Lists of section headings from three papers by JP Giroud

Just as soccer coaches study other teams' games and analyze them with their players, those who teach technical communication can analyze Giroud's papers to give examples of good practices. The many examples of focused thinking include the organization of papers into sections and the choice of section titles. Going through the list of headings, we realize the power of well-crafted section titles. Just reading them makes learning unavoidable!

Leakage Control using Geomembrane Liners

1. Introduction

1.1. The Fifth Victor de Mello Lecture

1.2. This paper

2. General Introduction to Leakage

2.1. Leakage happens and must be addressed

2.2. Terminology related to leaks, leakage and leakage rate

2.3. Units used for leakage rate

2.4. Zero leakage, a desirable goal but an inappropriate specification

2.5. Potentially detrimental consequences of leakage

2.5.1. Review of the potentially detrimental consequences of leakage

2.5.2. Acceptable leakage based on the detrimental consequences of leakage

2.5.3. Acceptable leakage based on achievability and measurability

3. Liners and Liquid Migration

3.1. Geomembranes and other liner materials

3.1.1. Presentation of geomembranes

3.1.2. Presentation of liner materials other than geomembranes

3.2. Liquid migration through liners

3.2.1. Modes of liquid migration

3.2.2. Diffusion

3.2.3. Laminar advective flow

3.2.4. Non-laminar advective flow through holes

3.2.5. Conclusion on liquid migration

Comment: up to this point we have read introductory stuff. Then comes the meaty part!

4. Leakage Reduction by Measures Taken During Construction

4.1. Detection of holes during construction

“ The secondary liner of a double liner system plays an essential role. The only suitable material for a secondary liner is a geomembrane because the leakage rate through the primary liner is generally so small that, if the secondary liner is a soil, even a low-permeability soil such as clay, much of the leakage collected will flow through the soil rather than being conveyed, detected and removed.

The secondary liner is not simply a back-up to the primary liner. ” […]

7.3. Case history: the first double liner

8. Quantitative Evaluation of Leakage

8.1. Data on holes in geomembranes

8.1.1. Data on frequency of holes in geomembranes

8.1.2. Data on size of holes in geomembranes

8.1.3. Relationship between frequency and size of holes in geomembranes

8.2. Theoretical evaluation of leakage rate

8.2.1. Equations for leakage rate calculation

8.2.2. Rate of leakage through geomembrane liners

8.2.3. Determination of the rate of leakage through composite liners

8.2.4. Determination of the rate of leakage in the case of semi-permeable soils

8.2.5. Impact of geomembrane wrinkles on the rate of leakage through a composite liner

8.2.6. Determination of the rate of leakage in case of double liners

8.3. Leakage rate measurement

8.3.1. The two situations of leakage rate measurement

8.3.2. Measurement of leakage rate in case of double liner

8.3.3. Water balance tests

8.4. Typical leakage rates for geomembrane-lined landfills and reservoirs

8.4.1. Typical leakage rates for geomembrane-lined landfills

8.4.2. Typical leakage rates for geomembrane-lined reservoirs

9. Leakage Control in Geomembrane-Lined Dams

9.1. Overview of uses of geomembranes in dams

9.1.1. Types of dams where geomembranes are used

9.1.2. Typical configuration

9.2. Leakage control goals specific to dams

9.2.1. Differences between dams and other liquid containment structures

9.2.2. Irrelevance of the zero-leakage goal in dams

9.2.3. Essential impact of dam body performance on leakage control goal in dams

9.2.4. Leakage control approach for dams

9.3. Influence of the type of dam on leakage control in dams

9.3.1. Leakage control approach in the case of embankment dams

9.3.2. Leakage control approach in the case of conventional concrete dams

9.3.3. Roller compacted concrete dams

9.4. Leakage monitoring in dams

10. Summary and Conclusion

10.1. Summary of information presented in this paper

10.2. Conclusion

“ This paper should encourage thinking by providing the rationale that supports engineering solutions related to geomembrane liners. ”

Reference

Giroud, J.P., 2016, “Leakage Control using Geomembrane Liners”, The Victor de Mello Lecture, Soils and Rocks, São Paulo, Brazil, Vol. 39, No. 3, pp. 213-235, https://doi.org/10.28927/SR.393213

Lessons learned from case histories of reservoirs lined with geomembranes

Abstract – Three case histories (in Europe, the Middle East and North America) [NOTE: the correct order is *"in Europe, North America and the Middle East*"] are used to address some important aspects of the design and performance of geomembrane-lined reservoirs constructed on, or in, soil and rock. After a brief introduction to geomembranes and related geosynthetics, a first case history presents the failure of the liner of a reservoir located on karstic ground. The following lesson was learned: a defective construction detail, combined with an inadequate design (due in part to ignorance of the geological and geotechnical conditions), can cause a catastrophic failure. This case history led to the development of the double liner concept. The second case history is about a double liner. It illustrates the important role played by the mechanical properties of the geomembrane. Geotechnical engineers, who are accustomed to deal with complex materials such as soils and rocks, are well prepared to understand the properties of geomembranes. A third case history shows that a "zero-leakage guarantee" offered by irresponsible suppliers of geomembranes, and believed by uninformed owners and engineers, can lead to a catastrophic failure. This case history illustrates the importance of a design that addresses the potential consequences of leakage through liners. The conclusion of this paper is that only a rigorous engineering approach, including both geotechnical and geosynthetics aspects, can ensure the successful performance of geomembrane-lined reservoirs and other liquid containment structures such as dams and canals. Examples presented at the end of the paper show that large reservoirs, canals and dams have been successfully constructed with a geomembrane liner as the sole waterproof component.

1 Introduction

1.1 Geomembranes

1.2 Geosynthetics associated with geomembranes

1.3 Lessons learned from practice

2 Case history 1: reservoir built on karstic ground

2.1 Introduction of the case

This first case history shows that both design details and conceptual design are important. This case history describes the failure of a geomembrane-lined reservoir built on karstic ground.

2.2 Liner system

2.3 Failure

2.4 Remediation

2.5 Construction of the remediation

2.6 Conclusion of this case history

2.7 Lessons learned from this case history

3 Case history 2: reservoir excavated in a salt formation

3.1 Introduction of the case

The extraordinary case history presented herein illustrates the importance of mechanical properties of geomembranes and teaches a good lesson to engineers. This case history shows that a predicted failure can nevertheless occur if the design engineer fails to convince the owner that the recommended preventive measures are necessary.

3.2 Design of the liner system

3.3 Analysis and failure prediction

3.4 Recommended preventive measure

3.5 Liner system installation

3.6 Observations during filling of the reservoir and liner failure

3.7 Inspection and comment

3.8 Remediation

3.9 Observation while the reservoir was in service [NOTE an entire subsection explaining one photograph!]

3.10 Conclusion of this case history

3.11 Lessons learned from this case history

4 Case history 3: reservoir built on soil sensitive to acid

4.1 Introduction of the case

4.2 Failure

4.3 Investigation

4.4 Analysis

4.5 Remediation

4.6 Conclusion of this case history

4.7 Lessons learned from this case history

5 General conclusion

5.1 Role of geotechnical engineers

5.2 Consequences of unrealistic expectations

5.3 Importance of rational analyses

5.4 Misleading effects of common sense

5.5 Examples of successful applications of geomembranes

Reference

Giroud, J.P., 2019, "Lessons learned from case histories of reservoirs lined with geomembranes", Revue Française de Géotechnique, Vol. 159, No. 2, 13 p., https://doi.org/10.1051/geotech/2019014

FROM GEOTEXTILES TO GEOSYNTHETICS: A REVOLUTION IN GEOTECHNICAL ENGINEERING

INTRODUCTION

HISTORY OF GEOTEXTILES

The forerunners

A revolution in the textile industry

The first steps of geotextiles

The emergence of a large market

Markets, manufacturers and products

Organization of the profession

BASIC CONCEPTS

Geotextile functions

Functions and applications

The emergence of geotextile functions

Discussion of geotextile functions

INVASION OF GEOTECHNICAL ENGINEERING BY GEOTEXTILES

Reasons which interest contractors

Reasons which interest designers

Reasons which interest owners

Fundamental reasons

INFLUENCE OF GEOTEXTILES ON GEOTECHNICAL ENGINEERING

Geotechnical engineering and the textile industry

Revolution in design

INFLUENCE OF GEOTECHNICAL ENGINEERING ON THE GEOTEXTILE COMMUNITY

The challenge

Research and development of understanding

Education of potential users of geotextiles

Organization of the profession

THE ROAD AHEAD

Materials

Construction methods

Use and evaluation of geosynthetic properties

Methods of design

CONCLUSION

Reference

Giroud, J.P., 1986, "From Geotextiles to Geosynthetics: A Revolution in Geotechnical Engineering", Proceedings of the Third International Conference on Geotextiles, Vol. 1, Vienna, Austria, April 1986, pp. 1-18. [link]