Advances in Geosynthetic Clay Liner Technology: 2nd Symposium

STP 1456

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Foreword

The Second Symposium on Geosynthetic Clay Liners was held in Denver, Colorado on 20 June 2003. It was sponsored by ASTM Committee D35 on Geosynthetics. Symposium chairmen and co-editors of this publication were Robert E. Mackey, P. E., S2L, Incorporated, Maitland, FL and Kent P. von Maubeuge, Naue-Fasertechnik GmBH & Co. KG, Luebbecke, Germany.

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MOVEMENTS OF COMPOUNDS THROUGH THE GCL

Overview

Soon after the inception of ASTM D35.04 Subcommittee on Geosynthetic Clay Liners, the first symposium on Testing and Acceptance Criteria for Geosynthetic Clay Liners (GCLs), STP 1308, was held on 29 January 1996, in Atlanta, Georgia. The intention of the symposium was to bring together the current knowledge and understanding regarding this relatively new product used in containment systems. Since that symposium, numerous GCL standards have been developed along with a greater appreciation of the product's capabilities and limitations. ASTM D35 determined it was time to assess the current state of GCL technology to better address possible revisions of the present ASTM GCL standards and determine what new standards will be required in the future.

This book represents the work of several authors at the 2nd Symposium on the Advances in Geosynthetic Clay Liner Technology, June 20, 2003, Denver, Colorado. The theme of the symposium was the current state of technology for GCLs. The topics for the symposium could be divided into the following categories:

- Ability of the current ASTM standards to assess GCLs,
- Needed improvement to GCL standards,
- Compatibility and longevity testing of GCLs, and
- New testing methods to advance the understanding of GCLs and their components.

The papers contained in this publication represent the commitment of the ASTM D35.04 Subcommittee to be proactive in the development of testing methods and proper usage of GCLs. Each paper addresses particular technical issues and concerns regarding the current status of this product. It is hoped that through the efforts of the ASTM D35.04 Subcommittee, a greater knowledge and understanding of the GCLs will be developed by the users of this product.

Assessment of Clay Component

The papers presented in the first session reviewed various aspects of testing the clay component and what knowledge these test results generate for the user. There is still significant debate regarding whether the results from the swell index test or the fluid loss test give a better indication of the hydraulic conductivity of the GCL. The two papers from this session represent the different viewpoints of the industry. Each paper presents its author's views and conclusions on this issue and other items of discussion. The reader of these papers will easily determine that the discussion present here in this STP will continue well into the future.

Durability of Clay Component

The issue of durability of the clay component subjected to adverse compounds and conditions is a new area of interest within the GCL field. One paper presented the use of viscosity to determine adverse effects on the hydraulic conductivity when the bentonite is subjected to various concentrations of salt solutions. Another paper reviewed possible changes in the GCL due to prolonged contact with leachate over a 4 to 6 month period. The

final paper reviewed the long-term effect on the performance properties of the GCL for two landfill caps in which the cover soil had various concentrations of calcium within the soil matrix. Each paper quantified the changes and various factors that promoted or hindered those changes. The end result of this session was a better understanding of liquid/soil interactions with the bentonite and the possible effects this has on the durability of the clay component of the GCL.

Evaluation of Current and Proposed GCL Standards

To assist the users of GCL products, ASTM developed ASTM D 5889 *Standard Practice for Quality Control of Geosynthetic Clay Liners* and ASTM D 6495 *Standard Guide for Acceptance Testing of Geosynthetic Clay Liners.* These ASTM standards listed various properties, test methods, and, sometimes, testing frequencies that should be applied to GCLs as part of manufacturing quality control and/or construction quality assurance. A paper presented at the symposium indicated that these standards have been able to accomplish the goal set by the ASTM D35.04 Subcommittee of developing more consistency in specifying and testing GCLs. It was noted that these standards need to be modified and updated to reflect the current practice in the industry. The authors stressed the continued promotion of these standards to improve standardization within the industry.

There was a paper presented on the review of the GCL direct shear test (ASTM D 6243). The authors reviewed various aspects of the test method including shear devices, specimen gripping/clamping system, hydration stage, consolidation stage, shearing stage, and post-test measurements. The result of this comprehensive review was recommendations for improvements to the test method and application of the standard.

Although not presented at the symposium, a paper included in this STP details a comparison of test methods used to test GCL for flux and/or hydraulic conductivity. ASTM D35.04 and the GCL industry promotes the use of flexible wall permeameters, as detailed in ASTM D 5887. However, rigid wall permeameters are still being specified for testing GCLs. This paper details the GCL performance based on the use of these two apparatus.

Movement of Compounds through the GCLs

GCLs are used primarily as a barrier material in containment systems. Their purpose is to keep liquids from leaving a specific area. This purpose becomes extremely important if the contained liquid would escape and have a detrimental effect on the surrounding environment. Although leakage through the GCL via advection is the most well known method of liquid migration from the containment area, compounds have the ability to migrate through the GCL via diffusion, by thermal gradients, or by the effect of freeze-thaw on the clay component. One paper detailed the investigation of the behavior of GCLs subject to thermal gradients in a containment application. This study indicated that although desiccation of the clay component is possible due to increased temperature, the reduction in GCL water content was not significant and could be correlated to moisture in the subsoil. Another paper detailed the investigation of the effect of freeze-thaw on the permeation of arctic diesel fuel through GCLs. The researchers found that, in comparison to de-aired distilled water, the hydraulic conductivity of the GCL was one order of magnitude less than that of water, even after numerous freeze-thaw cycles. Under the test conditions set by the researchers, the GCL performed very well.

The symposium also included a presentation detailing a test method and procedure to determine the amount of gas diffusion through GCLs. This is an area of future interest for some regulators, engineers, and researchers. Although not included in this publication, a

member of the ISO Committee TC221 on Geosynthetics gave a presentation at the symposium on the status of the European Union Standards (CEN) organization in developing a test method for gas diffusion through GCLs.

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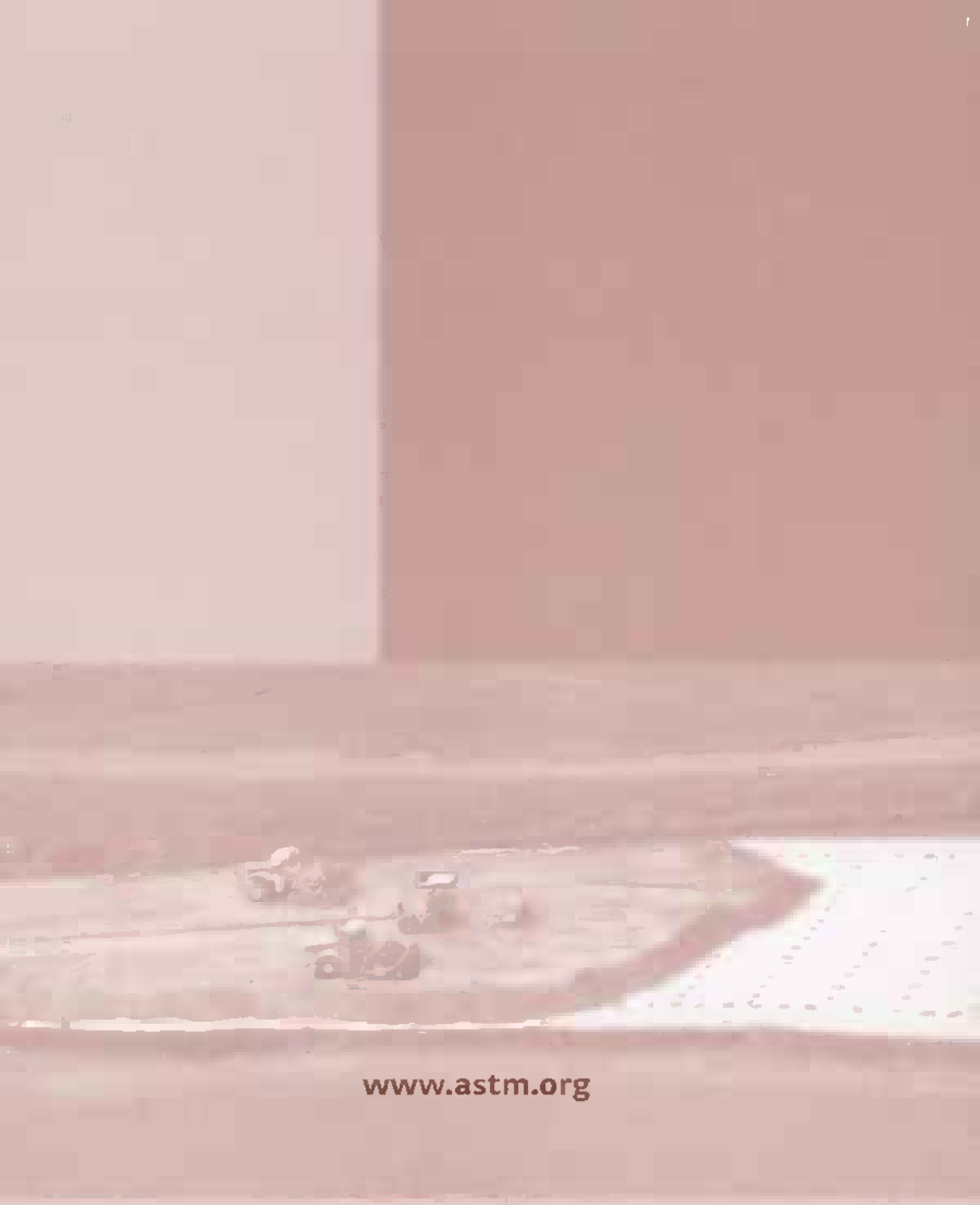

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