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NUMERICAL MODELING OF UNSATURATED INFILTRATION IN PERVIOUS CONCRETE DRAINAGE COMPONENTS FOR URBAN STORMWATER MANAGEMENT

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Abstract. This study presents a comprehensive investigation into the behavior of water infiltration in pervious concrete drainage components for effective urban stormwater management. The focus specifically centers on unsaturated infiltration phenomena observed in curbs and sewers, expanding upon previous studies that primarily examined saturated infiltration using Darcy's law and capillary suction effects. Employing a numerical modeling approach, the analysis capitalizes on the capabilities of CFD simulations within the open-source software OpenFOAM. The simulations utilize the porousmultiphaseFoam toolbox, which incorporates the Van Genuchten-Mualem model for solving the Richards equation. Such model is employed to accurately capture the hydraulic performance of the porous concrete material under investigation. Due to the nature of the hydraulic behavior, the study makes use of parameters from previous research while also comparing them with relevant literature examples. This comparison serves to assess the applicability of the chosen parameters. By focusing on unsaturated infiltration within a two-dimensional (2D) domain, this research aims to enhance our understanding of the underlying mechanisms governing water movement in pervious concrete drainage components. The findings contribute to the existing knowledge base, offering guidance for improved design and optimization of pervious concrete drainage systems to effectively manage stormwater runoff and promote groundwater recharge in urban areas. Furthermore, future research directions are identified, including the integration of rainfall models and experimental testing on laboratory or field samples to validate the numerical model against real-world case studies.