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Soil Improvement By Jet Grout Method And Geogrid Against Liquefaction: Example Of Samsun-Tekkeköy

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Liquefaction that occurs due to cyclic and temporary loads on non-cohesive and water-logged sandy soil during earthquake causes considerable loss of lives and property in Turkey and the world. Turkey is a country of which a major part of territories is under earthquake risk due to its tectonic characteristics. Therefore, necessary precautions should be taken against possible disasters such as earthquakes that cannot be prevented in existing conditions. This study focuses on soil improvement applications for a site, located in the influence area of the North Anatolian Fault Zone that is one of the most active strike-slip fault systems of the world. The site was found to have liquefaction potential as a result of the analyses taking into account seismicity of the region and soil conditions. The investigation site is located in the industrial installations, Tekkeköy district of Samsun province and 8 new fuel tanks will be built in the area. Accordingly, as a result of the drilling works performed on the ground for site investigation, the filling layer between 0,9-1,2 m up the ground surface, the medium-tight and medium sand between 6-8 m after filling layer and then at the bottom, following this, medium tight-dense fine-medium sand layers have been encountered. In the Standard Penetration Tests made in this layer, values within N_{30}=11-Refusal (>50) were obtained. It has been determined that the underground water level varies between 1.4-4 m according to the data obtained from the inspection well. In addition, the natural unit weight of the soil was determined as approximately 18 kN/m^3 and the internal friction angle as (ϕ), 30^o. The soil is composed of alluviums and layers of medium dense sand of the Holocene age originating from the sea. When all these conditions are evaluated, detailed risk analyses have been deemed necessary, since they indicate a risk of liquefaction. Liquefaction risk analyses were performed according to Seed and Idriss (1971) method for four scenarios of earthquakes with 6.0, 6.5, 7.0 and 7.2 magnitudes. As a result of the analyses made, it has been deemed necessary to improve the soil in order to prevent or reduce the liquefaction effects which may occur in a possible earthquake due to the presence of liquefaction potential in the research area. For this purpose, jet grouting method and geogrid fill system, which are used widely in Turkey, have been chosen as appropriate improvement methods. Geogrids are strong in tension so they are commonly used to reinforce subsoils below foundations. Additionally, jet grouting method provides high bearing capacity; it is solution to the settlement problems, it can be applied to almost any kind of soil and it has a short production period. Within this scope, optimal solution was obtained with 616 pieces of 8 m and 12 m jet grout columns with the diameter of 0.65 m and with geogrid mechanical fillings laid on jet grout columns. Thus, not only the risk of liquefaction was eliminated but also an improvement of more than 3 times of the bearing capacity of the foundation was acquired. In addition, the required quality control tests were carried out for the jet grout columns built in the research area and no adverse effects were observed.

Key words: Liquefaction, soil improvement, jet grouting, geogrid