INTRODUCTION: Structures in general are subjected to static and dynamic loads. But, the majority of structures are designed for static loads and the effect of dynamic loading is not considered. It has been well established that during earthquake, a number of buildings fail and the effect is much more severe when there is resonance. Resonance occurs when the frequency of base motion coincides with the natural frequency of the structure.

IMPORTANCE OF STUDY: Water tank is one of the main lifeline structures for human community that should be capable of keeping expected performance during and after earthquakes. According to seismic code IS:1893 (Part 1): 2016, more than 60% of India is prone to earthquakes. Due to earthquakes, failure of circular water tanks resting on ground is often seen around the world. Hence, sloshing frequency of liquid in tank and hydrodynamic pressure on wall under seismic excitation is required for evaluating the performance of water tanks.

OBJECTIVES:

The main objectives of the current study are:

- Conducting shaking table tests on water tanks to understand the dynamic effects of water.
- Determination of natural frequency of tank models using acceleration sensors.
- Determination of hydrodynamic pressures at various heights of tank models using pressure sensors under different dynamic loading.
- Determination of sloshing wave height of water in tank models under different dynamic loading.

EXPERIMENTAL PROGRAM:

Some of the main parts of experimental set-up are explained below:
• Horizontal shaking table apparatus:

Fig. 1 shows the horizontal shaking table apparatus mounted with a DC powered motor, flywheel and cam arrangement. The important specifications of the shaking table are as follows:

Maximum payload: 30 kg
Operating frequency: 0 – 25 Hz
Amplitude: 0 – 10 mm
Table size: 400 x 400 mm
Rotating table diameter: 390 mm

Fig. 1: Horizontal shaking table apparatus

• Sensors used:
EXPERIMENTAL RESULTS:

- Natural frequency of empty tank models

![Graph of natural frequency for 25cm diameter tank]

- Variation of hydrodynamic pressure
Fig. 5: Variation of hydrodynamic pressure with frequency in 25cm dia, 30cm Hs, 4mm amplitude

- Variation of sloshing wave height

Fig. 6: Variation of sloshing wave height with frequency for 25cm diameter tank, Hs = 10cm
CONCLUSIONS:

- For a particular amplitude of shaking, the hydrodynamic pressure increases with increase in frequency.
- 0.13% - 51.6% of increase in pressure is observed over hydrostatic pressure. Hence, dynamic behavior of circular water tanks should be considered while designing.
- For a particular frequency and head of water, sloshing wave height increases with increase in amplitude.
- The sloshing wave height obtained using theoretical procedure shows that as the frequency increases, the sloshing wave height also increases.
- In the present experimental study, the sloshing wave height is not showing uniform increase or decrease with respect to increase in frequency.
- The resonant frequency does not depend on the amplitude of input motion.
- For all amplitudes, resonant frequency decreases with increase in tank diameter for a particular head of water.