

Interactive comment on “Experimental assessment of the relationship between rainfall intensity and sinkholes caused by damaged sewer pipes” by Tae-Young Kwak et al.

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1. General comments This paper reports a series of experiments to analyze the sinkhole formation associated with rainfall intensity by simulating a leakage of an underground damaged sewer pipe. A slit at the bottom of the experiment chamber was considered as damage of pipe, and three different rainfall intensities were designed by controlling the hydraulic head connected to the slit of the chamber. The ground settlement was measured, and the deformation of soils around the pipe is captured by the particle image velocimetry (PIV) technique. Overall, the authors in this work present a rising issue of the sinkhole and its relationship to rainfall by utilizing an experimental

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model set-up. I believe this paper will be of interest to the audience and would support publication after the following comments are addressed.

1) Authors should clearly address and explain how the test procedure is designed to simulate the rainfall and the sewer pipes. a. In the test procedure, the hydraulic head was selected as a variable to represent the rainfall intensity, which eventually formed different target groundwater levels. Therefore, the amount of water introduced into the chamber and the duration of water supply stage may indicate additional information related to the rainfall intensity. For example, if the water supply stage of Test 3 took longer than that of Test 1, this set-up may not properly reflect the actual rainfall intensity and its influence on the groundwater level around the pipes. In addition, the flow from the damaged sewer pipe may not be the only source of water supply into the underground. b. In this work, the damage of sewer pipes is approximated as a slit of which the size is determined followed by the previous study. While this damage could be the main source of water supply into the ground, the drainage may not occur through this damage. In other words, the water drainage set-up using the slit and drainage valve may lead to an extra discharge of soils and water. If the groundwater is discharged through a thin slit at the bottom of the chamber, it may be easily expected that the soil around the slit may easily collapse and deformed.

2. Specific comments 1) Line 149: What's the meaning of multiple cycles? 2) Line 173: As point out by the authors, the test-set up is likely to the piping simulation. Then, is it possible to analyze the sinkholes and rainfall intensity though the piping analysis? For example, using the critical hydraulic gradient? 3) Line 255: How is the resistance factor determined? If there's an equation, it could be helpful for readers. 4) Line 262: Is the matric suction analyze in a quantitative manner? Because of cohesion, this may limitedly affect the behavior of soils. 5) Lines 279-280: The meaning is not clear.

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