Natural Hazards
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Discussions

Interactive comment on "Three dimensional slope stability problem with a surcharge load" *by* Y. M. Cheng et al.

Anonymous Referee #1

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REVIEW OF THE MANUSCRIPT: Journal: NHESS Title: Three Dimensional Slope Stability Problem with a Surcharge Load Author(s): Y.M. Cheng et al. MS No.: nhess-2015-16 MS Type: Research Article

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GENERAL COMMENTS:

This paper presents a 3-D analysis of slope stability subjected to a vertical local surcharge load. This subject is of great interest for many geotechnical and civil engineering issues such as slope stability assessment or bearing capacity prediction. The research falls within the scope of NHESS. Its content is sound and interesting, where both analytical, numerical and experimental studies are well presented. The main orig-

inality of the paper is the analytical treatment of the problem using a new (and realistic) 3-D failure mechanism. As other analytical solutions, the results presented in the paper constitute a useful benchmark for numerical simulations and provide rapid estimations of engineering design. Overall, this paper meets the high quality level of NHESS. In view of the above comments, I recommend the acceptance of the publication of this paper in NHESS after revising the following points.

SPECIFIC COMMENTS:

1. The principal part of the paper is devoted to develop an analytical solution for the safety factor relative to failure. The safety factor is introduced as in Strength Reduction Method. The resolution requires two steps: assuming a convenient failure mechanism and analytical computations using energy balance. The former is the key point of the model. In this paper, it is inspired from slip-line field theory and is supported by experimental data. However, the description of the failure mechanism is not clear for the readers. It is therefore suggested to rewrite the presentation of the collapse mechanism to better describe its geometry and explain its physical bases and assumptions. Due to the importance of this part, it is also suggested to incorporate it into the main body of the paper instead of putting it in Introduction. 2. Due to the 3-D geometry of the problem, it is quite difficult to follow trigonometric and geometric calculations. It is thus recommended to improve and add more graphical illustrations, especially for the two end failure zones. The coordinate system should be presented in the figures instead of in the text. 3.The main equation to solve (in the form of (40)) involves three angles and the safety factor variable k; namely four unknowns in one equation. A looping algorithm is needed to obtain the solution. Such an algorithm can be found in other publications such as (Michalowski, 1989). In any case, it is suggested to clarify the method of resolution (or refer to published works) so that the readers can better understand (and possibly employ) this solution. Moreover, given the level of numerical computations involved at this stage, it is more reasonable to call the solution "semi-analytical". 4.As the present model involves less parameters and gives practically more critical results,

one can state that it is more efficient than the Michalowski's model. However, based on which criteria the authors could state that the present model gives "better" and "more reasonable" results than the ones by (Michalowski, 1989)? 5.The authors stated that the tensile strength of soil mass has only a small effect on the final results as shown by later calculations. However, no parametric studies have been presented for this factor in order to check this statement. Please show the evidence (by calculation or referring to other works) to support this assumption.

SOME TECHNICAL CORRECTIONS:

Figures 1 (a-d) are too small and difficult to read. The notation for friction angle in the figures (ÏŢ) are not the same as in the text (φ). The point "h" is not marked in Figures 2. Typographical errors should be checked, e.g. line 10 p. 1297, line 20 P. 1312 etc.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 3, 1291, 2015.