Nat. Hazards Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/nhess-2019-318-RC1, 2020

Natural Hazards and Earth System Sciences
Discussions
Open Access
EGU

Interactive comment on "Assessment of the physical vulnerability of buildings affected by slow-moving landslides" *by* Qin Chen et al.

Anonymous Referee #1

Received and published: 28 February 2020

General comments

The paper shows the results of a study focused on the vulnerability analysis of buildings exposed to slow-moving landslides. To this aim, a methodological approach – which involves carrying out numerical analyses based on different rainfall scenarios – is proposed and applied to a case study in China. The addressed topic is significant. However, much effort should be done in clarifying and deepening some addressed issues in order to allow for the exportability of obtained results.

Specific comments

In Section 2.2.1 the Authors recall the equivalent elastic beam – originally introduced by Burland and Wroth (1974) to define a damageability criterion – in order to compute the

Printer-friendly version

Discussion paper

maximum deflection exhibited by the same beam under a uniform load whose modulus equals q. In Figure 2 this uniform load acts horizontally, in correspondence of the lateral surface of the building's foundation affected by the landslide; whereas in Figure 3 the uniform load is applied vertically to the elastic beam. Accordingly, it is not clear in which direction the maximum deflection develops. Furthermore, symbols adopted in Figures 2 and 3 to denote the geometrical characteristics of the building's foundation are not internally consistent. Could the Authors better explain?

In the same Section 2.2.1 the concept of "inclination" of a building is introduced. Does this inclination corresponds to the "rotation" or "slope" (i.e. the change in gradient of a line joining two reference points of the foundation base) or to the "tilt" (describing the rigid body rotation of the whole superstructure or a well-defined part of it) defined by Burland and Wroth (1974)? Or does it refer to another well-defined parameter? Please clarify. I also suggest to associate the Eq. (9) – used to express mathematically the concept of inclination – with a Figure helpful to better understand the meaning of symbols adopted in Eq. (9), including the angle alpha.

In Table 3 the shear strength parameters of soils involved in the shear zone of the Manjiapo landslide are summarized. Are they residual shear strength values? And, more in general, what type of laboratory tests was carried out? Please explain.

In Table 4 it is not clear if the Young's modulus refers to the masonry constituting the building superstructure or to the material constituting the building foundation. Please clarify.

In Section 4.1 the rainfall scenarios considered for transient seepage analyses are introduced. However, relevant information is provided neither on the fixed boundary conditions nor on the adopted hydraulic conductivities. Please improve this Section.

In Table 5 the results obtained for the four considered rainfall scenarios are summarized. In all the cases, the factor of safety (FS) is lower than 1. This would imply that the landslide is always moving, in disagreement with the information gathered by the

Authors about the cracks on the ground surface of the Manjiapo landslide. In particular, the Authors observe that “Meanwhile, since the extreme rainfall events were recently rare, the deformation of the landslide did not obviously change, which was similar to the deformation situation in June 2016. For example, the cracks on the landslide did not expand, and the number of new cracks was very few” (page 10 – lines from 249 to 252). Probably, the shear strength parameters used for the limit equilibrium analyses are too low (see Table 3) and should be compared with those deriving from the back-analysis of the event occurred on June 2016.

In Section 4.2 the results of the vulnerability analysis concerning a selected building within the affected area of the Manjiapo landslide are presented. Focusing on the obtained vulnerability curve (Fig. 12) the Authors observe that “the physical vulnerability is very low when the landslide is stable with a safety factor greater than 1.0” (lines from 326 to 327). How is this observation justifiable? Indeed, it is expected that the building vulnerability equals 0 (no damage) if the landslide does not move. In this regard, are the Authors sure that the chosen Weibull (1951) function is the best one to mathematically express the vulnerability curve when 1/FS is adopted as landslide intensity parameter?

In the Discussion, the Authors stress that “the physical vulnerability is inversely proportional to the building height” (line 384). This is not in agreement with thresholds values of the building inclination summarized in Table 2. Indeed, as the building height (from the outdoor ground) increases the threshold value decreases.

In my opinion, the vulnerability curves shown in Figure 15 have to be further validated before applying them in analyses at regional scale (lines from 403 to 408).

Technical corrections

The symbol adopted throughout the manuscript to indicate the unit of measurement of force should be “kN” (lowercase k) instead of “KN”.

The symbol adopted in Table 3 to indicate the unit of measurement of stress should be “kPa” instead of “kpa”.

In the Note of Table 3 it is not clear if the information provided about the “permeability coefficient” and the “volume of water content” (or “volumetric water content”?) refers to the considered soil in saturated conditions or not. Relevant units of measurement should be provided, if applicable.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2019-318, 2019.