that causes the damages of the reservoirs in recent earthquakes is the low tensile strength of concrete, which causes cracking and can lead to wall rupture, fluid leakage from the wall, and corrosion of reinforcements. According to the results obtained in this study, using ECC leads to the increment of the tensile capacity of the wall, which is the most important achievement of the present study. Also, one of the conventional methods for improving the dynamic performance of the reservoirs is the reduction of the bending moment of the wall. Due to the reduction of wall thickness in tanks modelled with ECC, reduction of the bending moment per unit width of the wall is an important achievement. According to the results obtained, In tanks modelled with ECC, the concrete fracture was not observed, and cracks had very small widths, which is not problematic.

### Key Words

Concrete Tanks, Dynamic Analysis, Nonlinear Analysis, Hysteresis, ANSYS.