CRITERIA FOR SEISMIC DESIGN OF ELEVATEDWATER TANKS IN SRI LANKA

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ABSTRACT

Sri Lanka is considered to be one of the potential country that expected to be experience moderate earthquake in the near future due to formation of new plate boundary about 400 km away from the Southern coast line. Even though the situation is quite dangerous, lack of research has been carried out by the local engineering's on this regards. Recently, Structural engineers have paid their attention to protect residential buildings, Hospitals and other public buildings. However, no attentions were paid on the seismic vulnerability of post disaster structures such as water tanks. The retrofitting of water and other storage tank should be given the same priority as other structures, since it can be use as a post disaster facility to supply reliable dirking water supply and to control fire in a case of emergency for effected areas. Not like as normal buildings, the water tanks should able to under go large plastic deformation with out failure where as buildings are expected to be remain in the elastic region under the future expected loading conditions. Therefore, especial attention should be paid while designing and construction of such important structures against dynamic loads.

BS 8110 and BS 8007 are commonly implemented design guidelines for design of elevated water tanks in Sri Lanka. The all most all the structures in the Sri Lanka are design based on the gravity loads. When, the tank containing liquid vibrates, the liquid in the lower region experts as impulsive masses that are connected rigidly to the tank wall while the upper region of the liquid termed as convective mass that is not moving with the tank wall, thus generating a seismic waves or sloshing motion fluids. Therefore, it is very important to take account such dynamic mass participation in order to calculate the forces during the design procedure.

The common design of staging structures for elevated tanks, under the lateral loads such as earthquake is extremely vulnerable so that in the past earthquake so many of tank's conservator was damaged and a few of them were destroyed and collapsed. Many elevated water tanks suffered damage to their staging (support structure). Analysis of resistance to some of damaged shaft staging shows that these structures lift excessive force more than design forces (based on IS: 1893-1984). Shaft staging of elevated tanks must have sufficient resistance against the axial loads, bending moment and shear forces due the lateral loads. The observation in damage pattern has shown that for tanks with high ratio of height to diameter and being in the range of long periods, bending behavior under seismic loads is more critical than shear behavior, so concrete column must be appropriately designed and has suitable detail in bending deformation just like the shear resistance and shear deformation.

This paper will summarize initial work done at the structural engineering laboratory of University of Peradeniya to develop design guideline for seismic analysis of elevated water tanks in Sri Lanka. Mainly it will introduce several techniques on seismic analysis of water tanks which is affordable to practicing engineers. Other than that, forensic investigation has been done in order to understand possible failure modes under seismic loading conditions. Finally, conclusions were drawn by emphasizing such study to mitigate future disasters in Sri Lanka.

Ker words: Seismic vulnerability, post disaster facility, elevated water tanks, forensic investigation