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Mechanism od earthquake-induced landslides considered from geotechnical aspects

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Numerous large and long distance-sliding landslides occurred during the 2004 Mid-Niigata Prefecture Earthquake, Japan. From the geological observations at several sites, three types of soils and rock were found. The failure mechanism of those landslides has been studied and the results are introduced in this paper. At the first landslide site the thin and loose tuff sand seam existed between the upper and lower rock layers. Ground water flow was found in this sand seam which was supposed saturated at the time of the earthquake. Undisturbed block sampling was done at the site. Cyclic direct shear tests under constant volume condition were conducted in the labolatory. At the second landslide sites sandy slopes were failed due to liquefaction with high ground water level in the slopes. Undrained cyclic tri-axial shear tests were done on the undisturbed sandy soils obtained at the sites. At the third landslide site the slope soils were composed of strongly weathered mudstone. Undisturbed soil sampling was performed along the borehole in the slope and cyclic tri-axial tests of the specimens were done under the undrained condition.
From these results and the subsequently performed FE analyse, it was concluded that the strong earthquake motion produced large excess pore water pressure in the slopes below the ground water table, much decreased the undrained shear strength of the soils and made the safety factor of the slopes fairly below 1.0, which led to the large and long-distance sliding landslides.