Liquefaction characteristics of gravelly soils

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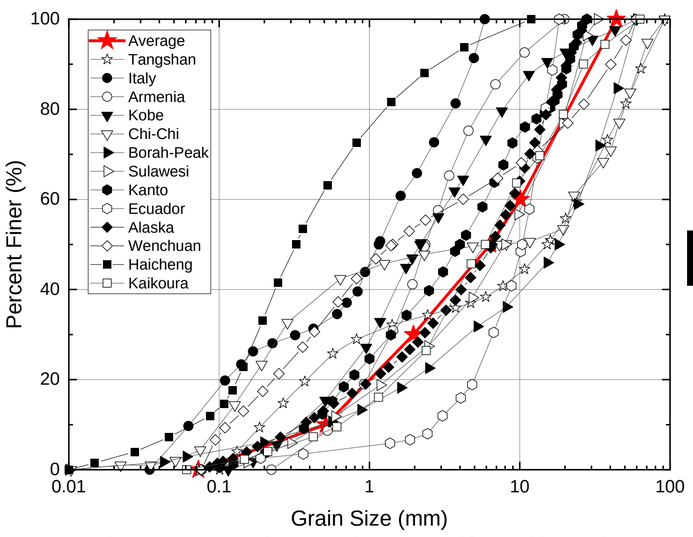
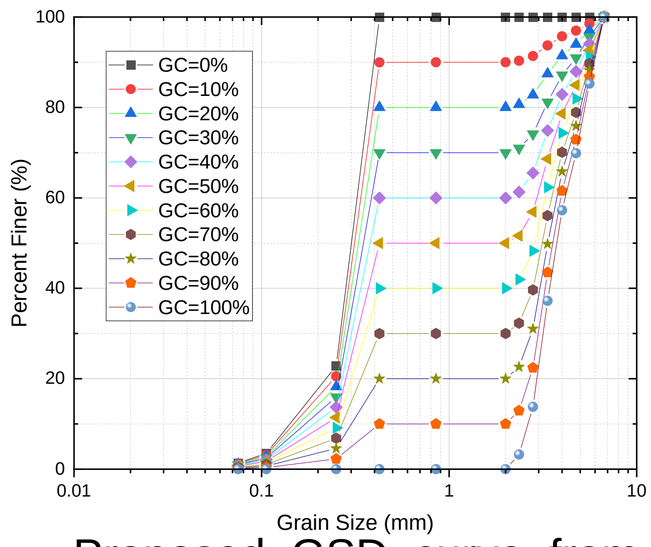
Case studies of gravelly soils

In the past, liquefaction was only considered for sands. However, several case studies of gravelly soils have been found around the world. The cases varied from flat to sloping ground. There is a need to study case studies to understand its mechanism.

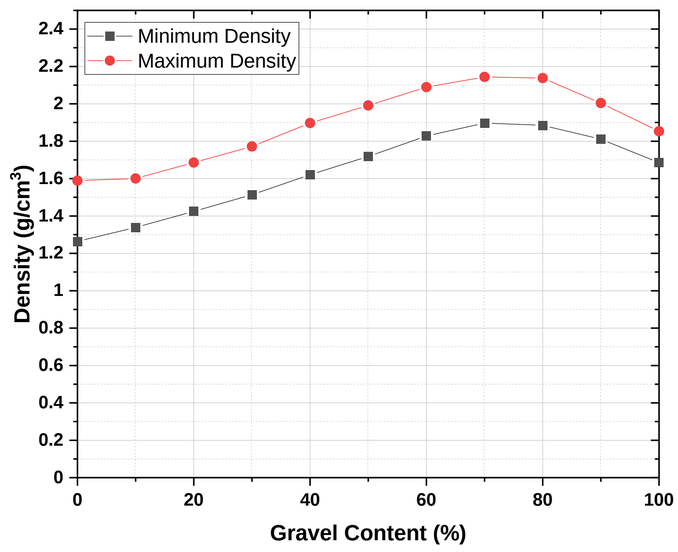
Case studies of gravelly soil liquefaction around the world



The Grain size distribution (GSD) curves of 13 case studies around the world show a wide range of gravel contents that can liquefy.



Proposed GSD curve from analysis of case studies and testing standards.



Density was found to increase with gravel content. The densest state was found at 70% gravel content.

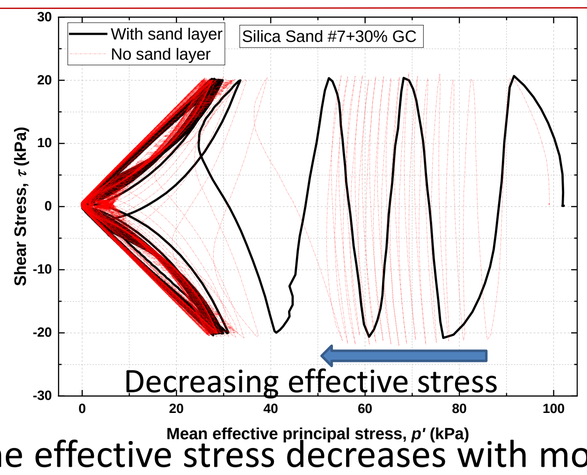
New test procedure for gravel

The experiments were conducted using the hollow cylinder torsional shear apparatus. This machine can reach high levels of deformation and can simulate actual ground conditions during an earthquake. A special specimen preparation method using a double pane mold and sand was also used to avoid membrane penetration error induced by the large particle sizes of gravels. Specimens with different gravel contents were tested in varying levels of cyclic stress.

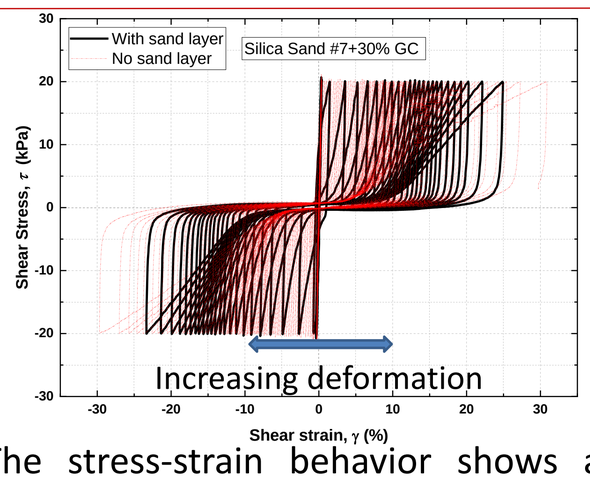
Specimen preparation

Experimental setup

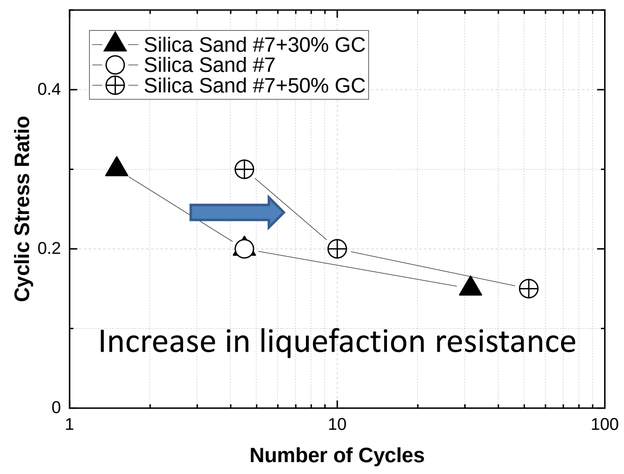
Liquefaction resistance of gravelly soils



The effective stress decreases with more cycles. When it reaches zero, the soil behaves like a liquid. The sand layer corrects the strength overestimation caused by membrane Penetration.



The stress-strain behavior shows an increase in shear deformation as the number of cycles increase. Strain accumulation in specimen with sand layer was faster than that of no sand.



Liquefaction resistance was less sensitive at low gravel contents and increased at higher gravel contents.