SHAKE TABLE TESTS ON THE STEEL FLUİD STORAGE TANK MODELS

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ABSTRACT

Dynamic behaviors of storage tanks under seismic loads are generally complex, which has been studied by many researchers. This issue was first introduced by Housner for cylindrical rigid Tanks. He assumed that the answer to Seismic rigid containers is divided into two impulsive and convective components. Impulsive pressure according to the coordinated movement is part of the generated rigid tanks walls. Convective pressure is also the other part of created fluid at the free surface of the tank contents. In this paper, dynamic behavior of steel cylindrical tank model withdiameter of 1.2 meter and height of 1.25 meters and with fixed roof condition have been tested on the international institute of Earthquake Engineering and Seismology (IIEES) shaking table.In this research, experimental tank model with three different level of liquid height subjected to three different earthquake records.Experimental results including frequency contents, damping values, and sloshing amplitudes have been compared with API650-2008 and ASCE regulations.

INTRODUCTION

Cylindrical steel tanks are the most commonly used Structures in Refineries, Petrochemical facilities, Oil warehouse's , Industrial factory's etc. Past earthquakes indicate extreme vulnerability of these kinds of Tanks. The dynamical Behavior of the tanks was first modeled by Housner which has been the basis of the regulations. He showed the free surface of a liquid tank when subjected to dynamic lateral acceleration, that the Fluid has two effects through the walls which includes; 1) impulsive pressure 2) convective pressure. The convective Pressure appears at the top of the tank because of the Sloshing and the impulsive pressure appears at the bottom of the tank and the fluid motion is created to coordinate with the walls. In fact, the frequency of the Sloshing is significantly lower than the frequency of the impulsive motion; this means that these modes can be amplify in specific frequency conent of an earthquake. (ASCE,2003)

Alaska earthquake in 1964 imported intense damages to the fluid tanks. The result of this earthquake indicated that the flexibility of the tank walls was one of the main reason extensive tank damages. Therefore,Housner, G, W, (1954), Housner, G,W, (1957a), Housner, G,W, (1957b) and Haroun, M, A. (1980), Haroun, M, A, and Housner, G,W, (1982a), Haroun, M, A, and Housner, G,W, (1982b), and other researchers started to extensive investigations and analyzing the interaction of fluid and structure issues using numerical and experimental methods Based on these investigations, a simplified model was presented to indicate the effects of flexibility of the tank walls. The results of extensive investigation regarding seismic