JOURNAL OF COASTAL AND HYDRAULIC STRUCTURES

Review and rebuttal of the paper

The effect of a suspended cut-off wall on backward erosion piping :

- laboratory tests and calculations

Nielsen

Editor handling the paper: André Koelewijn

The reviewers remain anonymous.

General comments This manuscript describes small-scale model tests and numerical simulations to assess the effectiveness of a suspended cut-off wall against backward erosion piping. The topic may be of interest to the journal's readership, but unfortunately, the manuscript is not well written, and important information about the tests and simulations is missing. In particular, as the authors' calculation of the hydraulic gradients from the test is unclear, this reviewer feels that the conclusions are not fully supported by the evidence provided. Thus, this reviewer recommends not accepting this manuscript in the present form. Revisions in accordance with the specific comments below may be needed.	The authors are grateful for the thorough review and have revised the document following the comments below. The calculation of the hydraulic gradient is explained in the revised paper.
(1) The statement in Lines 2-3 on Page 2 needs reference(s).	Reference to the relevant letter to the Dutch House of Representatives (2de Kamer) is included.
(2) The suspended cut-off wall (SCOW) appears for the first time at Line 3 on Page 2. This is a key component of the work in this manuscript, but it is not clearly defined and explained. The explanation with illustration and reference(s) is needed.	The SCOW has now also been added in line 2 of page 2 described there. Reference to Lane (1953) is included, as well as a sketch of a SCOW.
(3) “Assuming a stable sheet pile in horizontal direction” in Lines 5-6 on Page 2 does not make sense. It is hard to imagine the situation described here. Also, the meaning of the design criteria, i.e., the assumed failure mode and the conditions satisfied to cause the assumed failure, is unknown.	This is described in the textbook (Terzaghi and Peck, 1948). The potential confusing words ‘in horizontal direction’ have been removed and the text has been rewritten to clarify the method by Terzaghi.
(4) “One test was done without a SCOW and one with a SCOW of 5 cm long over the entire width of the container” in Lines 33-34 on Page 2 does not make sense. “5 cm long” means that the length of the wall in the vertical direction is 5 cm? Dimensions of the foundation ground and the cut-off wall are	Dimensions of the container are mentioned in the first line of this section. The 5 cm refers to the depth of the SCOW: ‘length’ has been replaced by ‘depth’.

unclear. They should be shown at the top of Fig. 2, i.e., both the plan view and the cross section of the model should be displayed.	In the caption of Figure 3 (former 2) is added: The seepage length from the filter left to the exit is 30 cm. The depth of the sand model is 10 cm, the depth of the cut-off wall 5 cm. Also, Figure 2 is updated and drawn to scale.
(5) In Lines 3-6 on Page 3, the authors explain the material used for the foundation ground. The materials and conditions of the filter layer and cut-off wall should also be explained. All the information needed to reproduce the experiments by readers should be provided in the manuscript.	More information is given: The SCOW was made of 1 cm thick acrylic glass. The filter was a permeable geotextile filter, approximately 1 cm thick. The seepage length is 30 cm.
(6) In Sub-subsections 2.2.1 and 2.2.2, the authors describe the observation at different water head differences (Delta H). To understand the significance of the Delta H, the seepage length should be clearly shown, but unfortunately, it is not mentioned in the manuscript. Based on Fig. 2, this reviewer tries to estimate it. However, as the location of the Standpipe 6 from the left end and the thickness of the filter layer are unknown, it cannot be done.	Figure 2, now Figure 3 is updated and drawn to scale.
(7) The authors talk about the erosion zone in Lines 16-17 on Page 3. However, this erosion zone is not clearly defined. Since it is not clearly defined and no figure for this condition is provided, no one can understand this erosion zone.	The word “zone” is replaced by “area” and it is indicated that this is the area where sand grains are removed.
(8) “The head at x=0.3 m is the head measured at the inlet of the box” at Line 3 on Page 5 cannot be understood by readers. Where is the inlet of the box? Does it correspond to the right end of the filter in Fig. 2? The x-axis and x-coordinate should be clearly shown in Fig. 2.	The x-axis and the distance from exit to filter are indicated in Figure 2 now Figure 3. The text has been rewritten to clarify the head loss across the filter.
(9) The authors say that “The head loss over the filter can be determined from the head difference between the standpipe at 0.3 m, upstream of the filter, and the one at 0.29 m (P6)” in Lines 3-4 on Page 5. According to this	Figure 2, npw Figure 3 is updated and drawn to scale. Furthermore, the seepage length is added.

explanation here, the left end of the filter is at x = 0.3 m. However, according to Fig. 2, the distance from the left end of the filter to Standpipe 6 is more than 1 cm, and it appears to be more than 3 cm	
(10) The authors talk about the exit tube at Line 6 on Page 5. What is the exit tube, and where is it located?	"Exit tube" and "Exit hole" has been replaced by "Exit" throughout the document.
(11) "This can be seen in Figure 4" at Line 10 on Page 5 cannot be accepted. Specifically, where can readers see this in the figure? For this reviewer, it is hard to understand this.	The standpipe numbers have been added. The last sentence is now: "The larger discharge results in a lower concentration of the sand-water mixture in the volcano and thus a lower pressure close to the exit, *as measured with standpipe 1, located 7 cm from the exit*".
(12) "The influence of contraction of flow lines to the exit hole is limited" in Lines 11-12 on Page 5 does not make sense.	Contraction of flow lines in the sand can lead to an increase in the pressure gradient as mentioned earlier in this section. Since there is already a pipe formed by erosion, the influence of this contraction will be limited and it is the sand-water mixture in the volcano that causes the decrease in piezometric head over time. The sentence has been clarified: *During the stage corresponding to line (I), there is already an erosion pipe of several centimeters, increasing the outflow area. This means that the contraction of flow lines to the exit is reduced compared to the initial situation, such that head losses are dominated by the sand water mixture.*
13) The authors say that "the slope of the line a proportional with the discharge" in Lines 14-15 on Page 5, but this reviewer doubts it. No reader can understand the timing of the measurements for Delta H = 7.4 (I) and 7.4 (II). If the former corresponds to Fig. 3(e) and the latter corresponds to Fig. 3(i), the pipe has already formed between Standpipes 6 and	There is always an increase of the discharge, even if there is erosion between standpipe 6 and 7. This is now indicated in the text.

7. This means that the apparent hydraulic conductivity of the soil between these standpipes has been changed. If so, this statement cannot be held because of the change in the hydraulic conductivity.	
(14) The authors say that "From that moment on, even without any further increase in the hydraulic head, the pipe propagated upstream across the SCOW and formed a depression near the upstream side of the wall (Figure 5 5(j))" in Lines 4-6 on Page 6. This situation may not occur in the real levee, as embankment settlement may not allow a large gap to form. More explanation is needed.	It is true that this situation might not occur in practice. However, in the experiments, with transparent cover, this process was observed. Here we describe the experiments, not the field situation. In the conclusion, text was added to describe the possibility of embankment settlement.
(15) The authors say that "Thereafter, the erosion process no longer progressed in the upstream direction but instead extended along the seepage path (Figure 5(m))" in Lines 7-8 on Page 6. The crack that appears in Fig. 5(m) may not happen in reality, this reviewer guesses. If so, further explanation is needed.	This section describes the experiment. What happens will depend to a large extent on the geometry of the real situation (height of the dike, type of sand). This is the post-failure behaviour. Important is the pre-failure behaviour.
(17) The authors say that "In this case we have a different situation since the inflow and outflow are different from the configuration of Terzaghi and Peck (Figure 2)" in Lines 14-15 on Page 8. This reviewer believes that no reader can understand the situation shown in Fig. 2.	Clarified with sketches of the cut-off wall and the sheet pile (now Fig. 1)
(18) The statement in Lines 15-16 on Page 8 does not make sense.	Explained that this is a comparison with the Terzaghi and Peck configuration
(19) The statement at Line 8 on Page 9 does not make sense. (20) What is "Rijkswaterstaat (2025)" in Lines 18-19 on Page 9?	Removed. This is a reference, see references list.
(21) The statement in Lines 6-7 on Page 10 does not make sense	Sentence changed.
(22) "The length of the fragment is chosen to be 16.75 cm" at Line 12 on Page 10 should read	Indeed, thank you, sentence changed as suggested.

as “The length of Fragment 1 is chosen to be 16.75 cm”?	
(23) The authors say that “The experimental average vertical gradient downstream of the SCOW just before failure, 1.74, is based on the measured head at P5, minus the head in P1 at failure” in Lines 14-15 on Page 10. Why can the authors use the head measured at Standpipe 1 for this assessment? A clear explanation is needed.	Sentence changed: *The experimental average vertical gradient downstream of the SCOW just before failure, 1.74, is based on the measured head at the bottom of the SCOW failure, P5, minus P1 to correct for exit losses that are also not present in the model.*
(24) The statement in Lines 18-19 on Page 10 does not make sense.	It explains why P1 is 1.6 cm at failure and not zero.
(25) The statement in Lines 22-24 on Page 10 is difficult to understand. Please make an explanation with an illustration.	A figure is added.
(26) “the criticalv ertical gradients” at Line 7 on Page 11 is a typo?	Yes this was a typo and is changed to “critical vertical stress”
(27) “that leads to ilure” at Line 12 on Page 12 is a typo?	Yes, should be failure
(28) The authors say that “In the experiment described 8 in this paper this was more than a factor 4” in the first conclusion. However, the factor shown here has not been explained in the sections before the conclusion.	It is now mentioned above figure 7
(29) The first sentence in the second conclusion is not supported by the observation in the experiment. We can see the significant difference between these two cases. Why can the authors say so?	From the pictures of the experiments. This is indicated in the text.
(30) “if the wall is well-designed” in the last of the second conclusion does not make sense, since design conditions for the wall have not been explained at all.	Sentence has been changed to: However, they will not lead to failure of the water retaining structure, until a much higher hydraulic head is applied.
(31) The first sentence in the third conclusion is explained clearly in the sections before the conclusion.	ok

(32) “different widths” in the fourth conclusion does not make sense. Different widths of what?	Different widths of the model container. This is now indicated in the text.
(33) The fifth conclusion may not be universally applicable. If the authors would like to say this, clear explanations of the conditions are needed.	It is according to Tanaka and Verruijt, as indicated in Figure 13. The literature and figure reference is included in the text.
(34) “The average vertical gradient along the SCOW that leads to failure due to heave in experiments is well above gamma’ / gamma_w” in Lines 24-25 on Page 13 does not make sense. The heave is not allowed in the experiment. Why can the authors say so?	This conclusion is removed
The research addresses a relevant topic in geotechnics by integrating numerical simulation with experimental measurements. The comparison between traditional design principles and experimental data underscores the study's scientific significance. The manuscript meets all professional criteria. The topic is novel and relevant, the literature review is thorough, and the research objectives are clear. The methodology is robust, and the conclusions are supported by the data. The paper is logically structured, concise, and its language and formatting—including figures, tables, and references—comply with the journal's guidelines.	Thank you.
1) Given the relatively small scale of the experimental setup (0.4 m length), how did you evaluate the influence of wall friction and boundary effects on the observed erosion processes and pressure distribution compared to real-world, full-scale conditions?	We are well aware that the experiments are small scale experiments. Therefore, it is mentioned in the text that larger scale tests are planned to investigate scale effects (conclusion 4) However, since the erosion is far from the surface of the sand we think that the influence of wall friction is not very high.
2) During the test, what procedures were implemented to ensure full saturation and to	Dry sand is rained in water. It is now mentioned in the text that this is done to get a fully

eliminate the influence of entrapped air, which could significantly affect the measured hydraulic conductivity and pore-water pressure readings?	saturated sample and that the tubes of the standpipes are checked for air bubbles.
3) Could you please clarify the modeling approach for the cut-off wall (SCOW) in D-Geo Flow? Specifically, was it implemented as an element with finite thickness and defined permeability, or as a boundary condition? Furthermore, did you account for any potential interface effects at the soil-wall contact in your numerical model?	It was implemented as a boundary condition. We have included pictures of the mesh used, so that this is clear. We did not account for potential interface effects.