

Vulnerability of bridges to scour: insights from an international expert elicitation workshop

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Response to Referee #2

GENERAL COMMENTS

REFeree COMMENT

The paper could be divided into two parts: results of the workshop and statistic evaluation of the expert's opinions.

RESPONSE

The statistical evaluation was based directly on the experts' stated judgements using the structured elicitation methods and question protocols (Section 4) that were introduced to and accepted by expert group. The authors did not select or modify the statistical analysis methods ex-post, hence these statistical results represent "results of the workshop".

In the next part, the authors applied statistical and probability methods and evaluate statistically all important parameters.

We selected a sub set of the important factors, guided by group discussion, and explored in more detail the experts' judgements about bridge failure probabilities conditional on those factors. We did not evaluate all potentially important parameters in the elicitation of failure probabilities and uncertainties for reasons of time constraints and prioritisation of effort.

We have expanded the description of the statistical methodologies used to clarify their role in (a) importance ranking of potential causative factors, and, (b) elicitation of conditional failure probabilities (as set out in more detail in the response to Referee #1).

The paper does not give an impression of the number and academic structure of the expert group.

We have included a breakdown of participant' territories and sectors in the introductory paragraph.

Therefore the factors, but especially the statistical evaluations could be seen also as the subjective opinion of a group of persons.

The elicitation process necessarily relies on the subjective (but informed) judgements of the experts, which is a feature of estimation under conditions of profound uncertainty.

However, as discussed in Section 4, the elicitation methodology itself is designed to enable those subjective judgements to be collected, summarised and assessed in as transparent and objective a form as possible – this is the underlying motivation for the Classical Model as is discussed in the paper and well documented in the cited references.

The intention of the paper is just to detect the factors and influences, without any vision and consideration on the mathematical evaluation, modeling of the score vulnerability or methods for the bridge scour risk reduction.

The intention is, as stated, to support future development of fragility functions, and hence generic scour scale risk assessment models, by gathering systematically expert views on the identification of factors that may be considered in characterising a fragility function loading condition, and in formalising the judgement of a panel of experts about the magnitude of uncertainty around such functions.

We recognise that the technical methods for the elicitation were introduced only in summary form, and have added further description in Section 4 to provide a more detailed account. In the interests of brevity and of maintaining focus on the substance of the workshop, we have not presented the mathematical basis for the elicitation methods. However, the mathematical formulation is readily discoverable in the references cited within the text and we have added explicit pointers to those references.

The study relates to assessment of scour vulnerability, and the management of uncertainty in that assessment, therefore detailed discussion or evaluation of methods for bridge scour reduction is not within the scope of the paper (other than in the sense that improved knowledge of scour vulnerability may help to achieve this general goal).

Therefore the publication could be used as a tool for detection of the scour influencing factors, but not giving any answer on the mentioned scour mitigation measures as well as definition of the maintenance level, specified as none, routine or premium.

We have added further discussion in Section 6 about how the results may support the development of fragility functions and hence risk assessment models. The aim was not to determine specific mitigation measures or identify specific strategies relating to the three generalised maintenance levels.

The mathematical evaluation of the fragility estimates presented in the Figures 3-5 is difficult to be followed and in some cases gives misleading or less explicit answers, especially in the case of maintenance (Figure 3). The comparison of figure 3 within 3*4 diagrams are presented is difficult for comparison and distinguishing.

As mentioned above, we have added further detail about the evaluation of the fragility estimates, including explicit references to sources in which the mathematical analysis is described in full.

We are not sure why the estimates presented in Figs 3-5 are considered “misleading or less explicit”. The reviewer does not offer a frame of reference against which our results are claimed to be “less explicit”, and it is therefore difficult to respond to this point. The graphs and tables in the paper are empirical results of the elicitation process, which we believe are described clearly and with appropriate reference to background literature.

We are not sure what the reviewer means by “The comparison of figure 3 within 3*4 diagrams are presented is difficult for comparison and distinguishing”, but are confident that the Figure and

accompanying text provide a clear summary of the results which can be interpreted with reference to terms defined within the paper. The results are complex, but this is an inevitable consequence of presenting a detailed view of the analysis and we contend that the salient features of the figures are identified and discussed within the text in Sections 5 and 6.

Discussion and Conclusion chapter is too extensive and therefore unclear, striving to an additional summary that will really summarize the findings of the work.

The Discussion and Conclusions section comprises four clearly labelled sub-sections, each with between 4 and 6 paragraphs of text. We do not agree that this is too extensive and would not necessarily equate the length of the section with its clarity.

We have observed that this comment does not align with the view of Reviewer #1, who stated that "Overall, it is well written and the results are nicely detailed".