Geotechnical Extreme Events Reconnaissance Report on the Performance of Structures in Densely Urbanized Areas Affected by Surface Fault Rupture During the August 24, 2014 M6 South Napa Earthquake, California, USA.

Julien Cohen-Waeber, Robert Lanzafame, Jonathan Bray, Nicholas Sitar

University of California Berkeley, Berkeley, CA, United Sates.

The August 24, 2014, M_w 6.0 South Napa earthquake is the largest event to have occurred in the San Francisco Bay Region, California, USA, since the M_w 6.9 1989 Loma Prieta earthquake. The event epicenter occurred at the South end of the Napa Valley, California, principally rupturing northwest along parts of the active West Napa fault zone. Bound by two major fault zones to the East and West (Calaveras and Rogers Creek, respectively), the Napa Valley is filled with up to 170 m. of alluvial deposits and is considered to be moderately to very highly susceptible to liquefaction and has the potential for violent shaking. While damage due to strong ground shaking was significant, remarkably little damage due to liquefaction or landslide induced ground deformations was observed. This may be due to recent drought in the region. Instead, the South Napa earthquake is the first to produce significant surface rupture in this area since the M_w 7.9 1906 San Andreas event, and the first in Northern California to rupture through a densely urbanized environment. Clear expressions of surface fault rupture extended approximately 13 km northward from the epicenter with a significant impact to infrastructure, including roads, lifelines and residential structures. The National Science Foundation funded Geotechnical Extreme Events Reconnaissance (GEER) Association presents here its observations on the performance of structures affected by surface fault rupture, in a densely populated residential neighborhood located approximately 10 km north of the epicenter. Based on the detailed mapping of 27 residential structures, a preliminary assessment of the quantitative descriptions of damage shows certain characteristic interactions between surface fault rupture and the overlying infrastructure: 48% of concrete slabs cracked up to 8 cm wide, 19% of structures shifted up to 11 cm off of their foundation and 44% of foundations cracked up to 3 cm. Of particular interest is the performance of pier and grade beam foundations which behaved more stiffly in comparison to typically observed shallow strip footing foundations.