Review: Assessing fragility of a reinforced concrete element to snow avalanches using a non-linear mass-spring model
(by P. Favier, D. Bertrand, N. Eckert, I. Ousset, and M. Naaim)

General remarks

The goal of this paper is to derive and present fragility curves for a Reinforced Concrete (RC) element subjected to avalanche loads. The authors state, that snow avalanche engineering knows hardly any proposals for such fragility curves and therefore their approach will be a useful contribution to future risk assessments. In addition the proposed approach could also be applied to other phenomena, like debris-flow or rockfall, that also lack fragility curves.

This paper attempts to build a bridge between civil- and avalanche engineering by assessing fragility curves for a RC structure that is loaded with an avalanche impact. The RC element is represented by a light and efficient Single-Degree-Of-Freedom (SDOF) numerical model which was validated by a Finite Element Analysis (FEA) and a Limit analysis. Furthermore the SDOF model was embedded within a reliability framework to measure its failure probability. This all sums up to a good representation of RC element and its behavior under a quasi-static loading. Unlike the civil engineering part, the avalanche engineering part is represented fairly poor in this paper. The RC element is subjected to a quasi-static loading, which does not represent the impact of an avalanche very well.

My main problem with this paper is the lack of avalanche dynamics and detailed analysis of an avalanche impact on a wall. If the authors aim to fill the gap between civil engineering and avalanche engineering with this paper, I expect both sides to be represented at least equally. The paper as it stands right now discusses almost exclusively problems that concern civil engineering. In my opinion the engineering analysis is rather standard and presents no new ground breaking results. Therefore it should be published in a journal that addresses civil engineering, if at all. But definitely not in NHESS, since the paper does hardly touch any natural hazard issues. Moreover I believe that many of the discussed topics like theory of plastic limit analysis, or Finite Element Analysis, just to name a couple, are not easy to understand without any engineering background. This leads me to the conclusion that this paper rejects the NHESS journal.

Right now I see two options on how to proceed with this paper:
(1) Publish it more or less as it stands right know in a civil engineering related journal. But in that case, drop the assumed avalanche impact loading and assess fragility curves for a RC wall subjected to any kind of quasi-static, equally distributed loading.
(2) Postpone the publication of the paper and have a closer look at avalanche dynamics. Because as you state yourself on p23 line20, the effect of time evolution of the avalanche pressure cannot be neglected. Only after taking those specific (but crucial) effects into account, are you able to assess fragility curves for RC elements subjected to loadings that are caused specifically by avalanches. If that part is added to the paper I would see it fit to be published in NHESS, since natural hazards, in this case avalanches, are the real cause of the loading acting on the RC wall and not a general quasi-static loading.

Personally I strongly hope that the second option is chosen over a quick publication in an unfitting journal. I think it would be a great benefit, if the gap between civil engineering and natural hazards engineering would be closed, or at least diminished. But as I have stated before, the coupling between the natural hazards problem and the engineering problem needs to be examined by the authors in detail.

Specific Remarks

1. p5 line20 I think it should be $L/h=40$ instead of $h/L=40$

2. p6 Fig. 3(a) I understand that this figure represents a random cross-section of a RC element to illustrate the behavior of stress and strain under bending. But still I find it confusing that $h > b$, since you are examining a wall, which is represented by a slender plate or beam (in 2D), and hence $h << b$ should be assumed.

3. p9 Fig. 6 This figure pictures a reinforcement ratio of well over 1%. That would be much more than the 0.4% that are assessed as the reinforcement ratio. I assume the exaggerated illustration of the steel fibers was done for clarity reasons. Make an indication of this exaggeration, so that it does not arise confusion of whether .you have used a different reinforcement ratio for the FEA.
4. p19 Description to Fig.11, third line: The sets with the mixed deterministic-statistical are (1,α,a) and (3,α,**a**), instead of *(3,α,b).*