JOURNAL OF COASTAL AND HYDRAULIC STRUCTURES

Review and rebuttal of the paper

Investigating Wave Transmission through Curtain Wall Breakwaters under Variable Conditions

Hoang Thai Duong Vu, Moritz Zemann, Peter Oberle, Frank Seidel, Franz Nestmann

Editor handling the paper: Alessandro Antonini

RESPONSE LETTER TO EDITOR AND REVIEWERS

Dear Dr. Antonini, JCHS scientific Editor,

thank you for giving us an opportunity to revise and resubmit our paper: "*Investigating wave transmission through Curtain Wall Breakwater under variable conditions*". We are very grateful that you and the Reviewers see potential in the paper. The Editor and Reviewers have expertise in providing professional, competent, and considerate comments. Indeed, the manuscript has been significantly improved based on those comments and suggestions. We would like to thank the Reviewers for their time and efforts to review our paper.

In revision, we have carefully managed to address in total 49 comments / suggestions. We highlighted all the changes in the "Revised version with changes marked" in combination with a "Revised manuscript without changes marked" for evaluation. Here, we briefly describe some major points of the revision as following:

1. Revise and shorten up the length of the paper, especially in the abstract and introduction sections.
2. Provide more information about the setups in laboratory experiment and numerical approach.
3. All figures have been modified with precise units and spaces. Names and types of regression lines have been addressed.
4. Performing additionally 15 tests in numerical modeling to compare with full-scale physical results from literature to enhance the reliability of the numerical approach.
5. The limitation of the study based on regular waves was clearly stated in Section 5.
6. Addressing all comments and suggestions from the Reviewer #1 and Reviewer #2. For a detailed explanation of our revision, please refer to our responses point-to-point to the Reviewers' comments.

We declare that this manuscript is original, has not been published, and is not currently being considered for publication elsewhere. We hope that you find our extensive revision and responses appropriate for publication and look forward to hearing from you.

Thank you again for giving us this valuable opportunity.

With our best regards,

Authors

REVIEWERS COMMENTS

Reviewer 1

The authors highly appreciate the Reviewer 1 for your effort to evaluate our manuscript. Thank you very much for your valuable comments and suggestions to improve our paper.

Comment 1: In line 13, the author to include references for the “multiple studies” that the author has mentioned.

We rewrote the abstract and deleted this sentence.

Comment 2: In line 23, why did the author investigate only regular wave conditions? And why the author did not investigate also (or only) random wave conditions?

Within this research, wave-structure interaction was investigated only in regular wave conditions due to restricted boundary conditions of our laboratoy facilities and computational runtime. We declare this in the section “Limitation and Oreientation for future studies” in the revision. See lines 528 - 540, page 22.

Comment 3: In line 64, the author to use another word than “natural-based” to describe the CWB.

Thank you. We re-wrote this sentence. See line 62, page 2.

Comment 4: In line 67, the author to include reference for the “scientific studies” that the author has mentioned.

We re-wrote the Introduction section and included the references, see lines 65-66, page 2.

Comment 5: In line 91, the author to include references for the “many studies” that the author has mentioned.

We included the references, see lines 82-83, page 2.

Comment 6: In line 100, the author to include references for the “other studies” that the author has mentioned.

We re-wrote the Introduction section and deleted this sentence.

Comment 7: Between lines 113 and 116 the author to include references.

Thank you. We corrected this sentence by adding “above” to refered to the mentioned studies in the previous paragraphs. See line 99, page 3.

Comment 8: In line 132 the author to include references.

We corrected the sentence. See line 110, page 3.

Comment 9: In line 137, the author to include references for the “studies” that the author has mentioned.

We re-wrote the Introduction section and removed that paragraph.

Comment 10: The author to explain why the author chose this geometry and characteristic for the CWB during the experiment.

We added the explaination in the revision, see lines 310-313, page 10.

The numerical model was further validated with other CWB configurations including A0.2S0.02, A0.1S0.2, A0.2S0.2 with different submerged rates and pier spacings, as pierspacing and bottom gaps act most significantly on the wave breaking efficiency of the structures (Suh et al. 2005; Subekti et al. 2019), therefore, we selected these configurations to test during the experiments.

Comment 11: In Figure 5, the author to explain how the readings from WG4 will not be affected by this close distance from the absorbing layer. Moreover, to include the distance between WG4 and the absorbing layer.

Thank you very much for your notification. The distance X from WG4 to the absorbing layer was setup of a wave length (m) for short-wave periods of 2 s to 3.5s, while X = 3 m for longwave periods of 4s to 8s to save the computational time and data storage. We corrected the sketch of wave flume setup by adding X (m), see lines 256 – 259, page 7.

Here, we made a sensitivity analysis to examine if X = 3 m is affected by the absorbing layer in case of long-wave periods (Fig. S1). Specifically, X varied from 3 m to 20.8 m (one wave length) and 30 m for the water depth of 4 m, wave height of 0.6 m, wave period of 4 seconds. The CWB I_120 was tested in the flume, bottom gap of 1 m and no overtopping. It can be seen in Fig. S2 that, when X changed from 3 m to 30 m, the wave transmission coefficient remained at a similar value of 0.23. It means that as the wave absorbing layer works effectively to absorb all incoming waves, the distance X between the WG4 and the absorbing layer can be reduced in the numerical approach to save the computational time and data storage.

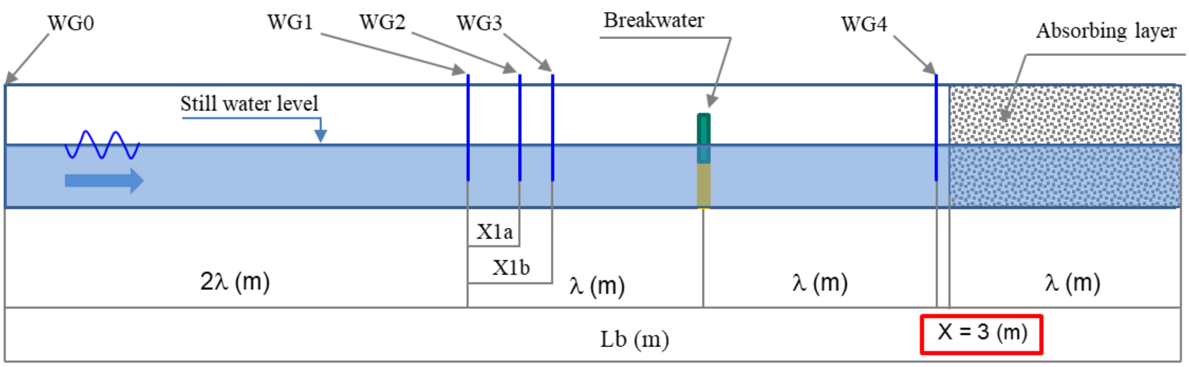


Fig. S1. Arrangement of the wave flume in the numerical model (for long wave-periods of 4s to 8s).

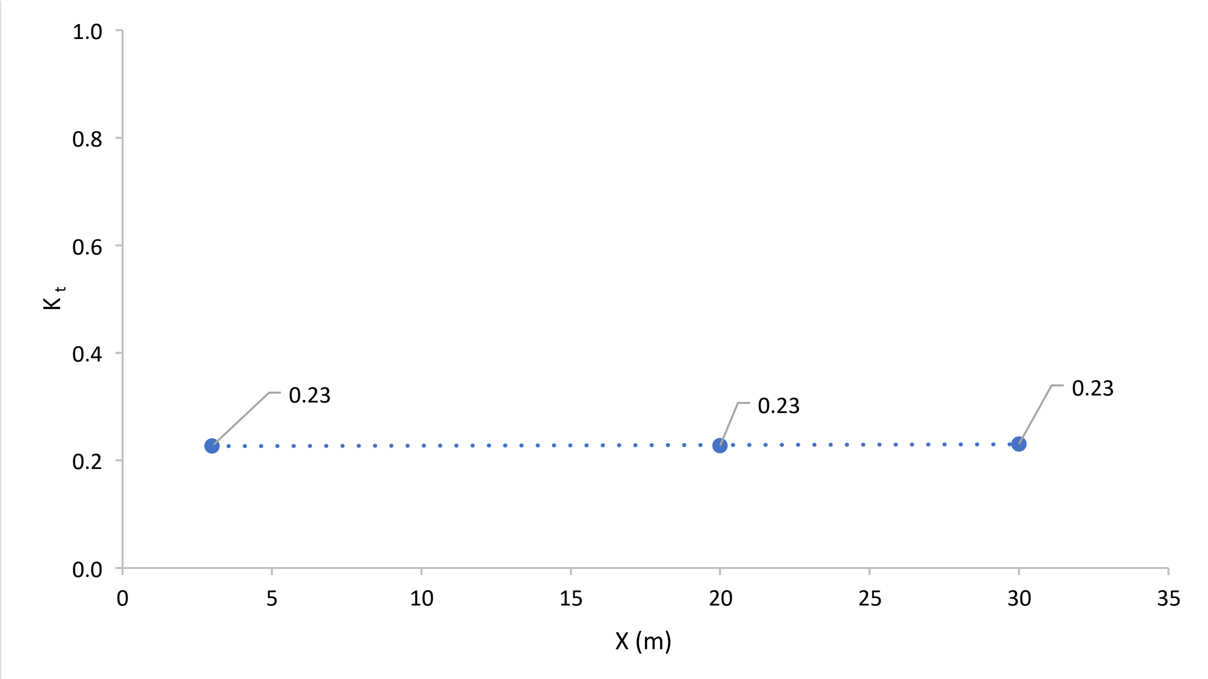


Fig. S2. Sensitivity analysis the distance X (m) on wave characteristics.

Comment 12: The author to mention the characteristics of the materials that were used for the absorbing layer and wave absorbing in the flume. Moreover, to include in Figure 4 the distance between absorbing layer and wave paddle and the distance between WG4 and wave absorbing.

A combination of sharp edged and smooth forms stones / rocks with different sizes (0.2 cm, 0.5 cm, 1 cm, 2 cm, 3cm, 5cm) were filled homogenisously on an inclinded metal sheet of the absorbing layer. The thickness of the rock layer is 4cm. The inclined metal sheet has homogenous holes of 0.1 cm, the distances among the holes are 0.1cm, therefore waves can go through and are slightly dissipated by the rocks and stones.

We added information about the absorbing layer in lines 186 - 188, page 5 and modified Figure 4 with detailed spacing distance as you suggested, see lines 218 – 219, page 6.

Comment 13: The author to mention why the wave generator cannot generate random waves.

According to your suggestion, we added some explanation about the wave generation in our laboratory and its technical restrictions to section 3.2, see lines 191 - 196, page 5. A wave generator, i.e., Wallingford system (Le et al. 2020; Le et al. 2021), was not accessible in our institute to generate random waves.

Comment 14: The author to include all the information regarding the friction & roughness of the sides and the bottom of the flume and if each individual of them will influence the results.

The sides of the flume are glasses with Manning’s roughness coefficient n = 0.010 to reduce wall effects to the maximum. Besides, the flume is 60 cm in width, and we setup the wave sensors at the center of the flume to minimize the effect of the flume walls. The bottom of the flume is smooth concrete surface (n = 0.013) which can be seen as a good approximation of the roughness of the seabed in the Mekong Delta. We added this information to manuscript, see lines 184 - 185, page 5.

Comment 15: The author to give more information for the equipment and software that were used for taken the measurement of the wave parameters, and how they are working, how they are taking measurements and equations they solve in order to provide the wave parameters.

The capacitive wave sensors were manufactured at the KIT-IWG, they include a copperwire, an insulation, and a capacitor C (Fig. S3). When water level goes up and down, the capacitor C changes his value, i.e., low- and high-values of C corresponding to the low- and high-water levels, respectively.

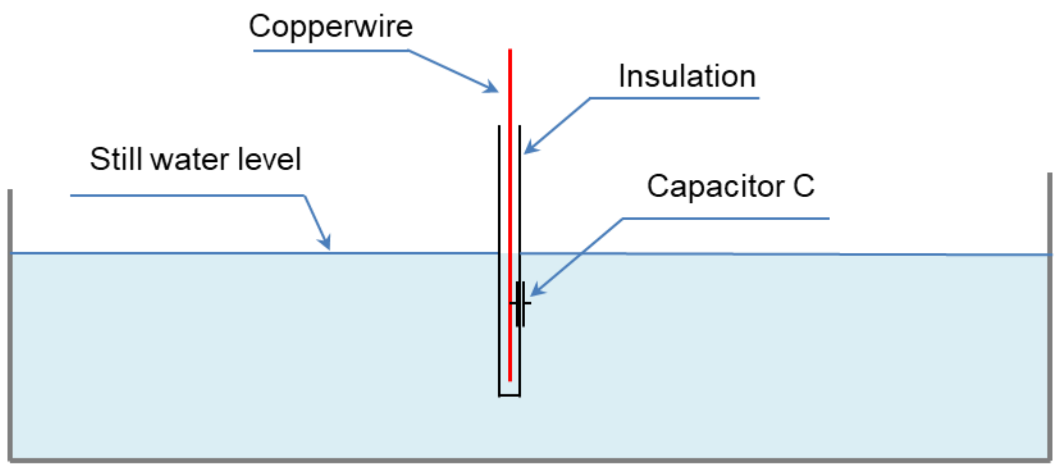
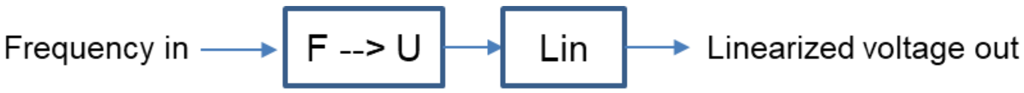


Fig. S3. Layout of a capacitive wave sensor.

The Capacitor is a part of a sine wave generator (G).

If C is low (low water level) the frequency is high, if C is high (high water level) the frequency is low. In our case the probes are setup with low water level of 10 kHz, high water level of 2 kHz.

Next step is a frequency to voltage converter and linearisation (Lin).



The Linearisation is necessary, because in wave generator f is a function of 1/C. This linearized voltage is given to an AD-Converter to read it and save data into a computer through the LabView (National Instruments) program. The wave data was acquired at 20 Hz.

Finally, we used WaveLab software (version 3.863) licensed by Aalborg University, Denmark to analyze wave parameters. The process of time series analysis and wave reflection analysis can be found at https://www.hydrosoft.civil.aau.dk/wavelab. We briefly describe this information in the revision, please see lines 178 - 179, page 5.

Comment 16: The author to mention the characteristics of the water that was used during the experiment.

Tap water was used to perform the tests (fresh water). See lines 188 - 189, page 5.

Comment 17: The author to mention the temperature of the water and also the room temperature where the flume was allocated.

We carried out the experiments in summer time, therefore, the temperature of water varied from 18 -25° celcius, while the room temperature was in the range from 24 – 28° celcius. See lines 189 - 190, page 5.

Comment 18: The author to include the sensitivity analysis of all the parameters and locations.

The sensitivity analysis of water temperature, water viscosity, and density of water were analysed in numerical modeling to test the K_t through the structure A2S- (bottom gap of 2m, no supporting piers, non-overtoping). Linear wave parameters included water depth of 4m, wave height of 0.6m and wave period of 4s. Four liquids were examined, i.e., fresh water at 20 °C, salt water with the temperature varying from 14 °C to 30 °C. The characteristics of four liquids have been provided in Table S1. It can be seen in Fig. S4 that, no differences in K_t values are detected under four different liquids, the K_t has similar value of 0.72. Therefore, our investigations using fresh water at 20 °C are seen to be reliable.

Table S1. Characteristics of four testing liquids.

Description	Temperature (°C)	Viscosity (kg/m/s)	Density (kg/m^3)
Liquid 1: fresh water at 20 °C	20	0.00100	1000
Liquid 2: salt water at 14 °C	14	0.00126	1026

Liquid 3: salt water at 20 °C	20	0.00109	1025
Liquid 4: salt water at 30 °C	30	0.00087	102 2

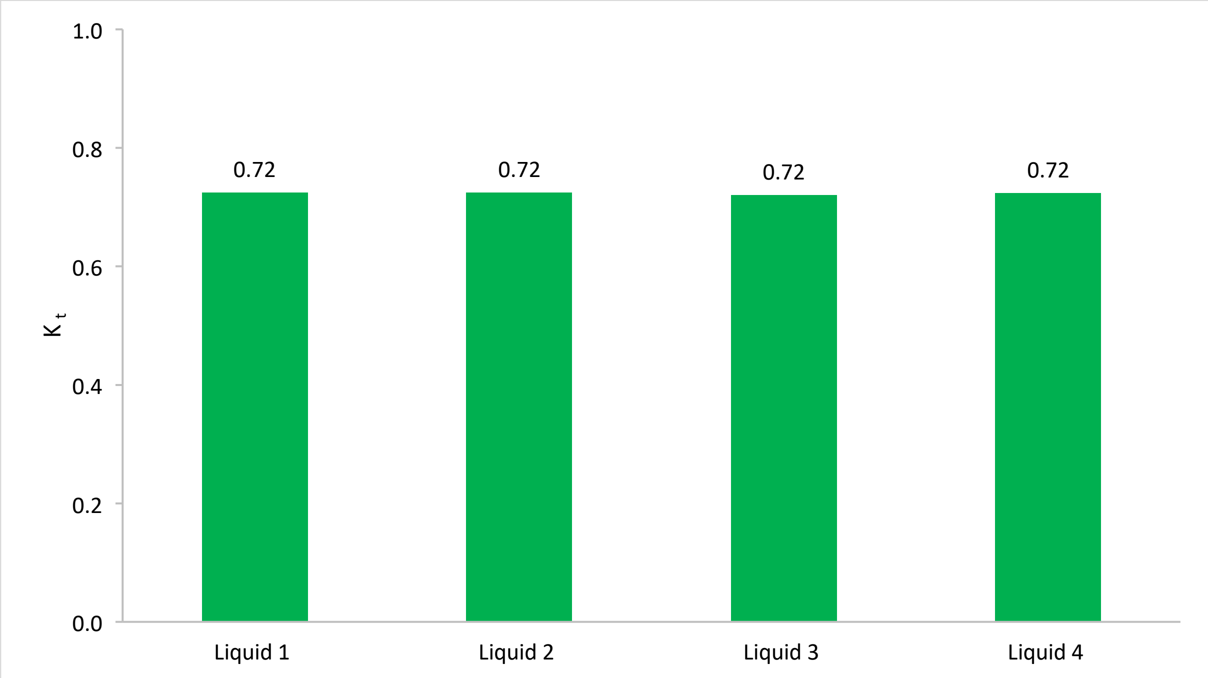


Fig S4. Sensitivity analysis of water viscosity, density and temperatures in wave transmission coefficient through A2S- configuration.

The locations of the probes of WG1 to WG4 were installed following the approach introduced by Masard and Funke (1980), therefore, no sensitivity analysis was performed for the locations of the probes.

Comment 19: The number of points based on the experiment (four in total) are not sufficient to make comparisons and calibrations with the numerical model (especially only for regular wave conditions). The author to explain and defend the author's decision for the approach that was taken.

Thank you very much for your comment, our explanation was misleading. Actually, there were in total eight (8) tests (four kinds of structures in two different wave periods and heights) in the small-scale experiments at the KIT-IWG. The approach of our study is to use physical results to prove the reliability of the numerical approach, then apply the numerical approach for further investigations of multiple CWBs under the Mekong wave characteristics in the full-scale.

Based on your valuable comment, we performed more validation tests in the numerical model to validate with experimental results from literature. See lines 350 – 360, pages 12 – 13.

To increase the reliability of the numerical approach, a validation with experimental results by Suh et al. (2005) was additional performed. Specifically, free configurations of D1.44, D0.96, and D0.48 by Suh et al. (2005) were examined in numerical modeling as shown in Fig. S5a. The structures have the same heights, constant pier spacing and thickness with different submerged rates. Fig. S5b presents the comparison of Kt values between numerical simulations (CFD, circles) and physical tests (EXP, rectangulars) plotted against the relative wave number (kh). It can be seen that, the results from CFD *simulations show a high agreement with EXP results for all three cases of D/h = 0.2 (green), 0.4 (blue), 0.6 (orange). Only a large difference for the case of D/h = 0.2 was noticed at the kh = 2.5, where the CFD values show significantly higher than CFD values (see dashed black circle, Fig. S5b).*

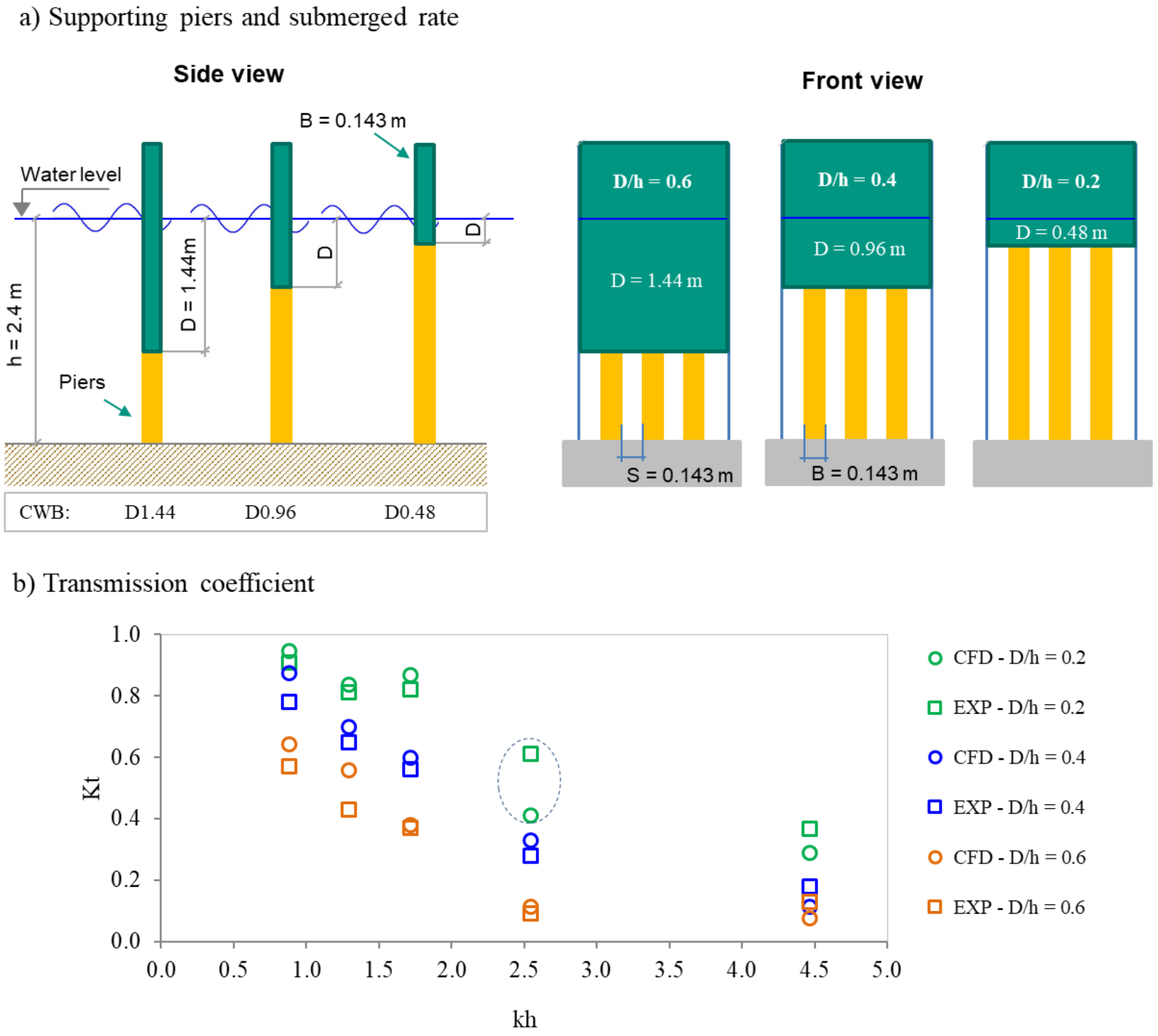


Fig. S5: Comparison of wave transmission coefficients (Kt) between numerical results (CFD) and full-scaled experimental tests (EXP) by Suh et al. (2005)

Comment 20: Author to compare the wave tests, the supporting piers and the bottom gap of the numerical model and the physical models of Suh et al. (2005) and Ajiwibowo (2018) that were used for comparison in order the similarity to be shown.

The description of the wave tests, supporting piers and the bottom gaps performed by Suh et al. 2005 and Ajiwibowo (2018) was written in lines 437 – 441.

Comment 21: All the numerical modeling results were analyzed, in the paper, very good and thoroughly. However, it can not be stated that the numerical model results are showing high agreement with the experiment results when the experimental results were used to calibrate the numerical model.

Moreover, only four (4) tests in the experiment and only for regular wave conditions are not sufficient. It needs more tests and also with random wave conditions for better comparison. It is understood that it might not be possible to do more experimental tests with random wave conditions due to time, funds or slots in the lab, therefore it would be better to calibrate the numerical mode with the experimental results and then compare it with data from the literature that use regular wave conditions for their tests.

Thank you very much for your comment and suggestion, herein we totally agree with. Due to the restrictions in our laboratory that the wave generator can not produce the random waves, and due to limited time in numerical simulations. We applied regular waves in our study as regular wave analysis is a good preliminary design tool and required design changes can be quickly assessed (Brekke et al. 2005). Therefore, many studies have been perfomed under regular waves, e.g., Rageh and Koraim (2010), Koraim et al. (2011), Koraim et al. (2013), Koraim (2014), Zhu et al. (2015), Ajibowo (2018), etc. However, the transferability of the results for practical application under random wave conditions needs to be evaluated. We acknowledge these limitations and plan further investigations using random waves before implementing a pilot CWB in the field.

Hence, within the framework of this paper, we greatly follow your suggestion to perform more works on the validation of the numerical model in regular waves to compare with results from the literature (i.e. Suh et al.2005) as mentioned in Nr. 13 and Nr. 19 above.

1 Reviewer 2

The paper presents an interesting analysis of curtain wall breakwaters (CWB) for use as more sustainable alternatives to traditional breakwaters.

The paper shows an experimental/numerical investigation to understand how different hydraulic parameters and configurations of CWB influence their capability of transmitting wave energy. The study is interesting and of interest for the readership of the journal, notwithstanding some obvious limitations, such as the study of regular waves only.

Thank you very much for your kind evaluation. The authors are grateful to the Reviewer 2 for your effort and time to review our manuscript and suggest valuable comments to improve our paper.

Comment 1: The study of scale effects with numerical models should be clarified (refer to Lines 249-251). In Table 1 only 1 test appears to be repeated in 1/10 and prottype scale. This is the test with H=0.5 m among test set No 1. Also, 1/10 is a fairly large scale, and I would expect, without sediment transport to have minimale scale effects.

Also, very importantly, numerical models are not affected by scale models if the processes that are not properly scaled are completely resolved. For example, if scale effects related to surface tension are expected, the model should include both the fluid and air phases. Could you please specify which type of scale effect are you expecting and which processes are you modelling?

Thank you very much for your comment. The objective of using the scaled laboratory model (1:10) in the KIT-IWG is to show an agreement between numerical approach and physical experimental results to enhance the reliability of numerical approach. Afterwards, the numerical model is mainly applied to investigate the wave-structure interactions under wave conditions relevant for the Mekong Delta.

We totally agree with you that, the scale of 1:10 is a fairly large scale. Based on our experimental experience, we evaluate the scale of 1:10 is sufficiently large. Hence, scale effects due to viscosity, surface tension and air entrainment have no significant impact on our target values. Please note that after validation of the numerical approach, the wave breaking efficiency of CWBs was simulated in full-scale with common parameter sets and therefore, scaling effects (if any) will not affect our study results and conclusions, respectively.

In the revision, we clarified the approach (see lines 240 – 244, page 7) and divided the wave boundary conditions into two separate tables, i.e., Table 1 and Table 2 as shown in lines 270 274, page 8 to avoid misunderstanding.

Comment 2: You used regression lines without explaining what type and which level of uncertainty is associated to them. This is done for all the results presented in Section 4.2. In some cases, this leads to connect with power laws 3 points (see Figure 13 and 15). Also existence of maxima (see series (iii) in Figure 15) is introduced but, due to the small number of samples availlable cannot be fully justified. In my view this aspect should be better explained in the paper and the simplest regression lines (linear) should be used wherever possible to give ideas of the general trends. Finding empirical relationships is out of scope for the paper and I do not think he should be attempted.

Thank you very much for your suggestion. We added the description of regression lines for the figures in the revised manuscript. Several trendlines are selected to have the best fit to the distributions of the K_t values as follows:

- Figure 9: power trendlines for K_t, lorarithmic and linear trendlines for K_r and K_d. See lines 374 - 375, lines 381-382, and lines 385 - 386, page 14.
- Figure 10: power trendlines, see lines 405 - 406, page 16
- Figure 11: exceptional trendlines, see lines 423 - 424, page 17.
- Figure 12: exceptional trendlines, see lines 440 - 441, page 18.
- Figure 13 to Figure 15: corrected to “linear trendlines” following your suggestion. See lines 457 – 458 at page 18, lines 486 - 487 at page 20, and page 510 - 511 at page 21.

Comment 3: Some numerical set up details should be much better clarified, e.g. if a convergence test was carried out, the Courant number. Also, some more details on the wave generation mechanism should be provided.

The numerical settings in the model are briefly clarified in the revision, see lines 245 – 249, page 7.

The settings in the numerical models are briefly described, e.g., the computational domain is covered with hexahedral cells; liquid properties include water at 20 □C, density of 1,000 kg/m3, dynamic viscosity of 0.001 kg/m/s; time-step is controlled by “Stability and convergence” and automatically adapted in order to ensure that Courant–Friedrichs–Lewy (CFL) numbers remain below a threshold of 0.45; advection is discretized using a second order scheme while the fluid fraction is solved with the default Volume of Fluid (VOF) scheme (Hirt and Nichols 1981).

A congergence test based on grid-size sensitivity analysis was mentioned in the manuscript, see lines 336 - 349, pages 11 - 12.

On the other hand, numerical uncertainty is additionally assessed in terms of the fine Grid Convergence Index (GCI) introduced by Celik et al. (2008) using three different representative cell sizes to examine the K_t values through the structure I_120 □. Here, three grid-sizes of 0.03m, 0.05m, and 0.1 m are selected corresponding to the K_t values of 0.235, 0.233, and 0.227 (Fig. S6). As K_t is an important coefficient to evaluate the wave energy breaking of breakwaters, hence, small changes could result in large numerical uncertainty identified in terms of the GCI. For this case, GCI remained low of 1.2%, therefore, this does not account for modeling errors.

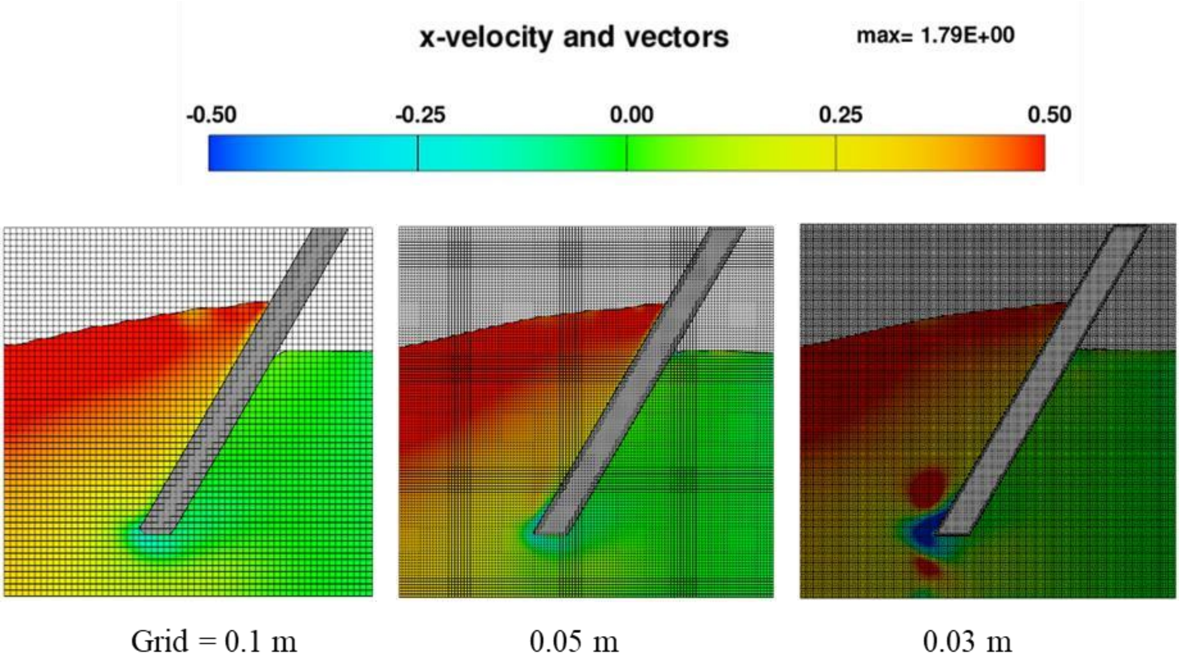


Fig. S6: Grid convergence for wave transmission through the structure I_120°.

Wave generation mechanism was mentioned in lines 231 – 239, page 7.

This CFD platform simulates regular linear and nonlinear waves (Stokes, Stockes and Cnoidal, and Solitary) as well as random waves. A linear wave has a sinusoidal surface profile and generated using Airy's linear wave theory. The elevation of a linear component wave is expressed as

$$\square = A sin(\omega t+\varphi)$$

where A, ω, and φ are wave amplitude, angular frequency and initial phase, respectively (Flow Science 2008). Irregular or random waves can be defined by either using multiple sinusoidal linear component waves with independent frequencies, amplitudes and initial phases, or using random wave generator based on a wave energy spectrum, i.e., JONSWAP or PiersonMoskowitz.

Comment 4: The limitation of having only studied regular waves should be highlighted. What is expected in terms of random waves? I suggest to link to regular and random waves studies for traditional breakwaters.

Thank you very much for your suggestions. The limitation of this study based on regular waves was addressed in Section 5 of the revision, please see lines 529 - 534, page 22.

Our study results are subject to limitations and uncertainties related to wave characteristics. Due to the restriction of our laboratory and the computational runtime in numerical modeling, we studied the wave-structure interaction under regular wave conditions. Although, regular wave analysis is a good preliminary design tool and as required design changes can be quickly assessed (Brekke et al. 2005), the transferability of the results for practical application under random wave conditions needs to be valuated. We acknowledge these limitations and plan further investigations using random waves before implementing apilot CWB in the field.

As random waves contain numerous wave heights and wave periods to be representative of the natural sea states, it is required to simulate random waves in a much longer interval to be reliable for wave analysis. Therefore, it is very time-consuming to simulate random waves within this study in numerical modeling because we tested a lot of scenarios and sensitivity analysis.

Link to regular and random waves for traditional breakwaters is addressed in lines 535 – 540, page 22.

Up to now we evaluated several studies on the hydrodynamic performances of breakwaters under regular and random wave conditions. For instance, Yamamoto (1981) showed comparable results in wave transmission through a floating breakwater under random waves and regular waves. Besides, Neelamani et al. (2002) stated that the "⊥"-type breakwaters worked even more efficiently in random waves than in regular waves, while the trends in both approaches showed the same. Hence, it can be assumed that the wave transmission through CWBs in regular waves would have similar values/trends under random wave conditions.

Comment 5: There are many important details that should be addressed in the paper, regarding notation, references and convention about spacing between measurement and unit, to name some examples. I have highlighted them in the detailed comments.

We have carefully corrected all issues you mentioned in the detailed comments section below (from Comment 7 to Comment 28).

Comment 6: The paper could be much more concise. I suggest to reduce the Introduction, which is in places out of focus.

Thank you, we have carefully revised and re-arranged the contents in the Introduction section. Currently the introduction is in focus and much shorter with 1388 words (instead of 1790 words in the last version).

Detailed comments:

Comment 7: Line 9-11: This is not the only coastal protection strategy and the statement should be put into context. Breakwaters are among the possible protection strategies.

We corrected this sentence according to your comment. Please see lines 9-11; page 1.

Comment 8: Line 11-13 this statement is not sustained at this stage of the paper and should be removed from the abstract, which is anyway a bit too long. I suggest to keep the description of the advantages of CWB (up to line 20) to a minimum and focus on methodology and results.

Thank you. We totally agree with your suggestion and deleted them.

Comment 9: Line 27: FLOW3D is one of the several CFD solvers available. It is more informative to say which type of theoretical approach was used.

We provided more information on the theoretical approach of FLOW3D. See lines 19 – 22, page 1 and lines 221- 223 page 6.

Comment 10: Line 28-30 "high agreement" is not quantitative, high espect to which metrics should be defined. Use normalised RMSE or similar for, e.g. flow variables.

Thank you. We adapted your comment in comparison of wave transmission coefficients between numerical and physical models in small-scales and large-scales with the correlations R^2 = 0.89 to 0.93, respectively. See Fig. S7 below.

We clarified it in the revision, see lines 24 – 25 in the abstract, and lines 361 -366 at pages 13 - 14.

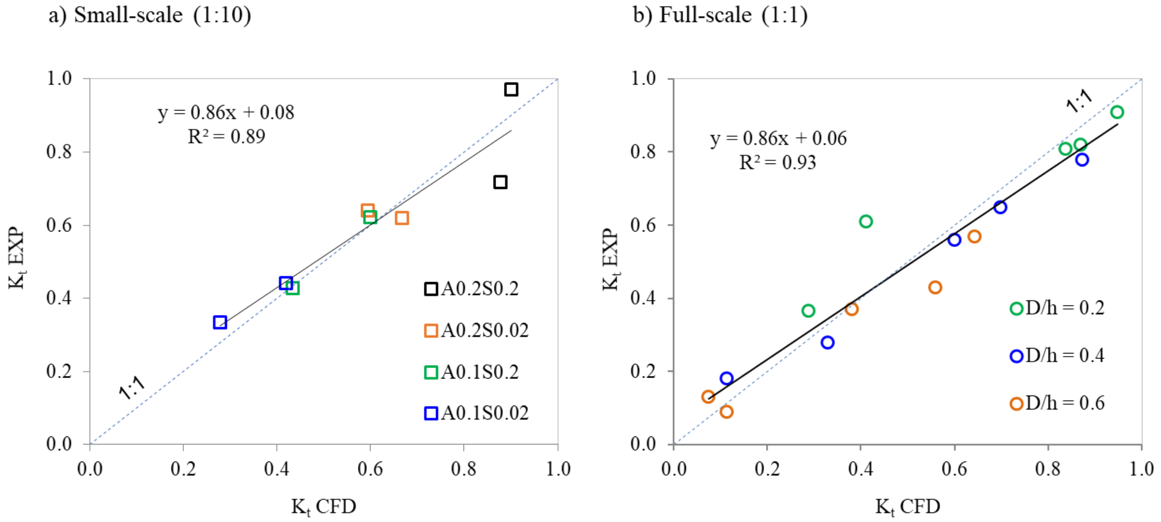


Fig. S7: Correlation of K_t values between numerical simulations (CFD) with small-scale (a) and full-scale (b) experimental results (EXP).

Comment 11: Line 31: inclination with respect to what?

We corrected the writing, see lines 16 – 17, page 1.

Comment 12: Line 45: This is a 25 years old reference, can you replace it with something more recent?

Thank you. The reference was changed to a more recent citation of the United Nations (2017), see line 43, page 1

Comment 13: Line 49-50, references are needed here. The effect on incresead temperatures is well documented, while the impact on storms intensity and frequency is more complex. I suggest to refence a relevant IPCC report.

As suggested, we added a citation of the IPCC, see Pörtner et al. 2022 in line 48, page 2.

Comment 14: Line 52 I would suggest another word instead of impact: maybe challenge?

Thank you. We re-wrote this statement following your suggestion. See line 46, page 2.

Comment 15: Line 64: What is meant here with more natural-based solutions? Nature-based solutions are usually solutions that mimic a natural process/enviroment. CWB are engineered solutions and I find it difficult to classify them within nature-based ones. Are the authors instead mean that the solution has less impact on sediment transport?

Thank you for your comment. We re-wrote this sentence, see lines 62, page 2.

Comment 16: Line 67: which studies? references are needed here.

We re-wrote the introduction and included the references, see lines 65 – 66, page 2.

Comment 17: Line 86: references are need here.

This paragraph was removed and combined with another paragraph to shorten the Introduction section.

Comment 18: Line 115: maybe applications (plural)

We adapted your correction, see line 101, page 3.

Comment 19: Line 116: more specific information about literature and the location of the port would be useful.

The name of the port was added to the text. See lines 101 -103, page 3.

Comment 20: Line 135 period starting with Especially, It lacks of punctuation and it does not read well. Please revise.

We re-wrote this paragraph in the revision, lines 113 -114, page 3.

Comment 21: Line 152 MD was already defined in line 127

We adapted. Thank you.

Comment 22: Line 202, "regularly" this is not very informative, which type of paddle is this, and the figure does not clarify much. Can you povide more information?

According to your suggestion, we added some information about the wave generation and its technical restrictions to Section 3.2, see lines 191 - 196, page 5.

Comment 23: Line 217 more accurately refer to Froude scaling laws.

Thank you. We provided more information referring to Froude scaling laws, i.e., Froude number equation, expressions of similitude in the scales of geometry, time, velocity and mass. See the correction from lines 208 to 214, page 6.

Comment 24: Lines 239-245: This information is more suitable for the Introduction/literature review section.

Thank you, we adapted for your suggestion and shorten this paragraph to describe more about the wave mechanism in FLOW3D. See lines 231 – 239, page 7.

Comment 25: Line 304 no space between measurement and unit. Please always allow one space as per convention. Check also figures, e.g. Figure 7.

All figures in the manuscripts have been corrected based on your excellent notification.

Comment 26: Line 326: You considered an interval that is not a multiple of the wave period. Which consequence has this on your results given the relatively lo number of waves? Also Courant number should be provided. Please also specify that your grid cells are squared.

According to Brekke et al. 2005, for an acceptable regular wave, the waves should be of near permanent form and the height of the waves from one cycle to the next within the test duration should have minimum prescribed fluctuations. Therefore, we examined the regular waves in the most stable interval of around nine to ten waves. The Courant number maintains below 0.45 following the numerical setups as addressed to the Comment 3 (in the Reviewer 2 section) above.

Comment 27: Line 379 although the periods tested are limited, you might want to try use B/L instead of B only.

Thank you very much for your comment. As the sub-section 4.2.2 focuses on the effect of the wall thickness (B) on the wave characteristics, therefore, we kindly keep the expression of B only versus the relative wave number (kh) from 0.5 to 4.05 corresponding to the wave periods of 8s, 6s, 4s, 3.5s, 3s and 2s, respectively.

Comment 28: Line 764 This reference seems not to be correct. Also, Line 770 Is there an Harvard style reference for this source? I suggest to chack carefully al references to be in one consistent format as required by the journal.

Thank you for your notification. We replaced the mentioned reference by Le et al. (2021); Dao et al. (2021), see line 171, page 5. We also updated the style of all references in the revision according to the format of JCHS.

1.1 Reference

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