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Plug formation in the flow of cohesive granular media down an incline ROBERT BREWSTER, ALEX LEVINE, University of Massachusetts, GARY GREST, Sandia National Labratories, JAMES LANDRY, BAE Systems — The study of cohesive granular media is fundamental to the exploration of sand in a geophysical context where small quantities of a wetting fluid generate cohesive stresses within the granular aggregate. We have performed large-scale, three-dimensional molecular dynamics simulations of the flow of cohesive and non-cohesive granular media down an incline. We find that cohesive granular media generically separates into a plug flow regime near the free surface of the pile and a flowing regime whose rheology does not fit the standard Bagnold scaling. We analyze both the structure of the coexisting plug and flowing states and determine the velocity, density, and stress profiles throughout the material. Based on this numerical data, we propose a generalization of the Bagnold constitutive relation to describe the relation between shear stress and rate of strain in the flowing cohesive state. We also discuss the relationship between the thickness of the steady-state plug and the magnitude of the internal cohesive forces.

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