

THE RISK ASSESSMENT OF INCORRECTLY INSTALLED VINYL HEAVE SCREENS IN DIKES

The Dutch River dikes serve a vital role in protecting the country from floods, but they are susceptible to a damaging process called piping. Piping occurs when water seeps through the dike's soil, eroding it and weakening the dike's structure. Various measures can be implemented to prevent piping and safeguard the dikes, including heave screens. Among the available options, vinyl sheet piling has emerged as an advantageous solution due to its durability, corrosion resistance, and cost-effectiveness. However, the installation of heave screens can be complex and risky. Improper installation can lead to ineffective functioning, allowing heave and piping to occur. Additionally, screens may suffer damage during installation or degrade over time, compromising their effectiveness. This research aimed to evaluate the risks associated with the incorrect installation of vinyl heave screens, specifically concerning backward erosion piping in a dike.

A thorough risk assessment was conducted to assess these risks, utilizing the Wolferen - Sprok dike reconstruction project as an important reference. The study identified four failure mechanisms of heave screens: underpass, through pass, overpass, and backward pass. Potential causes of installation errors were classified into seven groups, including incorrect placement, soil resistance, obstacles in the ground, unsuitable sheet pile type, unsuitable installation equipment, insufficient embedding of the screen, and damage to the sheet pile. The study analyzed how installation errors influenced these mechanisms. Probability and impact assessments were conducted to determine the likelihood and severity of each mechanism occurring and its impact on the hydraulic gradient, a crucial indicator for evaluating heave risks. The research revealed that incorrect installation significantly increased the failure probability, particularly for mechanisms such as under-pass and over-pass. The risks doubled or even tripled when installation errors were considered, underscoring the need for mitigation measures.

A comprehensive approach involving detection, prevention, and mitigation measures is recommended to mitigate the risks associated with incorrect installation. Detection measures are crucial for identifying potential errors, while preventative measures address soil conditions, insertion speed, and sheet pile system reinforcement. The risk assessment concludes with recommendations for water boards and contractors, including site analysis, appropriate plank selection, assessment of ground resistance, monitoring installation parameters, and post-installation checks. The use of a Bowtie diagram is also proposed as a visual tool for communicating risks and associated measures.

