Research Project

92-10GT

Capsule

Technology Transfer Program

LTRC

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Development of Accelerated Creep Testing Procedure for Geosynthetics

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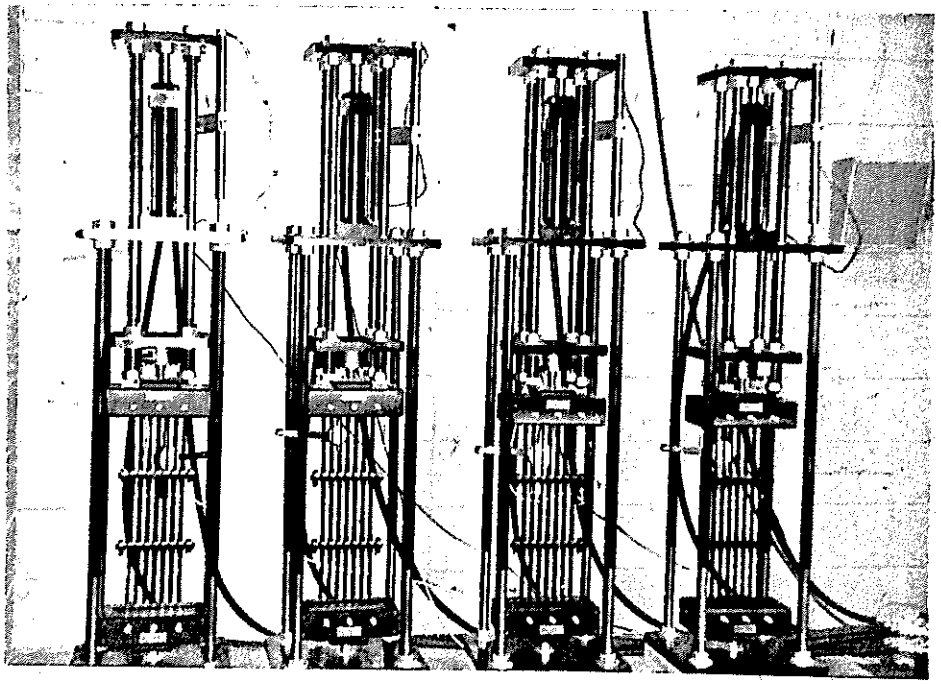
Problem

The main design concern for stability of geosynthetics-reinforced soil structures is the prediction of the long-term (creep) behavior of the geosynthetics. Current design methods and standards usually incorporate a safety factor for creep and other degradation mechanisms to obtain the allowable long-term strength of geosynthetics. Usually, geosynthetic creep tests are performed for durations of 10,000 hours and can only be extended to one order of time magnitude (up to 10 years).

Creep performance for longer durations can be predicted using accelerated creep tests. Creep results of geosynthetics under elevated temperatures can be extrapolated to relate creep behavior to longer time intervals. However, a standard procedure for the time-temperature technique to estimate creep strains of geosynthetics has yet to be established.



The creep testing equipment evaluates geogrid deformations in room temperature in 10,000-hour tests.

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Louisiana Transportation Research Center

Sponsored jointly by the Louisiana Department of Transportation and Development and Louisiana State University
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Objectives

The objectives of this research are three-fold:

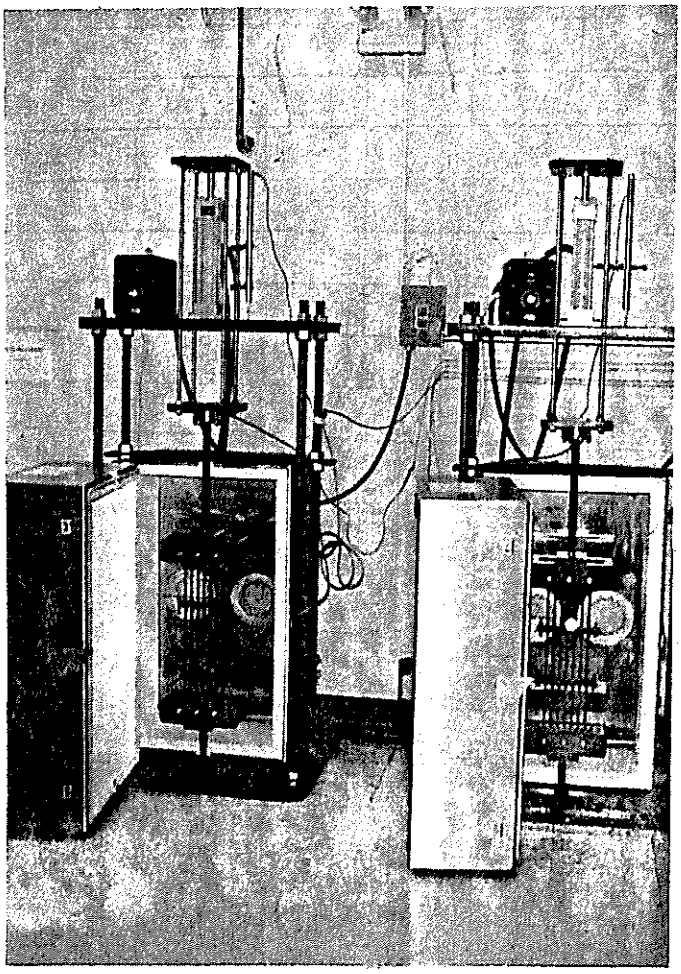
- Develop a creep testing apparatus permitting geosynthetic tests under various controlled temperatures and extension loads.
- Perform creep tests on geosynthetics under various loading levels, elevated temperatures and testing durations.
- Develop an interpretation procedure for extending creep test results to longer time intervals.

Description

Temperature-controlled creep testing equipment was designed and constructed to perform creep tests on geosynthetics specimens under different loading levels. Testing procedures evaluating the effect of temperature on the short- and long-term tensile strength of geosynthetics were executed.

HDPE (High Density Polyethylene) and polyester geogrids, typically used in soil reinforcement, were tested to establish the applicability of time-temperature equivalence.

Data analysis procedures were developed to establish time shift factors and to extend 1,000 hour creep test results to longer time intervals (100 years).



Temperature-controlled creep testing is used in accelerated creep tests of geosynthetics.

Methods for establishing the ranges of loading levels, testing durations, and temperatures were instituted for the prediction of creep strains for longer time intervals.

Implementation Potential

The growing use of geosynthetics as reinforcement elements in the stability of permanent highway embankments and slopes makes it necessary to evaluate the long-term durability of these materials.

The applicability of temperature-accelerated creep tests in predicting creep strains for longer time intervals offers a practical and economical solution to enable testing of geosynthetic reinforcements in reasonable time frames. The research program can be implemented for other types of polymers typically used in the reinforcement of embankments, pavement subgrade layers, and other highway applications.

Creep test results will provide the selection criteria of the temperature ranges at which accelerated creep tests are applicable. The analysis of creep test results will provide estimation of creep parameters for the life of the structure.