

Interactive Comment on “Assessing the risk posed by natural hazards to infrastructures” by Unni Marie Kolderup Eidsvig et al.

The paper proposes a method for risk assessment of infrastructures to a wide range of natural hazards. The article certainly addresses a topic which is well within the scope of NHESS, however, considerable changes should be made prior to publication which will better highlight the value of the work which is presented here.

Comments:

1. **Introduction and Background chapter:** The authors refer to three levels of analysis. How do these levels correspond to the aims/end users of the method presented here?
2. **Figure 1:** What is a “Top event”? What are the “Barriers”? What do the authors mean with “loss of infrastructure”? Is this 100% loss? Or just disruption?
3. The **theory and literature review part** that should be found in the Introduction/Background chapter is rather weak. In more detail I have the following comments:
 - a. The authors refer to “critical infrastructure” (p.2/l.11). What is critical infrastructure and what does it include? The authors should consider providing some basic definitions. In this way terms that are incorrect or need to be defined and can be found throughout the text may be avoided e.g. “the severity of risk” (p.2/l.18), “what can go wrong (evaluation of sensitivity (susceptibility) and resilience)” (p.2/l.25), “acceptability/tolerability of risk” (p.2, l.30), “susceptibility functions” (p.4, l.23), “mapping threats of natural hazards” (p.3,l.11).
 - b. A very important topic in the risk analysis of infrastructure is “resilience”. The authors refer to this term only once (p.2, line 25) without explicitly discussing it. Studies regarding the resilience of infrastructure are also not mentioned.
 - c. The literature review can be found in page 4, lines 17-30, however, the authors list the papers that contain reviews on the topic “vulnerability and infrastructure” without giving any additional information. What is the state of the art of physical and/or social vulnerability assessment regarding infrastructure? What kind of methods have been proposed and what is used by authorities and decision makers?
4. **Figure 2** is the core figure of the paper presenting the methodology. In my opinion, the Figure should be revised in order to better show:
 - a. The three steps described in the methodology chapter (4.1).
 - b. The grouping of the indicators (physical/social vulnerability). The authors claim that the physical vulnerability indicators are demonstrated in Figure 2 (p.9/l.19-20)

5. The **methodology** has to be described in greater detail focusing on the following topics:
 - a. In Table 4 the criteria for choice of score are described in a very trivial way. “The infrastructure is robust towards the natural event and/or could withstand the natural event for a long time/some time/quite short or short duration”. How do the authors define or differentiate between, for example, “short” and “quite short” duration? Is this the same for all scenarios? (what is short duration for a road closure is not short for electricity distribution etc.)
 - b. What about the weighting of the indicators? In the discussion chapter you refer to a “flexible weighting system” (p.15, l.30-31). Where is this system described? Which weighting method do you use? Are all indicators equally important?
 - c. Risk ranking: The risk ranking seems quite arbitrary to me. Who and based on which criteria identifies the risk levels? Often the risk levels are identified by decision makers and are connected to specific actions (e.g. evacuation). Is this the case here?
6. **Application chapter:** The application chapter may be significantly improved if the authors consider the following:
 - a. Figure 3: The authors should consider to improve the figure by adding a small map of Norway showing the location of the case study within the country. Moreover, they should consider starting the session with text and not the figure itself.
 - b. The session may be illustrated with more information regarding the case study area. Why was it chosen? Have they experienced the impact of natural hazards in the past affecting their infrastructure? How many people live there? Is the infrastructure important for the local community or for the whole country?
 - c. Listing the generic scenarios and then the site-specific scenarios seems like a repetition to me. I would just keep the second list with the numbered site specific scenarios.
7. **Results:** The results are summarized in Table 8. The seven scenarios are assigned with a risk level. Is the aim of the study to compare these scenarios and if yes is this really possible? (see previous comment on criteria for choice of scores). If the aim of the paper is among others the comparison, be consistent and refer to it in the scope chapter.
8. The **discussion chapter** is too short. I would expand it making two sessions: one session highlighting the usefulness and advantages of the methods through examples and one session outlining the assumptions that had to be made, the limitations but also the future developments that are necessary. The authors refer to many interesting topics that need to be further discussed and sometimes illustrated with examples:
 - a. P.14/l. 28-29: “It provides more guidance to the user than general risk assessment methods”: Which other methods are available and what does this method offer that the

others cannot (link to literature review)? This needs to be further discussed here in order to highlight the benefits of your method.

- b. P.15, l.1: Give an example showing the usefulness of this ranking. As mentioned before the ranking may be connected to specific actions/decisions.
 - c. P. 15, l. 11: “implicit guidance on how to reduce vulnerability”. This is an interesting topic and a great opportunity for the authors to highlight the usefulness of the method. Please give some examples on how can this be achieved by using the specific approach.
9. **Appendix:** In the main text the authors refer to the assessment of two dimensions of vulnerability: Physical and societal. However, in the appendix they refer to “vulnerability assessment” and “societal consequences”. Is this the same? (See comment about definitions).
10. **General comment:** be careful with the use of the word “infrastructure” in plural. I am not sure if it really exists (I am not an English native speaker myself). Please check.