Civil Infrastructure Researches, Vol. 8, Issue.1, Spring and Summer 2022, pp. 21-34

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A Study of the Buckling Behavior of Aboveground Cylindrical Steel Tank under Seismic Loading

In this study, the seismic response and buckling of aboveground cylindrical steel liquid storage tanks subjected to horizontal components of earthquake ground motions is investigated using incremental dynamic analyses (IDA). A *broad steel tank with diameter of 30 m and height to diameter (H/D) ratio of 0.40 was designed using API 650 standard. The incremental dynamic analyses of liquid storage tank were performed for seven real seismic ground motions, which were scaled for PGAs of 0.05g to 0.50g. To verify the accuracy of the propose finite element model of the tank-liquid system, natural periods of the tank-liquid system vibration modes computed from finite element analysis compared to those obtained by analytical solutions and other numerical study. Small difference between natural periods indicates the acceptance accuracy of the finite element model. The mean peak base shear and overturning moment of the steel tank are estimated using mass spring model and compared with those obtained by finite element model. The mean peak base shear and overturning moment from finite element model greater than those obtained by mass spring model for PGA less equal 0.20g and vice versa for PGA from 0.30g to 0.50g. The incremental dynamic analysis results show that buckling of tank shell occurred at a height of 2.8 m above the tank base. Also mean critical horizontal peak ground acceleration (critical PGA) and mean critical dynamic base shear force, which induces buckling at the bottom of the cylindrical shell, are estimated.*

Keywords: Steel Tank, Incremental Dynamic Buckling, Fluid-Structure Interaction, Dynamic Buckling, Elephant Foot Buckling, Shell Buckling.

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Received 07 November 2021, Revised 28 December 2021, Accepted 28 December 2021.
DOI: 10.22091/cer.2021.7560.1324