

Nat. Hazards Earth Syst. Sci. Discuss., referee comment RC2
<https://doi.org/10.5194/nhess-2021-293-RC2>, 2021
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Comment on nhess-2021-293

Anonymous Referee #2

Referee comment on "Invited perspectives: Challenges and future directions in improving bridge flood resilience" by Enrico Tubaldi et al., Nat. Hazards Earth Syst. Sci. Discuss., <https://doi.org/10.5194/nhess-2021-293-RC2>, 2021

This paper examines the factor affecting bridge resilience and illustrates through literature research and the output of a recent workshop with major stakeholders in the sector possible actions to take based on the points individuated.

The paper is a welcome contribution given the importance of the infrastructure on the built environment and the future predicted impact of climate change, and present several important challenges and future opportunities.

While the work is very comprehensive, there could be a few additional points of reflection that could be included:

In general, the text could be accompanied by more results from the literature, in particular of these could help highlight the elements of uncertainty.

Line 135: One of the main factors of uncertainty in the scouring equation could be discussed further, examples include the definition of critical velocity (see Hamidifar et al 2021)

Line 150: I would highlight also the first works by Oliveto and Hager 2002 and 2005, on temporal scour evolution

175 -180 I would show some of the possible morphologies individuated from literature, which would help illustrate the point on important differences.

210 Scouring on deck by Carnacina et al with debris accumulation also illustrate the potential increased scouring as well as flow acceleration (Carnacina et al. 2019)

220 Would be nice to have a comparison of various literature fragility curves, again as an illustration of the vast uncertainty existing around their determination also in line 265

Line 410 the reference to Bayesian Networks is not fully clear? It seems an important challenge but the expected outcome could be extended further, how this could merge the data?

Other general comments include:

- Plots with the cause of failure of bridges as a percentage of mechanism, given the breadth of the stakeholders this statistic would be very welcomed
- In the table and based on a high-level cost/opportunity analysis, which action should be taken first or prioritized, together with a desired temporal framework.
- Protections are generally overlooked, but several older bridges have been protected with rip-raps gabions, block ramps or similar structures.
- I can't find Cantero-Chinchilla and de Almeida, 2021 in the list of references, which should illustrate the literature on debris impact on scouring. Other references on the topic exist that show the impact of debris accumulation on scouring, the impact on scouring protection that highlight important results on scouring temporal evolutions and morphologies (see for example the early work by Melville and Dongol 1992 but also Lagasse et al 2006, Pagliara and Carnacina 2010, Carnacina et al 2019)

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