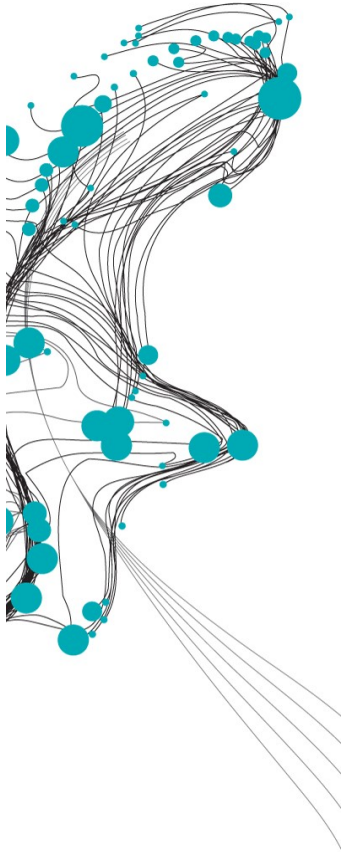


A STUDY OF THE EFFECT OF THE SLOPE ANGLE OF A GREEN DIKE ON THE FAILURE OF THE GRASS REVETMENT DUE TO WAVE IMPACT



Parts of the Netherlands are protected against floods from the sea by dikes. At the Dollard in the Netherlands, a special dike was constructed, a green dike. A green dike is a dike with a grass cover on the entire slope and does not contain a hard revetment to deal with the incoming waves. Unfortunately, it is uncertain under which exact storm circumstances the seaside grass revetment fails. The assessment of the strength of the grass revetment against wave impact is captured in the “Wettelijk Beoordelingsinstrumentarium” (WBI), but the slope angle is not included although it has an important effect on the revetment strength. Therefore, the objective of this research is to determine the effect of the slope angle on the duration until failure of the revetment due to wave impact, also termed resistance-duration.

Results of executed experiments were gathered with a literature study and were used to establish the relation between the slope angle and the resistance-duration. The results of the experiments with different slope angles are compared with the WBI and the Wave Impact Pressure Erosion (WIPE) model. A linear negative correlation between slope angle and resistance-duration described this relation in slope angle the most accurately. This means that a grass revetment on a slope of 1:6 has twice the resistance-duration compared to a revetment on a slope of 1:3 with similar wave conditions.

This relation was applied on the case of the project “The Wide Green Dike” at the Dollard. For different storm conditions the moment of failure was calculated. This resulted in a return period of 90 years for a slope of 1:7, while the WBI, that does not take the slope angle into account, predicts a return period of less than 10 years. The slope angle thus substantially reduces the probability of failure for the grass revetment in case of a gentle seaside slope. Additionally, this study found that waves below 0.5 meter do not cause damage to the dike and will not result in failure. The WBI suggests a threshold value of 0.25 meter, but the results from this study indicate that an increase of this threshold value to 0.5 meter can be considered.

Although the number of experiments is limited, this study showed the importance of the slope angle on the resistance-duration of the grass revetment. It is recommended to include the effect in the customised assessment of the WBI.



Figure 1: Cross section of a traditional dike and a wide green dike [van Loon-Steensma and Vellinga, 2019]

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