



Slip Phenomena by Occurrence of Air Film Between Tank and Basement

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ABSTRACT

In this paper we deal with slip phenomena of oil tanks. Oil tanks whose bottoms are flat are set on a concrete base and they are not anchored. So, when they are accelerated by an earthquake, they may be rocked or slid. Actually the phenomena have sometimes been observed since Alaska earthquake in 1964. If a tank moves and the pipes attached to the tank break, the oil leaks out and it is in danger. As for the reason we have discussed whether the coefficient of friction is small or large. But some cases cannot be explained on the viewpoint of the coefficient of friction. Therefore, we tested with a tank model on a flat shaking table. The diameter and the height of the acrylic model is 150mm and the wall thickness is 5mm. The bottom is made of vinyl chloride whose stiffness is lower than the acrylic one. The four pressure transducers are set on the bottom to measure the air pressure between the bottom and the shaking table. Water volume in the tank and the center of gravity of the tank can be changed. The acceleration and the movements of the tank were measured in sweeping a vibration acceleration of the shaking table at a constant frequency. As a floor material, acryl and rubber were chosen. As a result, the acceleration at which the tank begins to slip is less than the theoretical value calculated from the coefficient of friction. Another characteristic is the fact that the tank slips more easily at the higher frequency. The reason is why the air film causes between the bottom and the shaking table after rocking and the film makes it easier to slip. That is, the apparent coefficient of friction is less due to the air film than the real coefficient of friction. The effect is more in case of the higher frequency and the higher coefficient of friction. The water in the tank makes the slip acceleration more or less owing to sloshing.