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Manuscript Title: Experimental study on scour and turbulent flow characteristics around unsubmerged I-head and T-head groynes

Response to Reviewer1

Dear Reviewer,

We would like to extend our sincere appreciation to you for dedicating your valuable time to review our paper and provide invaluable feedback. Your insightful comments have been instrumental in shaping the current version of the manuscript, and we are grateful for your contributions to improving our work.

The authors have diligently considered each of the comments and strived to address them comprehensively. We are committed to meeting the high standards set forth by the journal, and we hope that the careful revisions made to the manuscript align with your expectations.

We welcome any further constructive comments or suggestions you may have to enhance the quality of the paper. Your expertise is highly regarded, and your input is invaluable to us.

To facilitate your review of our responses to the comments, we have provided a point-by-point breakdown below, in blue. Additionally, all modifications made to the manuscript have been highlighted in yellow for your convenience.

Comments and Suggestions for Authors:

There are many previous studies regarding using this type of physical models for groynes. I cannot find considerable novelty in your work.

Author response: Thank you for your comment regarding the novelty of our work. We appreciate your scrutiny and we would like to provide additional context to clarify the unique contributions of our study in the context of previous research on physical models for groynes. While it is true that there has been prior research on the use of physical models for groynes, it's important to note that our study focuses on addressing significant gaps in the existing literature.

In this field, previous research has emphasized the advantages of T-head groynes over the traditional I-Head Groyne (IHG) [42-47]. However, the majority of these investigations on THG have centered around specific aspects, such as evaluating local scour depth [44,46,48-51] or analyzing flow characteristics around these groynes [42,52-54].

What sets our study apart is its comprehensive approach. We have delved into 3-D mean and turbulent flow characteristics and their correlation with scouring around the THG. Moreover, there is a notable absence of comparative studies between IHG and THG, which our research specifically addresses [47].

Furthermore, most THG investigations have been conducted in channel bend configurations, leaving a gap in understanding their behavior in straight channels featuring a mobile bed. Our study, situated in such conditions, aims to bridge this knowledge gap by presenting experimental results and comparing scour patterns, mean and turbulent flow characteristics around both IHG and THG, particularly under unsubmerged clear-water flow conditions.

It was observed that the effective bank protection length in case of THG is around 1.5 times higher than in case of IHG while the maximum equilibrium scour depth in case of THG is around 3 times higher than in case of IHG (Page: 18; Line: 575-581).

In response to the reviewer's valuable suggestion, the authors have additionally incorporated a comprehensive cost-benefit optimization analysis for both groyne types (Page: 15-17; Line: 428-515), enhancing the overall quality and scope of the paper. The findings from the presented cost-benefit analysis acts as a guidance in decision-making approach for selecting groyne shape and dimensions. We appreciate the reviewer's input in this regard.

We believe that the insights garnered from this investigation have the potential to inform future design approaches, potentially expanding the utilization of different head shaped groynes in various settings.

Additionally, the experimental data generated in our study will serve as valuable input for the calibration and validation of numerical models in this domain, further contributing to the advancement of river engineering research.

These points are also emphasized at the end of the introduction section in the revised manuscript to provide a clear overview of our research objectives and contributions. (Page: 2-3; Line:91-125)

I suggest considering some novelties for example optimizing the size of I-head and T-head groynes (using optimization algorithm and surrogate models along with the physical model).

Thank you for your valuable suggestion regarding the optimization of the size of I-head and T-head groynes. We have taken your recommendation into consideration and have carried out a comprehensive cost benefit analysis to address this aspect.

In our study, we performed a cost benefit analysis for both IHG and THG, considering key parameters such as their length, depth of flow, and thickness of the groyne as the variables. Our objective was to estimate the cost expression for the construction of both IHG and THG, while also considering the effective bank protection length as observed from our experimental data as the benefit for constructing these groynes.

To provide a detailed and transparent account of this analysis, we have included the derivation of the cost benefit ratios as Annexure A in the revised manuscript. Additionally, we have incorporated the expressions and observed plots resulting from the cost benefit analysis, along with thorough discussions and conclusions drawn from these findings, within the revised manuscript as a sub-section in the Result and discussion section (Page: 15-17; Line: 428-515).

The cost-benefit analysis reveals that when considering both the cost of construction and effective bank protection lengths, IHG is the more cost-efficient groyne compared to THG.

This addition not only enhances the depth of our research but also addresses your suggestion by providing a quantitative evaluation of the cost-effectiveness of different groyne configurations. We believe that these enhancements significantly contribute to the value and relevance of our study.

If you have any further comments or suggestions regarding this aspect or any other aspect of our work, we would greatly appreciate your feedback.

1. What is the main question addressed by the research? response: turbulent flow features by a physical model for two types of groynes.

Author response: As aptly noted by the reviewer, this study explores into the 3-D mean and turbulent flow characteristics and their correlation with scouring around both IHG and THG structures. It presents a thorough comparative analysis of these two groyne types. In response to the reviewer's valuable suggestion, the authors have additionally incorporated a comprehensive cost-benefit optimization analysis for both groyne types (Page: 15-17; Line: 428-515), enhancing the overall quality and scope of the paper. We appreciate the reviewer's input in this regard.

2. Do you consider the topic original or relevant in the field? Does it address a specific gap in the field? Response: in the current form, no novelty is available, and no important research gap is addressed

Author response: In response to the reviewer's comments, we have endeavored to provide a more explicit delineation of the research gap and how it is effectively addressed in the revised manuscript (Page: 2-3; Line:91-125). We sincerely appreciate the reviewer's insightful suggestions for enhancing the novelty of our work. As suggested, we have incorporated the cost-benefit optimization technique, which has allowed us to draw significant and valuable conclusions (Page: 15-17; Line: 428-515). We are grateful to the reviewer for their valuable input, which has undoubtedly improved the quality and contribution of our research.

3. What does it add to the subject area compared with other published material? Response: as mentioned no considerable novelty compared with previous studies

Author response: In response to the reviewer's comments, we have endeavored to provide a more explicit delineation of the research gap and how it is effectively addressed in the revised manuscript (Page: 2-3; Line: 91-125). We sincerely appreciate the reviewer's insightful suggestions for enhancing the novelty of our work. As suggested, we have incorporated the cost-benefit optimization technique, which has allowed us to draw significant and valuable conclusions (Page: 15-17; Line: 428-515). We are grateful to the reviewer for their valuable input, which has undoubtedly improved the quality and contribution of our research.

4. What specific improvements should the authors consider regarding the methodology? What further controls should be considered? Response: adding optimization method for finding the best size of the groynes. In fact, a surrogate model and optimization method along with the physical model

Author response: Thank you for your valuable suggestion. We have taken your input into consideration and have included a dedicated section in the Results and discussion section focusing on cost-benefit optimization for various dimensions of both IHG and THG (Page: 15-17; Line: 428-515). This section introduces cost-benefit functions for both groyne types, which are derived from the construction costs and the benefits in terms of effective bank protection length provided by each groyne type. we have included the derivation of the cost benefit ratios as Annexure A in the revised manuscript. This addition enhances the comprehensiveness of our study and allows for a more detailed assessment of the optimal groyne size. We greatly appreciate your input, which has contributed to the enhancement of our methodology.

5. Are the conclusions consistent with the evidence and arguments presented and do they address the main question posed? Response: conclusion is acceptable based on the selected method. However, the main problem is lack of novelty

Author response: We appreciate your acceptance of our conclusions. Regarding the concern about novelty, we have taken your feedback seriously and have made substantial improvements to address this issue. By incorporating the suggestion for a comprehensive cost-benefit optimization analysis, we have enhanced the originality and depth of our research, which we believe adds a novel dimension to our study. We hope that these additions have contributed positively to the overall quality and relevance of our work.

6. Are the references appropriate? Response: more recent references can be added

Author response: Thank you for your suggestion regarding the references. We have taken your feedback into consideration and have incorporated several more recent references into the introduction section [45-54] (Page: 2-3; Line:91-116) to enrich the literature review and provide a more up-to-date context for our research. We believe these additions enhance the quality and relevance of our paper.

Comments on the Quality of English Language. Response: Some typos and grammatical errors can be seen

Author response: Thank you for pointing out the typos and grammatical errors. We have reviewed the manuscript and made the necessary corrections, as suggested, on (Page: 3; line:138, Table 1), (Page: 4; line:148), (Page: 9; line: 263/264,270, 281), (Page: 10; line: 287), (Page: 13; line: 357), (Page: 17; line: 541/542, 544/545) to ensure the quality of English language in our paper.