Contact

meindert.van@deltares.nl
T +31(0)6 2255 8695

huub.debruijn@deltares.nl
T +31(0)6 5124 6029

Making dike upgrade techniques more effective

Vacuum trial at Schardam using the new Beaudrain S technique

"POV Macrostability" is a 24-million-euro research project that is being managed for the High-Water Protection Programme (HWBP) by the Riverenland Water Authority. It consists of 60 subprojects looking at how to reduce the risk of macrostability using new reinforcement techniques. Macrostability is the phenomenon in which large parts of a dike slide when water levels are extremely high. Deltares is responsible for the technical vision and the quality of the research output and we are also involved in large full-scale trials.

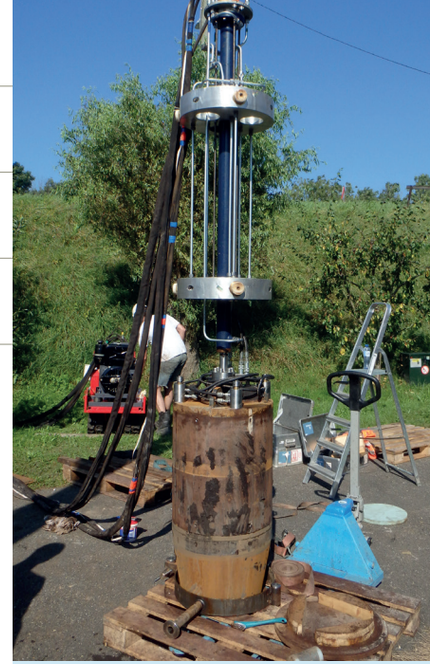
One of the subprojects developed new design rules for stability walls in dikes that have been accepted by the ENW expertise network and that result in a 20% more cost-effective approach to dike upgrades. Another subproject is a study of the actual strength of dikes. The strength of the dike and the subsoil is tested using large and undisturbed samples from the Hollandsche IJssel dike taken with a large-diameter sampler developed by Deltares in collaboration with Wiertsema and Partners.

One full-scale field trial looked at "vacuum consolidation", a method used to reduce settlement and horizontal deformation due to construction works. Applying a 60% vacuum under a geotextile on top of the soil has the same effect (higher shear strength) as preloading with a 3.5-metre-high sand berm. The durability of the higher shear strength is being assessed in three full-scale experiments. Pilot locations were selected near Bleskensgraaf and Schardam, which is where the conventional and new Beaudrain S vacuum techniques were applied. Field measurements, monitoring and laboratory tests were conducted before, and at different times after, four months of vacuum. Ball penetration tests showed an increase in strength by a factor of 3 due to the vacuum. At 100 days after the removal of the vacuum, there was a minor decline in ball resistance due to consolidation effects and the reduction of vertical stresses. Designers will be provided with a guideline for the expected increase in strength with vacuum consolidation.

Vacuum trial at Bleskengraaf

Another field trial looked at the "JLD Dike Stabiliser", a ground nailing technique. The JLD Dike Stabiliser is a long anchor rod with a spade-shaped anchor that is placed in the dike at an angle of approximately 45 degrees. A load displacement element is placed over the anchor rod to reduce cutting through the soil. A plate attached to the anchor rod is placed on the surface of the dike and the anchor rod is pre-loaded.

A consortium consisting of Deltares, JLD Contracting, Wiertsema and Partners, and the Antea group conducted two full-scale failure trials in Purmerend. One test used nails and the other did not. The analyses of the data from the tests showed how the technique works, how it should be modelled and what dike safety approach can be used as part of the new flood risk approach. The acceptance of the results by ENW facilitates the application of the technique in real dike-upgrade projects. A pilot project with the JLD Dike Stabiliser will be implemented in a secondary dike in Amsterdam in 2017.



Large-Diameter Sampler

Failure during full-scale testing of dike with JLD Dike Stabiliser (hidden in the ground)

Further reading:
http://www.povmacrostabiliteit.nl/