

GEONET CREEP REDUCTION FACTOR AT 40°C

The allowable transmissivity of a geocomposite drainage layer is determined in accordance with GRI-GC8, Standard Guide for “Determination of the Allowable Flow Rate of a Drainage Geocomposite” (2001). One of the most important parameters in the determination of the allowable transmissivity is the reduction factor for creep, RFCR, under sustained compressive load. RFCR, takes into account compressive creep from 100 hours (simulated in the transmissivity test per GRI-GC8) to the design life of the landfill.

RFCR is a function of geonet polymer, structure and its ability to retain its structure and thickness under load. It is also well known that the creep of a polymer-based geonet increases with the increasing temperature. Although the standard compressive creep test per GRI-GS4 (as referenced in GRI-GC8) is performed at ambient temperature (20 oC), it is important for the design practitioner to recognize the field-anticipated temperature and apply the appropriate RFCR that would be most representative to the specific facility.

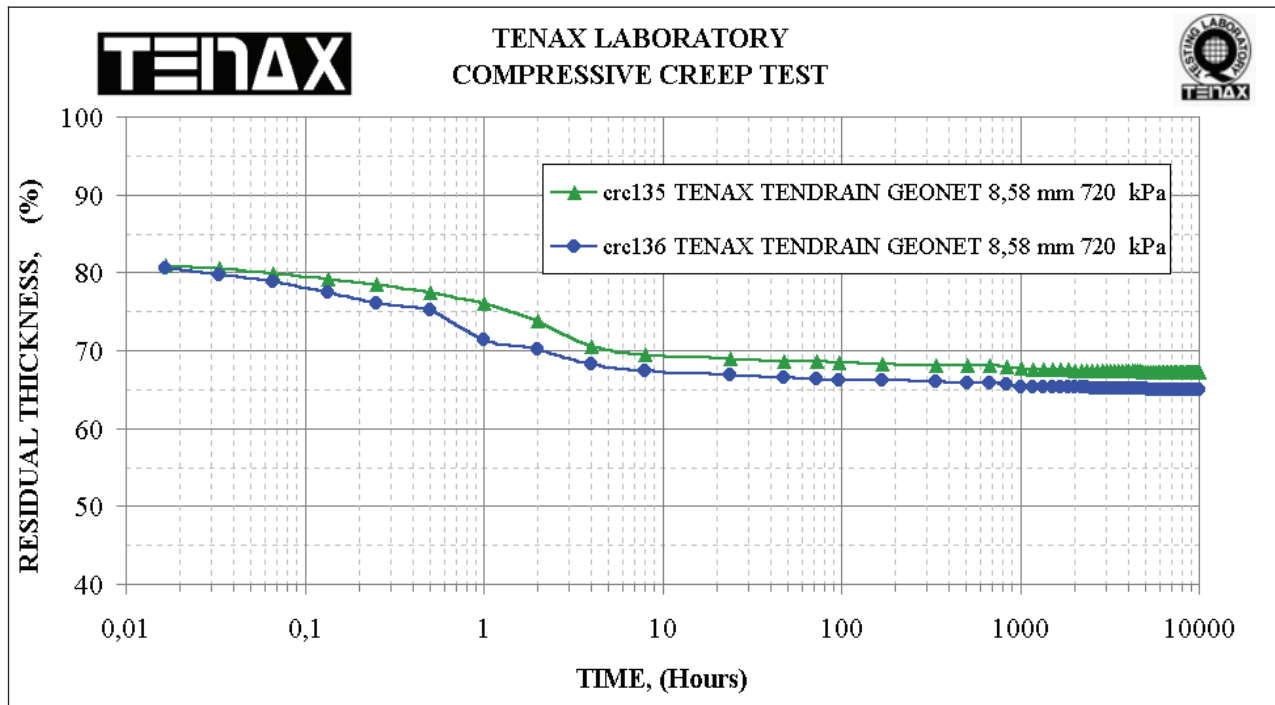
The current trend in the waste industry is to move away from the “dry tomb” landfills and towards “wet” landfills with bioreactor landfills or incorporating leachate recirculation. Biochemical reactions during waste degradation generate heat, while the rate of waste degradation tends to increase with temperature. The optimal temperature for a bioreactor landfill has been reported to be 40 °C (104 °F) by Gurijala et al. and 34 to 38 °C (95 to 100 °F) by Mata Alvarez and Martina-Verdure (Reinhart and Townsend, 1998). Of course, temperatures within a waste mass will differ from site to site due to the waste composition. For example, landfill waste temperature were reported ranging from 100 - 135 °F (38 – 57 oC) at the Sullivan landfill in New York by Hansen and Shaw (2002).

Of more importance, to understand the effect of heat on the liner systems of landfills, monitoring the in-situ temperature at the surface of the primary membrane has been performed. Yoshida and Rowe (2003) reviewed liner temperature data at landfills in Japan, Germany, Canada, and the USA having a typical temperature ranging from 35 to 45 oC. On-going research by Geosynthetics Research Institute has been monitoring the in-situ temperature at the liner of both a “wet” cell and a “dry tomb” cell at a municipal solid waste (MSW) landfill in southeastern Pennsylvania. Koerner and Koerner (2005 & 2006) reported the data after monitoring periods of approximately 10.5 years for the dry cell and 4 years for the wet cell. In the dry cell the temperature was measured to be approximately 20 oC for about 5.5 years at which it suddenly increased to its current measurement of 30-34 oC. In the wet cell the temperature was measured to be approximately 25-28 oC in the beginning and steadily increased to its current measurement of 41-46 oC.

In recognition that temperatures on the liner of a landfill may be greater than the standard ambient (20 oC) temperature typically used for compressive creep testing, a testing program is conducted to investigate the creep characteristics of TENDRAIN geonet under a higher temperature.

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The test program applied a constant normal force of 15,000 psf (720 kPa) to the TENDRAIN geonet for a duration exceeding 10,000 hours at 40 °C. Per Gri-GC8, the creep reduction factor at 15,000 psf and 40 °C is calculated to be 1.2 when extrapolated to 30 years of design life; below is a graph of the compressive creep test at 40 °C .



Reference

GRI Standard GC 8, 2001, Standard Guide for "Determination of the Allowable Flow Rate of a Drainage Geocomposite", 11 p.

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Yoshida, H. and Rowe, K., (2003), "Consideration of Landfill Liner Temperature", Proceedings Sardinia 2003, Ninth International Waste Management and Landfill Symposium, Cagliari, Italy, October 6-10, 2003.