MODELLING THE INFLUENCE OF TRANSITIONS IN DIKES ON GRASS COVER EROSION BY WAVE OVERTOPPING

Transitions in dikes appear to be weak spots for grass cover erosion by wave overtopping. Erosion models are available to predict and evaluate grass cover erosion on dikes. However, it is currently not known how the influence of transitions on grass cover erosion must be included in these computational models. The objective of this thesis is therefore to set up a model approach to analyse the effects of transitions on grass cover erosion and to derive representative influence factors for one transition type.

Suitable transition types for the model analysis are selected based on expert opinions and the availability of data from wave overtopping tests. A general approach is introduced for analysing the influence of transitions on grass cover erosion by wave overtopping. The approach describes how the grass cover strength is determined considering the damage along the slope and, next, how representative influence factors for the transitions are calibrated based on the damage at the transition. The approach is specified for two erosion models: the hydrodynamic-erosion model and the cumulative overload method. Also, three methods for flow acceleration along the landward slope are considered for the cumulative overload method. Next, the model analysis is applied to seven test sections with a geometrical transition at the landward toe (Fig. 1).

The influence of the geometrical transition is calibrated in terms of the turbulence intensity parameter r_0 and the load factor α_M for the hydrodynamic-erosion model and the cumulative overload method, respectively. The calibration of turbulence intensity parameter r_0 for the load increase at geometrical transitions results in r_0 = 0.25 for mild slopes and r_0 = 0.45 for relatively steep slopes. The calibrated load factors for the three flow acceleration methods vary between α_M = 1.4 and α_M = 1.6 for mild slopes and range from α_M = 1.4 to α_M = 1.8 for relatively steep slopes. Generally, the calibrated load factor α_M exceeds the theoretical value for the load increase at geometrical transitions as function of the slope steepness by Hoffmans et al. (2018). It is concluded that the hydrodynamic-erosion model is better applicable for determining representative influence factors for transitions on grass cover erosion than the cumulative overload method.

The modelled erosion depth is linearly related to the inverse strength parameter C_E in the hydrodynamic-erosion model. Model results showed that the erosion rate of the grass sod is relatively high compared to the erosion rate of the clay layer. It is therefore recommended to distinguish between erosion of the grass sod and erosion of the clay layer to improve the hydrodynamic-erosion model. Finally, it is recommended to apply the calibration approach to other transition types to determine representative influence factors for each transition type using the hydrodynamic-erosion model.

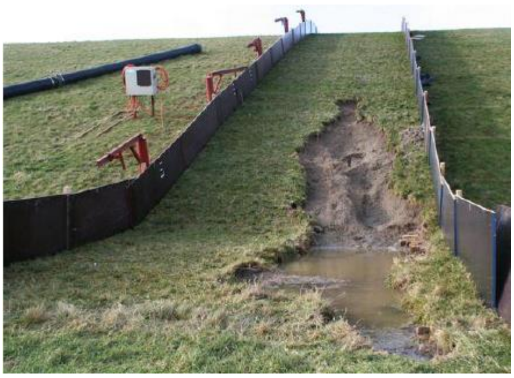

Figure 1: Example of grass cover erosion at the landward toe after a test with the wave overtopping simulator (Van der Meer, 2014)

Van der Meer, J.W. (2014). *Samenvatting kengetallen en resultaten golfoverslag- en golfoploopproeven*. Concept edition.

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