

## Developing of Fragility Curves for Baffled Concrete Cylindrical Liquid-Storage Tanks

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The liquid storage tanks are widely used in industrial areas such as petroleum complexes, petrochemical plants and water transfer systems. The categorization of these reservoirs is based on their shape and functional purposes. Classification based on the former includes rectangular and cylindrical tanks and on the latter are above-ground and ground-supported tanks. The cylindrical tanks are usually used with fixed or floating roof. According to the reports of tanks failure in previous earthquakes, the liquid sloshing is a common phenomenon in the failure of cylindrical tanks. Sometimes using the entire capacity of tanks having a fixed roof is necessary, which leads to exceeding the predicted freeboard. Subsequently, collision of sloshing wave with the fixed roof results in collapse. Also, in the case of the floating roof, due to liquid sloshing during an earthquake, collision of roof and tank walls occurs, which leads to collapse. In this study to prevent tank failure due to sloshing, circular baffles are used as damping devices around the perimeter of tanks. In order to investigate the dynamic response of the baffled tank comparatively, fragility curves for both the baffled and non-baffled tanks are developed. To investigate the effect of the ratio of liquid height to the tank diameter, three types of tanks including tall, medium and shallow are studied. Structural design of tanks is based on the ACI 350.3 code. Ratio of the baffle width to tank radius is considered to be a constant value and the baffle submergence depth is taken to be more than the sloshing wave height. The ANSYS software is utilized for dynamic analysis of the studied tanks. Noting that the sloshing phenomenon is a major factor in this study, the liquid overflow is investigated as one of the effective parameters in developing the seismic fragility curves. One of the other important issues in concrete tanks is control of crack width for preventing leakage and corrosion of rebars. Accordingly, the seismic fragility curves for critical crack width, bending capacity of wall and over turning moment at the base of the tanks are developed for tanks without baffle and the baffled ones. The results indicate that use of baffles significantly reduce the maximum height of fluid sloshing. On the other hand increase of the response parameters including tensile crack width, the overturning moment at the base of the tank and the wall bending capacity is observed to a small extent.

### **Key Words**

Concrete cylindrical tank, Dynamic analysis, Crack width, Water sloshing, Seismic fragility curve.