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Interactive comment on "Re-evaluating safety risks of multifunctional dikes with a probabilistic risk framework" *by* Richard Marijnissen et al.

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We thank reviewer 1 for the constructive and helpful comments and suggestions. We hope he/she will be satisfied with the coming changes of the manuscript.

General comments:

Comment 1: The paper is extremely relevant in the context of the design of flood protection under consideration of multifunctionality. In general it is well structured and contains all necessary information to follow the discussion

Response: We thank the reviewer for this nice comment.

Comment 2: The paper could be improved by explaining more clearly what was actually

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calculated to allow a better understanding of results and findings.

Response: We agree that further explanations on the methods and findings are needed. The section describing how mutlifunctionality is implemented in the case-study is (being) revised entirely as well as further explanations on the reinforcement strategies. Furthermore additional explanations on the results will be provided in the revised manuscript. Finally the abstract is being revised entirely based on suggestions from reviewer 2 as well to make it clearer what was calculated.

Comments 3: The word function is used regarding multifunctionality as well as mathematical function. Because this word is used very often in the text, the authors should revise the text if the context for the word function is always clear.

Response: This is a good point. The word “function” in the context of multifunctionality will be changed to “multifunctional use” or “multifunctional elements”. Function in the context of mathematical functions are usually part of a larger definition like Probability Density Function (PDF) which require no further context.

Specific comments:

Comment 4: Page 1: L11ff: (While a traditional ...) please define more precisely. As for now it does not become clear what the difference really is.

Response: This was indeed not clear from the abstract. Based on the suggestion of reviewer 2 as well the abstract is being revised to be more self-explanatory.

Comment 5: Page 3: L18: “... to exclude flood defences with an insignificantly low failure probability ... “ If the probability to fail is insignificantly low, this would be a positive result. Why should such flood defences be excluded?

Response: The goal of an assessment is to check whether it meets the safety standards. If the dike passes the basic assessment in can be excluded from further detailed and tailored assessments for that failure mechanism as it is already considered to be safe. To reflect this the word “exclude” can be replaced by “approve”.

Comment 6: Page 5: L11ff: The referral to table 1 gives the impression that either the set of analysed MFFDs or the respective calculations can be found in table 1. Neither is correct. Table 1 only shows (very generally) the differences of the approaches.

Response: Table 1 is meant to introduce the reader to the different approaches as you correctly identified. The sentence will be reformulated to: “a set of MFFDs is assessed with the new probabilistic approach and the traditional conservative approach (see Table 1 for the approaches).”

Comment 7: Table 1: Please rethink: If the probability of occurrence in scenario 1 (additional function present) is x%, is then the probability for scenario 2 (additional function absent) really 100-x %? This seems to be a mistake. Otherwise this needs explanation in the text.

Response: x will be changed into P (from probability) in scenario 1 and 1-P in scenario 2. Since only 2 scenarios are considered the probability of scenario 1 + the probability of scenario 2 must equal 1 or 100%. The % sign may have led to confusion and will therefore be removed.

Comment 8: Page 7: L28: is there really a hole presenting the profile or is there an empty space, the outer shape of the area of the additional function or something like this?

Response: In principle all space occupied by the additional function becomes empty. This was referred to as a hole because the outer edge is no longer grass, but rather loose soil. In the revised version of this section the word hole will not be used as it may convey a different message. This section will be revised entirely (also based on a comment by reviewer 2).

Comment 9: L31f: Why is the probability of the absent structure chosen to be 1%? And why is this a conservative approach?

Response: This number has been subject to some discussion. Initially the reliability

requirement for housing structures in the Netherlands was taken (P_absent = 1E-5), but that would only reflect the structural reliability. Another approach was to look at the designed lifespan of houses which is 50 years (P_absent = 0.02) but this neglects the fact many structures are renovated rather than destroyed. According to van der Flier and Thomsen (2006) 0.13 and 0.23% of houses are demolished annually in the Netherlands. Based on this 1% was chosen as an conservative order of magnitude estimation of the house being demolished during a high water event. This explanation will be added in the revised manuscript.

Comment 10: Page 8: L3: ... when the structure remains just outside of the profile (0,1,2)... Please explain: why does this not also apply to profiles 3 and 5?

Response: Thank you for pointing this out. This sentence should have referred to 0,1 and 5 not 0,1 and 2. It does not apply to 2 and 3 because here soil is replaced by additional weight of the structure leading to a net positive effect on stability. Because the explanation of the findings were confusing to the reader, this section has been rewritten for the revised manuscript.

Technical corrections

Comment 11: Page 1: L22: ..., a better understanding... L26: “This is true...”please reformulate. Page 3: L4ff: please do not use the personal pronoun “we”. Page 5: L12: ...and the traditional... Table 1: ...a given failure mechanism ... probability of occurrence Page 7: L10: ... by weighing... L25: please reformulate... L27: ...2 two...?; ...present in which CASE the load... Page 8: L1: ... berm [] both... L6: for better readability: ...along the full length, the inclusion of uncertainty... L7f: reformulate: TRUE L34: reformulate: “risk of functions” Page 9: L1: personal pronoun “we”... see above L2f: Please revise the sentence for better understanding. Figure 3: Please reformulate the caption: ...for calculation the probability”...

Response: We thank the reviewer for pointing out these corrections. These will be implemented in the revision.

References:

van der Flier, C., and Thomsen, A.: Life cycle of dwellings: Analysis and assessment of demolition by Dutch housing associations, International Conference ENHR, Ljubljana, Slovenia, 2-5 July 2006; Workshop 7, Physical Aspects of Design and Regeneration, 2006,

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