

Pipe depth measurement in small-scale backward erosion piping experiments

K. Vandenboer

Ghent University

V.M. van Beek & A. Bezuijen

Deltares, Ghent University and Deltares

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Backward erosion piping is an important failure mechanism for water-retaining structures, a phenomenon that results in the formation of shallow pipes at the interface of a sandy or silty foundation and a cohesive cover layer. Although the pipe depth reveals a lot of information on the backward erosion process, it has never been measured systematically. In this study we used a contactless laser triangulation sensor to measure the pipe depth during and after small-scale backward erosion experiments with a circular exit for three poorly graded sands with mean grain sizes varying from 0.155 mm to 0.544 mm. The pipes prove to be extremely shallow and the pipe depth close to the pipe tip is just large enough to let a particle through. As the pipe grows, the pipe depth increases due to scour and reallocation of grains, allowing for a higher flow rate and more grains to pass. Furthermore, the pipe often consists of a shallow part in the middle and deeper parts at the outside.