Geophysical Research Abstracts
Vol. 18, EGU2016-6968-2, 2016
EGU General Assembly 2016

A preliminary study on surface ground deformation near shallow foundation induced by strike–slip faulting

Pei-Syuan Wong and Ming-Lang Lin
Taiwan (r03521107@ntu.edu.tw)

According to investigation of recent earthquakes, ground deformation and surface rupture are used to map the influenced range of the active fault. The zones of horizontal and vertical surface displacements and different features of surface rupture are investigated in the field, for example, the Greendale Fault 2010, MW 7.1 Canterbury earthquake. The buildings near the fault rotated and displaced vertically and horizontally due to the ground deformation. Besides, the propagation of fault trace detoured them because of the higher rigidity. Consequently, it's necessary to explore the ground deformation and mechanism of the foundation induced by strike-slip faulting for the safety issue.

Based on previous study from scaled analogue model of strike-slip faulting, the ground deformation is controlled by material properties, depth of soil, and boundary condition. On the condition controlled, the model shows the features of ground deformation in the field. This study presents results from shear box experiment on small-scale soft clay models subjected to strike-slip faulting and placed shallow foundations on it in a 1-g environment. The quantifiable data including sequence of surface rupture, topography and the position of foundation are recorded with increasing faulting.

From the result of the experiment, first en echelon R shears appeared. The R shears rotated to a more parallel angle to the trace and cracks pulled apart along them with increasing displacements. Then the P shears crossed the basement fault in the opposite direction appears and linked R shears. Lastly the central shear was Y shears. On the other hand, the development of wider zones of rupture, higher rising surface and larger the crack area on surface developed, with deeper depth of soil. With the depth of 1 cm and half-box displacement 1.2 cm, en echelon R shears appeared and the surface above the fault trace elevated to 1.15 mm (Dv), causing a 1.16 cm-wide zone of ground-surface rupture and deformation (W). Compared to the investigation in field, rupture of the Greendale Fault, produced a 30-km-long, 300-m-wide zone of ground-surface rupture and deformation (W), involving 5.29 m maximum horizontal , 1.45 m maximum vertical (Dv, max) and 2.59 m average net displacement. Meanwhile, en echelon R shears and cracks were recorded in some region. Besides, the 400-m depth of deep sedimentation (Ds) in the Christchurch City area. Greendale Fault showed close ratio Dv/Ds and W/Ds compared to the experimental case (in the same order), which indicated the wide zone of ground-surface rupture and deformation may be normalized with the vertical displacement (Dv). The foundation located above the basement-fault trace had obvious horizontal displacements and counter-clockwise rotation with increasing displacement. Horizontal displacements and rotation decreased with deeper depth of soil. The deeper embedded foundation caused more rotation. Besides, the soil near the foundation is confined and pressed when it rotates.

Key words: strike-slip fault, shallow foundation, ground deformation