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Pore water pressure change necessary to cause liquefaction failure of soil masses in undrained condition

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A theoretical model predicting the pore pressure change necessary for liquefaction failure of saturated soil masses in undrained condition is assessed. It is shown that a threshold pore pressure, ut, derived from the Mohr Coulomb failure criterion when pore pressure at failure is equal to the corresponding shear resistance is enough to initiate liquefaction type of failure in sandy masses. Loading tests to failure on source-area sandy soils from a catastrophic landslide location, undertaken to verify the model, show that under definite conditions of loading, a threshold state, characterized by the equality and subsequent constancy of pore pressure and shear resistance from a few seconds after the commencement of shearing until failure, develops in the sands at a given density. It is shown that not only do the sand samples characterized by this state sustain this unique equality and constancy from a few second after the start of shearing until failure but that their behavior unambiguously forms a boundary between the contractive and dilative sands at a fixed confining stress. Samples in which the threshold pore pressure was exceeded readily liquefied while those in which the pore pressure built-up was below the limit gained strength by tendencies to dilate. This paper demonstrates that while the stability of a slope founded on sandy soils may be breached when the pore pressure exceeds a certain limit, it is possible to make estimates of the limit. It is shown that where such estimates are accompanied with adequate field measurements of pore pressure, the efficiency of landslide prevention projects may be enhanced because only slopes whose stability is proven to constitute a real public threat are reinforced and reinforced adequately.