

EXCELPLAS TECHNICAL NOTE EP93



Title: ‘Best Practices for Strain Measurement of Geomembranes by Extensometer’

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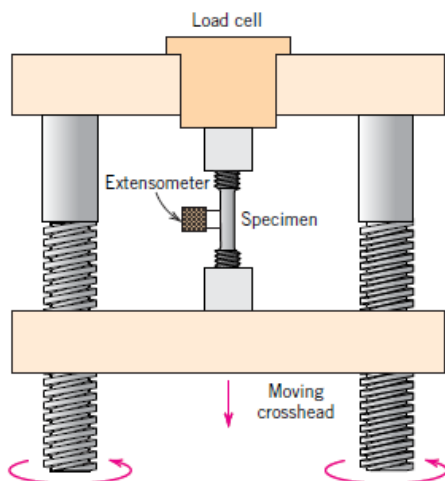
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Abstract:

Geomembranes are widely used for environmental containment, such as lining landfills and wastewater treatment plants. To ensure their effectiveness and reliability, it is important to test the tensile properties of geomembrane specimens accurately. Extensometers are commonly used for strain measurement in these tests, providing reliable and precise data for analysis. In this article, we will discuss best practices for strain measurement of geomembranes using extensometers.

Understanding Extensometer Gauge Length and Measuring Range

The extensometer gauge length is the distance between the initial measuring points on the geomembrane specimen. The gauge length requirements may vary depending on the testing standard being used. It is important to check the standard for specific requirements before selecting an extensometer.



The measuring range of an extensometer is its measuring capacity in tension (+) or compression (-) in units of % strain, maximum extension, or maximum deflection. It is important to select an extensometer with a measuring range that is suitable for your testing application. In general, it is best to select an extensometer with a measuring range that is greater than the expected strain or displacement values to ensure accurate data.

$$\epsilon = \frac{l_i - l_0}{l_0} = \frac{\Delta l}{l_0}$$

Interfacing Extensometers with Testing Machines

Extensometers can be interfaced with testing machines using various methods, such as strain gage bridge or analog output. It is important to ensure that the testing machine electronics are compatible with the type of extensometer being used.

Specifying an Extensometer for Geomembranes

When selecting an extensometer for geomembrane testing, it is important to consider the required gauge length and measuring range. It may be necessary to use additional gauge length adapter kits or extensometers to meet all requirements. The range of specimen temperatures being tested should also be considered when selecting an extensometer.

Selecting a Gauge Length for Geomembranes

Longer gauge length specimens and extensometers are generally preferable, as they can help overcome potential challenges during testing. Gauge lengths of 1-2 inches (25-50mm) are most commonly selected for geomembrane testing. Shorter gauge lengths may be more challenging to test accurately.

Measuring ranges of 25-50% elongation are commonly selected for geomembrane testing. Selecting a measuring range that is significantly more than the range of interest may have ergonomic and dynamic disadvantages. It is important to ensure that the test range does not exceed the extensometer's nominal measuring range.

Preventing Data Acquisition and Interpretation Problems

Tensile test methods often include the removal of the extensometer after yield to prevent damage to the device. If the indicated strain remains constant after removal of the extensometer, it may be necessary to change the strain measurement source from extensometer to crosshead.

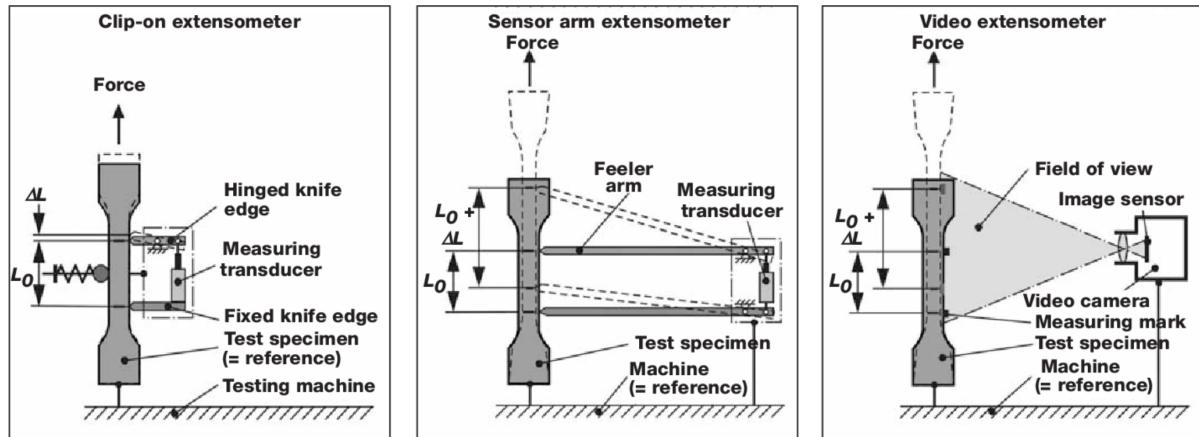
To prevent damage to the extensometer due to falling off the geomembrane specimen, a tether can be used. The cord should be adjusted so that it is entirely loose during the test and attached to a suitable point above the test space. If the extensometer does not have a tether mount, the cord can be attached in a suitable manner that does not impede its operation.

Precautions and Care During Use of Extensometer

Clip-on extensometers normally have a limit of a few millimetres, and pre-loads are directly applied to the tensile testing samples. However, there may be superimposed bending stresses (and scratch/ indentation from extensometer clips), and to compensate for these, instead of traditional contact extensometers, a digital extensometer should be used for delicate or small samples.

However, while using a digital extensometer, a technician should select the appropriate lighting contrast, so the video extensometer detects the true gauge marks. Also, to maintain the accuracy in the results, all types of extensometers should be calibrated at regular frequencies by a professional calibration body.

The figure below is a schematic explaining the operating principle of various extensometers.



Conclusions

Extensometers are a valuable tool for strain measurement in geomembrane testing. By following best practices for selecting and using extensometers, accurate and reliable data can be obtained for analysis. It is important to consider gauge length, measuring range, and test range when selecting an extensometer and to prevent data acquisition and interpretation problems by using appropriate techniques.