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ABSTRACT OF THE DISSERTATION
„ Creep as a design criterion for underground non-pressure high-density polyethylene tanks"

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The dissertation addresses the interaction between underground, non-pressure tanks made of high-density polyethylene (HDPE) and the soil medium, with particular emphasis on forecasting their long-term service behavior. Chapter 2 characterizes the tanks, their design, and the conditions of soil-structure interaction. Chapter 3 reviews the mechanical and rheological properties of HDPE and the principal creep models used to describe polymer deformation. Chapter 4 formulates the main these and research questions that have defined the direction and scope of the research and analyses. Chapter 5 presents the research methodology in the field of specimen preparation, three-point bending tests, uniaxial tension tests, and the measurement techniques used. In Chapter 6, a comparative analysis of material models is carried out in terms of their suitability for describing HDPE creep under tank service conditions, and a model developed on the basis of the author's own tests is presented, together with an assessment of its validity and accuracy using statistical methods. Chapter 7 presents the proposed constitutive model, the parameter calibration procedure based on the author's tests, and a numerical analysis of tensile specimens and bending beams built on this model, with reference to the HDPE creep test results. Chapter 8 contains a summary, conclusions, and design recommendations that account for long-term deformations due to HDPE creep at the design stage and in the durability assessment of in-service structures.

The outcome of the work is a proposed constitutive model for forecasting the long-term deformations of HDPE retention tanks, validated through laboratory tests and numerical analyses, along with a set of practical design recommendations concerning the durability of these structures over the intended service life.

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