Effect of road pavement thickness on liquefaction-induced settlement

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Introduction

Soil liquefaction is one of the most severe geotechnical issue related to the seismic shaking. The Great East Japan earthquake 2011 caused the severe liquefaction in Tokyo bay area including the ground subsidence, tilting of the structures, uplift of the light structure and damage to the road facilities(Fig. 1).It was reported that almost 42km^2 of the Tokyo Bay area severely damaged because of the liquefaction.

Fig. 1. Road condition of main road and residential road after the Great East Japan earthquake

1-g shaking table with laminar soil box

1-g shaking table model tests were conducted with the laminar soil (Fig.2 & Fig.3) box to reproduce the field conditions at lab scale to understand the disaster mechanism of the road facilities. The scale down factor for all the model tests were 1/20.

Silica sand No. 5 (Dr=47%) overlaid by the two different roadbed pavement models is used for the testing sample. The pavement model was consist of silica sand, Kaolin clay, cement and water.

Fig. 2. Laminar soil box(100cm x 40cm x70cm)

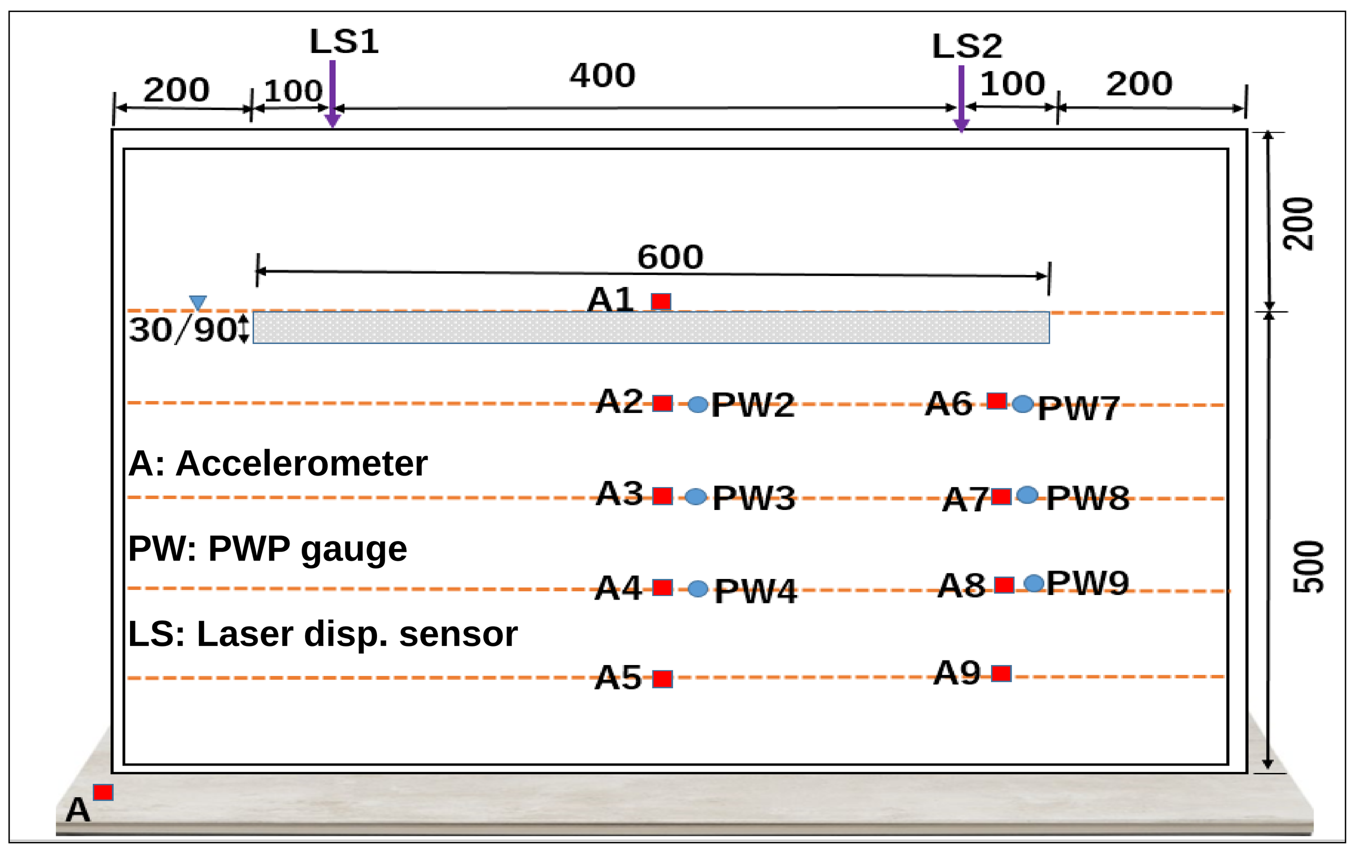

Fig. 3. Sensors locations in soil model

Liquefaction-induced damage(Test results)

The time histories of input seismic shaking and average settlement measured by LS1 and LS2 are shown in Fig.4. Thin pavement structure underwent more settlement (damaged) while the thick pavement showed less settlement (less damage) due to the seismic loading. This may be due to the reason that the stiffness of the thin pavement compromised during shaking and hence increase the pore water pressure underneath sufficiently as compare to the thick pavement.

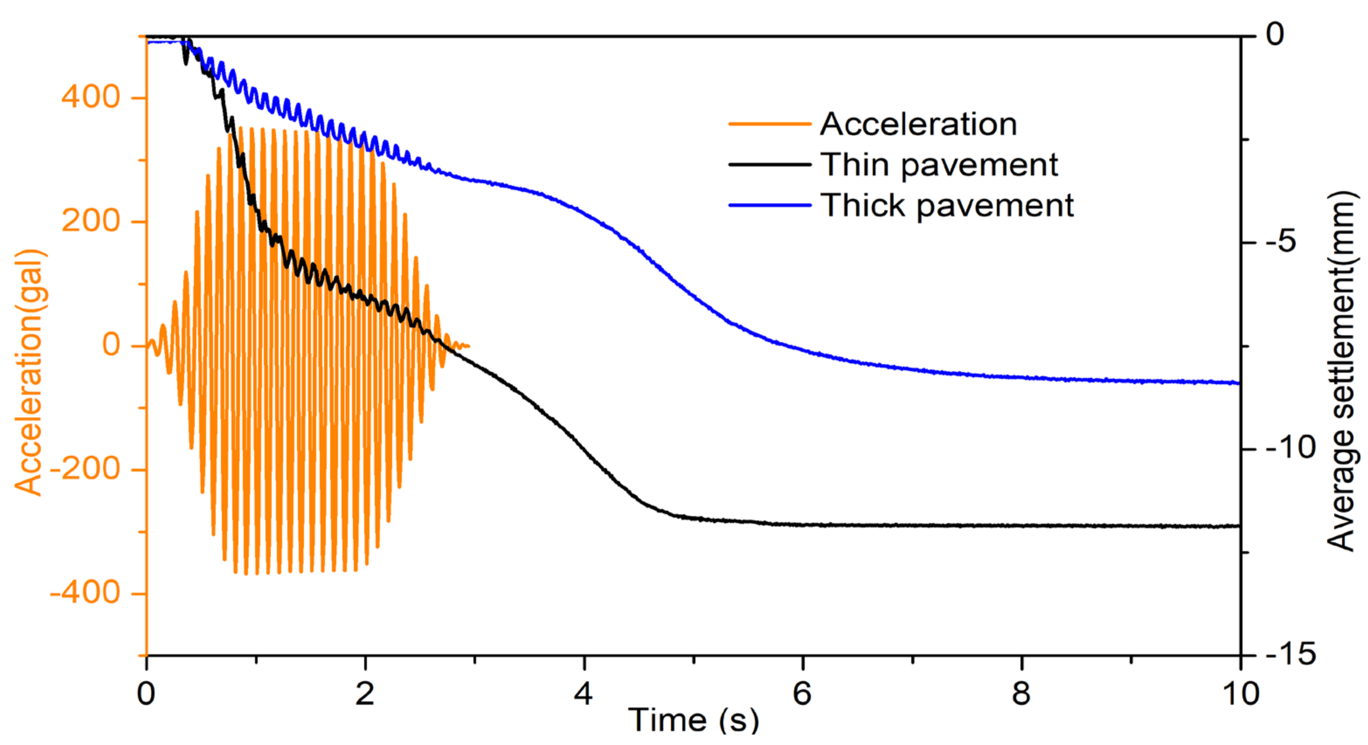

Fig. 5. Acceleration vs settlement graph

(a) (b)

Fig. 6. (a) Main road model with thick pavement and (b) residential road model with thin pavement after 1-g shaking test

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