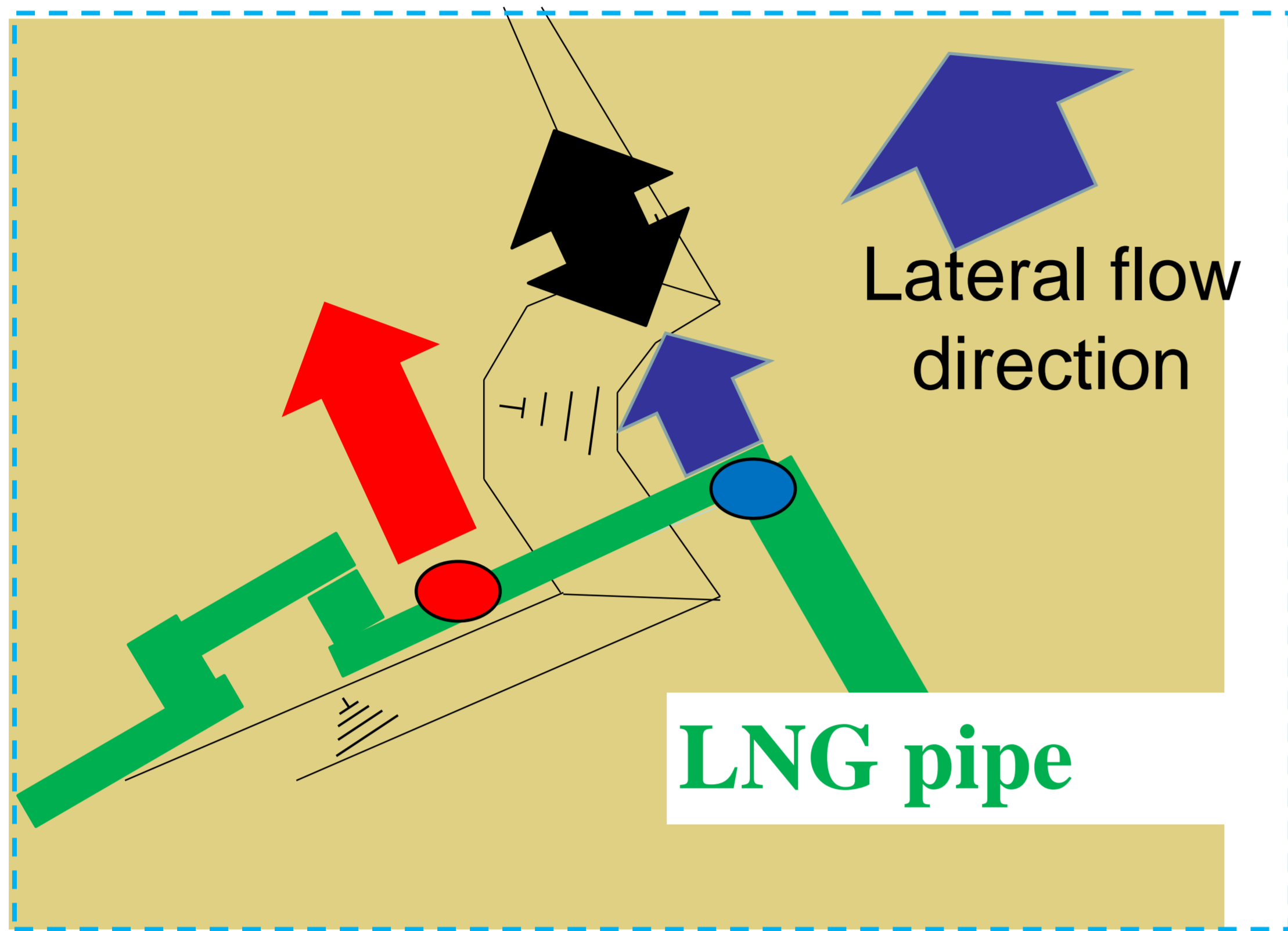


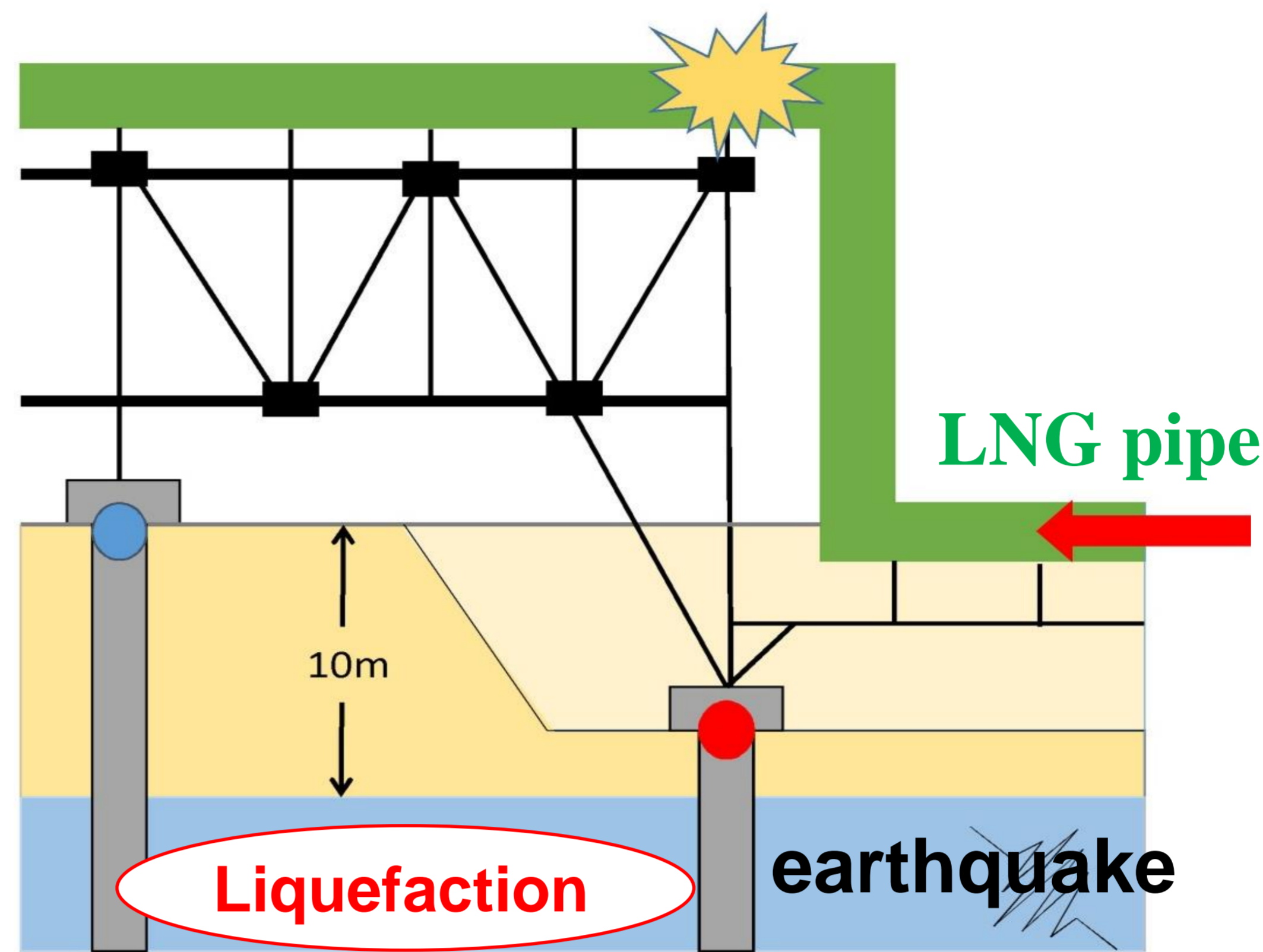
# Shaking table tests on two and three dimensional behavior of embankment on liquefiable ground

## Introduction

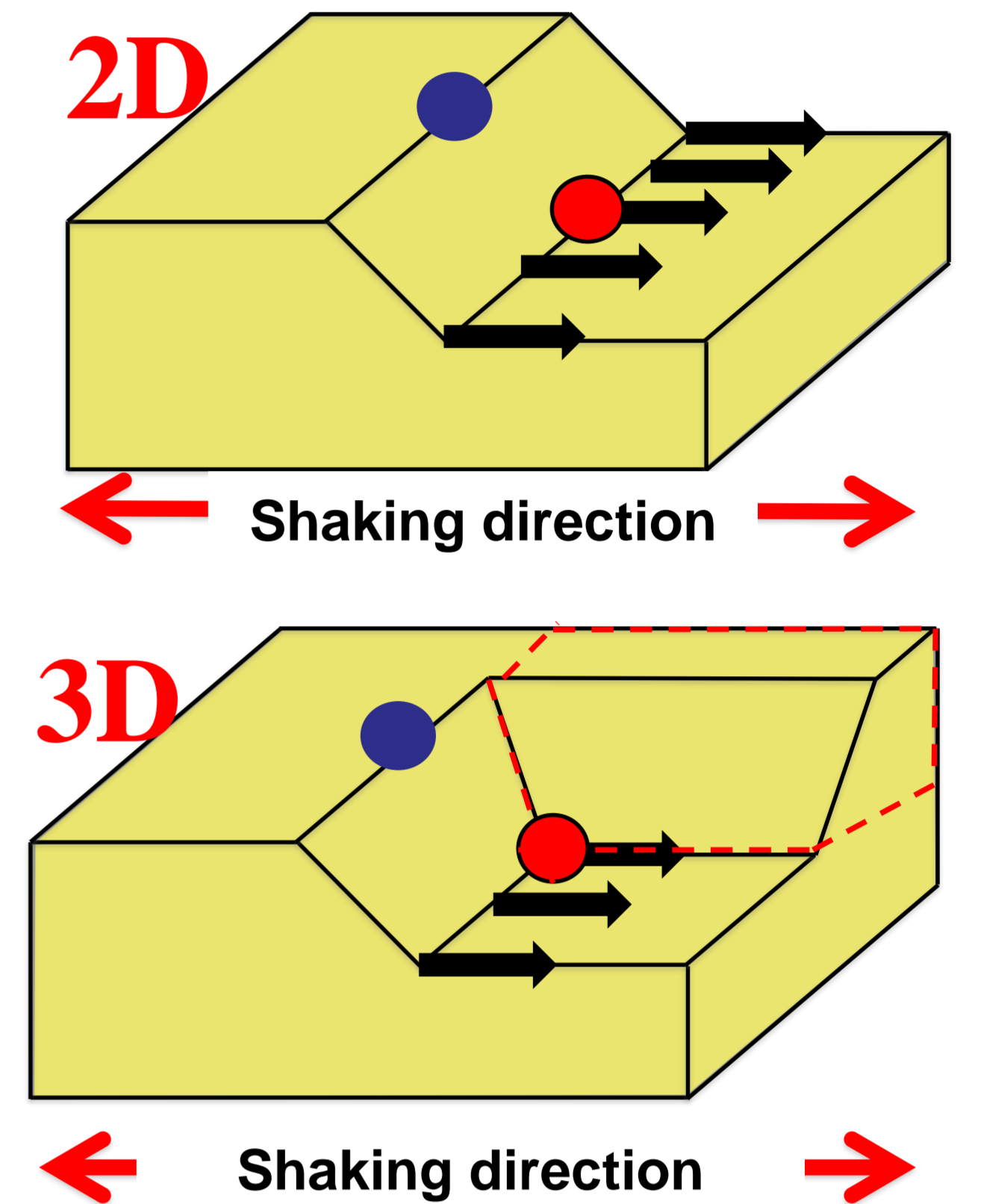
The purpose of this research is to evaluate the seismic stability of existing three-dimensional embankment, against future earthquakes that induce liquefaction of the ground beneath the embankment. Furthermore, even with advanced software such as FLIP, it is not possible to simulate or predict such kind of complicated three-dimensional behavior.



Plan view of the 3D embankment



Cross-section of the pipeline crossing 3D embankment

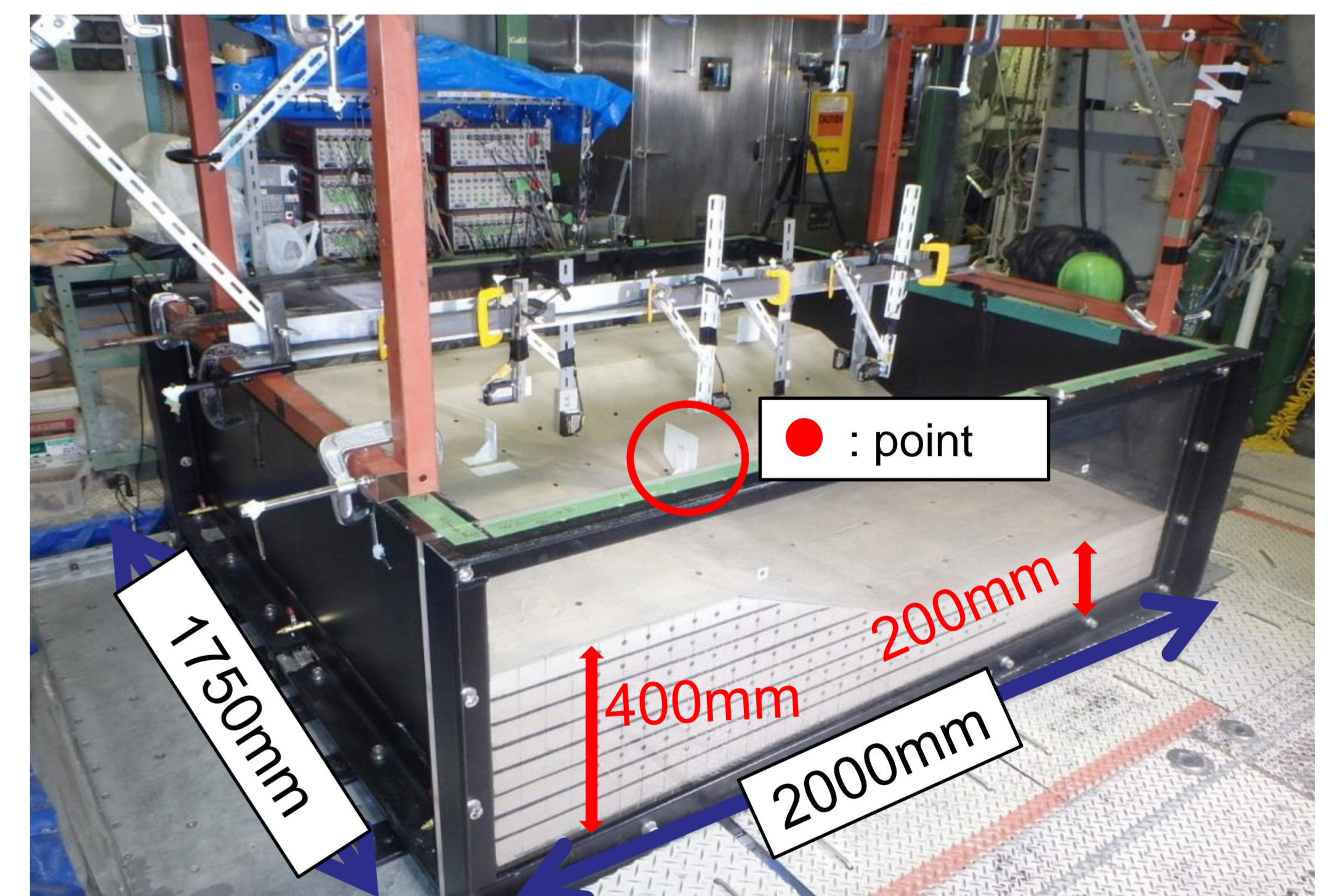
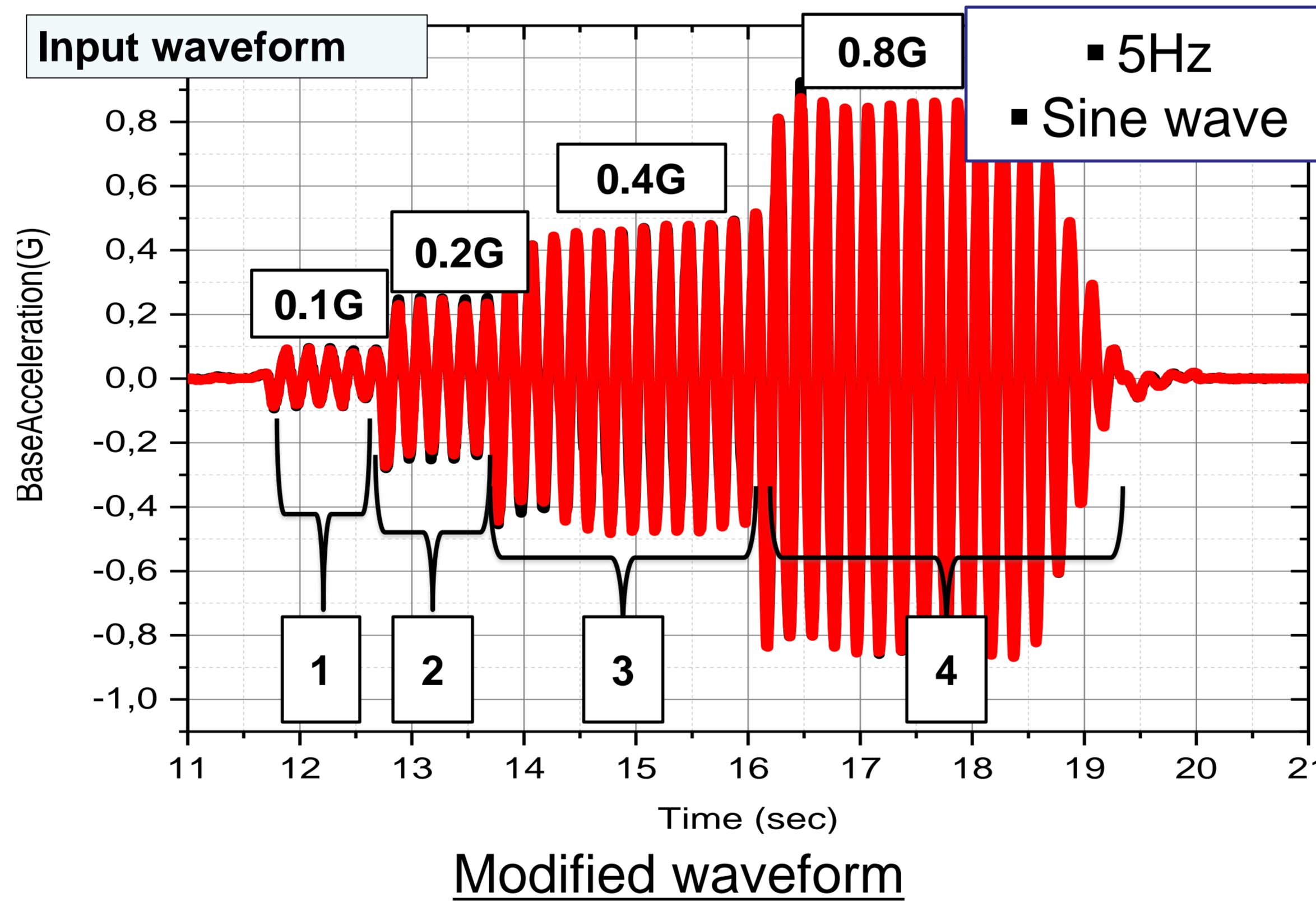


Schematic illustration of 2D and 3D

## Input wave and large shaking table

From current study using of carbon-dioxide (CO<sub>2</sub>) and distilled water supply for shaking table test in Hongo campus was implemented. The purpose of using carbon-dioxide is to achieve high extent of saturation; the pore air in the sample is removed circulating carbon-dioxide (CO<sub>2</sub>) gas slowly through the specimen from its bottom to the top.

Regular sinusoidal base acceleration of a frequency of 5Hz was applied. The acceleration amplitude was increased step by step in 4 stages starting from 100gal 1<sup>st</sup> stage, 200gal 2<sup>nd</sup> stage, 400gal 3<sup>rd</sup> stage and final 800gal 4<sup>th</sup> stage. In other words, to witness the ground below and around the embankment to liquefied gradually.



Large soil container

## Deformation of the embankment in 2D and 3D cases

The occurrence of crest settlement larger than half of the embankment height is not unusual (Matsuo, 1999). This type of embankment failure is called "Slumping" (Type 3). Similar type of failure occurred at the Tokachi river dike during the 1993 Kushiro-Oki earthquake. There were both positive and negative effects by the presence of 3D (three-dimensional) shape of embankment. The positive effect is that it reduced the horizontal displacement in shaking direction. However, it increased the total horizontal displacement and settlement of the embankment.

