

Analysis of Tilting Cause of a Residential Building in Durrës by the Use of Cptu Test

Authors : Neritan Shkodrani

Abstract : On November 26, 2019, an earthquake hit the central western part of Albania. It was assessed as Mw 6.4. Its epicenter was located offshore north western Durrës, about 7 km north of the city. In this paper, the consequences of settlements of very soft soils have been discussed for the case of a residential building, mentioned as “K Building”, which was suffering a significant tilting after the earthquake. “KBuilding” is an RC framed building having 12+1 (basement) stories and a floor area of 21000 m². The construction of the building was completed in 2012. “KBuilding”, located in Durrës city, suffered severe non-structural damage during November 26, 2019, Durrës Earthquake sequences. During the in-site inspections immediately after the earthquake, the general condition of the buildings, the presence of observable settlements on the ground, and the crack situation in the structure were determined, and damage inspection were performed. It was significant to note that the “K Building” presented tilting that might be attributed, as it was believed at the beginning, partially to the failure of the columns of the ground floor and partially to liquefaction phenomena, but it did not collapse. At the first moment was not clear if the foundation had a bearing capacity failure or the foundation failed because of the soil liquefaction. Geotechnical soil investigations by using CPTU test were executed, and their data are used to evaluate bearing capacity, consolidation settlement of the mat foundation, and soil liquefaction since they were believed to be the main reasons of this building tilting. Geotechnical soil investigation consist in 5 (five) Static Cone Penetration tests with pore pressure measurement (piezocone test). They reached a penetration depth of 20.0 m to 30.0 mand, clearly shown the presence of very soft and organic soils in the soil profile of the site. Geotechnical CPT based analysis of bearing capacity, consolidation, and secondary settlement are applied, and results are reported for each test. These results shown very small values of allowable bearing capacity and very high values of consolidation and secondary settlements. Liquefaction analysis based on the data of CPTU tests and the characteristics of ground shaking of the mentioned earthquake has shown the possibility of liquefaction for some layers of the considered soil profile, but the estimated vertical settlements are at a small range and clearly shown that the main reason of the building tilting was not related to the consequences of liquefaction, but was an existing settlement caused from the applied bearing pressure of this building. All the CPTU tests were carried out on August 2021, almost two years after the November 26, 2019, Durrës Earthquake and when the building itself was demolished. After removing the mat foundation on September 2021, it was possible to carry out CPTU tests even on the footprint of the existing building, which made possible to observe the effects of long time applied of foundation bearing pressure to the consolidation on the considered soil profile.

Keywords : bearing capacity, cone penetration test, consolidation settlement, secondary settlement, soil liquefaction, etc

Conference Title : ICSMGE 2022 : International Conference on Soil Mechanics and Geotechnical Engineering

Conference Location : Paris, France

Conference Dates : June 23-24, 2022