

Interactive comment on “From rapid visual survey to multi-hazard risk prioritisation and numerical fragility of school buildings in Banda Aceh, Indonesia” by Roberto Gentile and Carmine Galasso

Anonymous Referee #2

Received and published: 23 February 2019

General Comments: This manuscript provides a timely discussion on how to accomplish strategic prioritisation of intervention on school buildings in a transparent way using the Analytic Hierarchy Process in a multi-hazard context (earthquakes and tsunami). The approach is validated through a detailed analysis and a simplified mechanical methodology (i.e., SLAMA).

I report in the following what I consider minor comments that could improve the overall quality of the manuscript.

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1) The explicit reference to Banda Aceh in the title could be removed as the methodology and approach is rather general and the case of Indonesia is a case-study 2) More discussion on the problem of “code enforcement” should be provided. The approach of classifying building according to the release of building codes is rationale, it makes sense, it refers to a widespread practice in regional analyses but a comparison with the real construction practice should be provided. In the specific case this is possible (e.g., comparison of reinforcement in figure 5e with code provisions. 3) I personally do not agree with the low weight given to soil conditions in the matrix A. Is the case study area located in a relatively firm soil area? A comparison with the Vs30 model based on slope from USGS should be provided and discussed (Allen and Wald 2009) 4) It is not clear how and if brittle failures are accounted for in the detailed procedure presented in the second part of the work. If not, a simple approach for element classification as ductile or brittle could be attempted comparing the amount of longitudinal and transversal reinforcement ratio in typical elements as done in some previous work for the L’Aquila case in Italy (De Luca and Verderame 2013).

Specific Comments:

Page 1 Line 10 – change Resilience with REsilience to be consistent with the acronym
Line 17 – change demonstrated with implemented on Line 30 – add a comma after the closed bracket
Page 2 Line 10 – Some of the references to prioritisation programme of schools in other countries should be already cited here
Line 33 – the importance of schools should be discussed including a reference from UNHDR or UN.
Page 3 Line 1 – the use of schools as shelters in crisis is highly debated can you add a reference on this topic to acknowledge this aspect?
Line 14 – change representative with consistent with building codes and practice of the country.
Page 5 Line 33 – it should be mechanism-based and not mechanics-based
Page 6 Line 21 – on what basis DS3 is considered equivalent to life-safety, are you basing this on Hazus, EMS98 etc. Further specification on this is necessary
Page 8 Table 2 – This table is too dense, try to reduce/condense the text in this table
Page 9 Line 13 – Pmax and Pmin in the equation

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are those indicated in Fig 2a or in Fig 2b? I assumed it is Fig 2a, if this is the case, I would remove the grey dots in Figure 2b. Page 10 Line 2 – On what basis you assumed 25%? Do you have a reference or any evidence for this assumption? Table 3 – What is the rationale for the weights? Why unfavourable soil is so low? See general comment 3) Page 11 Table 4 – is a scoring system from 1 to 9 too granular as it is based on expert judgement? Table 5 – again why unfavourable soil is so low Page 12 Line 24-27 – Asprone et al. used a similar multi-hazard index in 2013, compare differences with this approach. Page 13 Line 12-16 – The 50-50 split should be assumed and changes on the basis of how suitable are Hazus typologies with respect to the building stock to the country considered. In a more general context this could be 70-30 or 30-70 if the typologies are more or less representative of the building stock. I understand this is arbitrary, but more discussion should be provided on this. Page 16 Line 10 – was there any double-check of code-enforcement? Situations like Figure 5e allow this sort of discussion and this should be provided. See general comment 2). Page 17 Line 6 – why you assumed modal values (and not median for example?) Page 18 Line 9 – Are you referred to length of the elements or section dimensions? If this is the overall length of the elements why they increased with time? Page 19 Line 1 – again, did they correspond to what was prescribed by code? Table 6 – I am surprised that 2012 code was not prescribing stirrups in joints, is there again a difference between practice and code? Page 23 Line 14 – can SLAMA account for brittle failures? If not a preliminary classification of the elements as ductile or brittle could be useful, see general comment 4). Page 25 Line 26 – can you provide a reference for the drift thresholds? Page 27 Line 26-28 – How did you compared the Inspire index results with results of the fragilities? A more detailed discussion should be provided right after Table 8. At the moment the comparison/validation is not very clear.

References:

Allen, T. I., & Wald, D. J. (2009). On the use of high-resolution topographic data as a proxy for seismic site conditions (VS 30). *Bulletin of the Seismological Society of*

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America, 99(2A), 935-943.

Asprone, D., De Risi, R., & Manfredi, G. (2016). Defining structural robustness under seismic and simultaneous actions: an application to precast RC buildings. *Bulletin of Earthquake Engineering*, 14(2), 485-499.

De Luca, F., & Verderame, G. M. (2013). A practice-oriented approach for the assessment of brittle failures in existing reinforced concrete elements. *Engineering Structures*, 48, 373-388.

Interactive comment on *Nat. Hazards Earth Syst. Sci. Discuss.*, <https://doi.org/10.5194/nhess-2018-397>, 2019.

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