Politecnico di Torino
Department of Structural, Geotechnical and Building Engineering

DISEG

NICOLÒ GUARENA

Contaminant transport through landfill composite liners due to geomembrane defects

BIO

Dr. Nicolò Guarena obtained a PhD degree in Civil and Environmental Engineering at the Polytechnic University of Turin, where he is currently serving as a Research Associate. His research activity has been mainly devoted to the experimental and theoretical investigation of the coupled chemo-hydro-mechanical behaviour of fine-grained soils, the use of engineered clay barriers (e.g., geosynthetic clay liners and polymer-amended bentonites) for the control of contaminated liquids in the subsoil, the assessment of the containment performance of landfill lining systems against emerging contaminants (e.g., per- and polyfluoroalkyl substances), and the characterisation of the mechanical behaviour of municipal solid wastes and industrial byproducts.

The relevance of the research activity conducted to date has been recognised through several remarkable awards, such as the nomination by the ISSMGE Technical Committee 215 “Environmental Geotechnics” as the recipient of the Bright Spark Lecture Award at the 9th International Congress on Environmental Geotechnics, the nomination by the Italian Chapter of the IGS as the recipient of the 10th National Prize AGI-IGS, and the nomination by the Italian Geotechnical Society as one of the two delegates at the 7th International Young Geotechnical Engineers Conference. In January 2024, Dr. Guarena started to serve the journal “Geotextiles and Geomembranes” (published by Elsevier) as a member of the Editorial Board, and in March 2024 he was elected as a member of the Board of the Italian Chapter of the IGS.

ABSTRACT

Composite liners consisting of a geomembrane, placed over a low-permeability clay layer, are used throughout the world for the lining of waste disposal facilities, with the aim to prevent the groundwater quality from being compromised, and an unacceptable risk for the human health and the environment from occurring. Despite the importance of developing a rational approach to calculate the contaminant transport rate through composite liners, for both the design of new landfills and the risk assessment of the existing ones, limited attention has been paid so far to the derivation of analytical, numerical, or hybrid analytical-numerical solutions, which can help designers assess the containment performance of lining systems. After an overview of the simplified calculation approaches that are currently adopted for the performance-based design of composite liners, the presentation will outline the main features of a novel theoretical framework, which allows the advective-diffusive transport of inorganic contaminants to be modelled considering imperfect contact conditions between the geomembrane and the underlying clay layer

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Aula Albenga
June, 13th 2024
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DEVID FALLIANO

An engineered cementitious-based material for process and product innovations: from 3D to 4D concrete printing

BIO

Devid Falliano is an Assistant Professor (RTD-A) at the Department of Structural, Building, and Geotechnical Engineering (DISEG), Politecnico di Torino, Italy. In 2018, he received the PhD degree in Engineering and Chemistry of Materials and Constructions at the University of Messina (Italy). His research activity is mainly focused on: strategies for improving the durability of new and existing reinforced concrete structures; theoretical and experimental aspects of 3D concrete printing; experimentation and mechanical characterization of cementitious-based composite materials for structural and non-structural purposes.

ABSTRACT

Reduction in resources, rising raw material costs, global population increase, and increasingly stringent energy requirements are driving the construction industry to seek innovative solutions that can meet the needs of the coming decades. In this respect, the research of synergies between innovative technologies, such as 3D concrete printing, and innovative building materials could play a significant role.

This talk presents the peculiarities of a cementitious-based engineered material whose density can be designed between 80 kg/m3 and 2000 kg/m3. The ability to also adjust its rheological properties makes this material suitable for 3D printing applications. This suggests the idea of varying the density of the extruded layer during the printing process itself, resulting in the innovation of 4D concrete printing. This leads to the possibility of optimising the mechanical and physical properties of the element to be produced point by point, taking the concept of design optimisation to a higher level.

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