The 2021 World Congress on
Advances in Structural Engineering and Mechanics (ASEM21)
GECE, Seoul, Korea, August 23-26, 2021

Matric suction effect of cement based materials on the shape stability of 3D printed concrete

*Jin Hyun Lee[1)] and Jae Hong Kim[2)]

[1), 2)] *Department of Civil Engineering, KAIST, Daejeon 305-600, Korea*
[1)] *jinhyun.lee@kaist.ac.kr*

ABSTRACT

In the general mix design for 3D printed concrete, the shape stability can be improved by adjusting water-to-binder (w/b) ratio or using various types of binders or fines. This study analyzed the effect of binder system or particle configuration on the shape stability in terms of matric suction. The matric suction is the force generated by the capillary phenomenon in the unsaturated solid particle system. As a result, the matric suction makes the particles stick together and improves the resistance to the external shear stress. The shape stability was evaluated by the uniaxial compression test, which is called squeeze flow test. Fly ash and slag were used as substitute binders and nanoclay was used as the main additive. The relationship between the shape stability and matric suction was obtained by various w/b ratios, types of binder and additives, or both of them. The higher matric suction caused the better shape stability. Mohr-coulomb failure criterion described this phenomenon. The shape stability was considered as compressive strength and the intercept of shear stress axis, called cohesion, was considered as the matric suction.

REFERENCES

R. A. Buswell, W. R. L. de Silva, S. Z. Jones, and J. Dirrenberger, “3D printing using concrete extrusion: A roadmap for research,” Cem. Concr. Res., vol. 112, pp. 37–49, 2018.

D. G. Fredlund, N. R. Morgenstern, and R. A. Widger, “SHEAR STRENGTH OF UNSATURATED SOILS.,” Can. Geotech. J., 1978.

[1)] Graduate Student
[2)] Associate Professor