UNRAVELLING THE SECRET OF LIQUEFACTION IN LOOSE SANDS BY FREEZING

How strong is the Groningen sand in the subsoil during an earthquake? That is the question addressed by this study, which involves sampling at three locations in Groningen. Earthquakes can cause an imbalance in the sand and groundwater, turning it into quicksand in a process known as 'liquefaction'. The result is that the sand loses its strength, with possible damage to buildings, dikes, gas pipes and power lines as a result. The aim of this study is to assess the chances of this happening in Groningen. However, taking the samples while minimising the disturbance of the sand grains is not an easy task. Specialised methods were used such as the freezing of the soil before sampling.

'To date, no liquefaction has been observed in Groningen after earthquakes but we know from examples abroad that this is a risk in earthquake areas,' says geo-engineering expert Mandy Korff. 'On behalf of NAM, we are investigating when sand will liquefy and lose its strength. We are looking at sands of different ages. We expect, for example, the old sand from the Pleistocene to be stronger than is currently assumed in our calculation models and in any case stronger than the recently deposited, younger Holocene sand. These tests will allow us to determine with more certainty the risks of liquefaction for a given earthquake strength, and therefore to make better estimates as to whether and which measures must be taken to prevent or limit damage.'

This was the first time that frozen samples had been taken in Europe. The sampling method was first tested and monitored in the laboratory. After successful sampling in the laboratory, preparations were made for sampling in the field in Groningen under the supervision of permafrost experts from Alaska (CRRL). At each site, an area of 2 x 2 metres was frozen to a maximum depth of 10 metres using nitrogen. The temperature was monitored using fibre optics. The samples were drilled in the frozen soil body and transported in frozen form to the Deltares geotechnical laboratory in Delft. They will then be kept frozen during sample preparation before being defrosted shortly before the start of the laboratory tests in 2018. They will comprise the application of static and cyclic loads. We will use the results to validate current and new models for liquefaction. The work is part of the NAM study programme looking at risk management for earthquakes in Groningen (NAM.nl).

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Further reading:
https://www.deltares.nl/en/news/deltares-studies-the-strength-of-sand-in-groningen/