TECHNICAL NOTE

Specifying the Applied Pressure in Transmissivity Testing

Drainage geocomposites are used in landfills to convey either liquid or gas to a collection point, to prevent pressure head build up on the liner system, and to address possible slope instability due to detrimental pore pressure. Drainage geocomposites are used in closure systems for the surface water drainage layer and gas venting layer. In bottom liner systems, they are used in the leachate collection system as well as in the leak detection system and/or groundwater suppression layer if required.

[GSE Geocomposite]

The applied pressure or load specified for a transmissivity test is one of the important test parameters an engineer should identify for transmissivity testing according to ASTM D4716 in project contract documents. Other parameters include: the product (geonet or geocomposite), test configuration which models field conditions, hydraulic gradient representative of the design slope, and the test duration. Per GRI GC8, the test duration for transmissivity testing is 100 hours. In recognition of the relatively short test duration compared to the actual design service life in which the drainage system must perform, the specified applied pressure must take into consideration all possible factors that may influence the actual applied normal pressure on the drainage geocomposite; thus, the hydraulic performance of the drainage geocomposite.

Closure systems:

A typical closure system incorporates a barrier layer, drainage layer, 18 inches of vegetative support soil, and 6 inches of topsoil. Assuming a unit weight for the soil layer of 125 lb/cf, the direct loading on the geocomposite would be 250 psf. This applied pressure value only accounts for the weight of the soil and not other factors such as equipment loading during soil placement or closure site end use that would increase the loading on the geocomposite for a duration of time. To account for the extra loading the drainage geocomposite may experience after installation, it is recommended that for typical closure systems an applied pressure of 1000 psf be specified.

Bottom liner systems:

The most common use of a drainage geocomposite in bottom liner systems is for the leachate collection layer and leak detection layer. During the permitting of a bottom liner system, the design engineer is frequently required by the state permitting agency to perform a hydraulic analysis of the proposed landfill cell using the HELP (Hydraulic Performance of Landfill Performance) model from the time of first placement of waste through the placement of a final closure system. For leachate collection layer design, the greatest quantity of liquid is after the initial placement of waste when the applied pressure on the geocomposite is the least. As the waste height in the cell increases, the quantity of liquid will decrease due to the liquid storage capacity of the waste. Although the quantity of liquid that the drainage composite must handle is decreasing with waste height, the applied pressure from the waste is increasing which decreases the transmissivity performance of the drainage geocomposite. Thus, at a landfill cell's maximum height, both the quantity of leachate to be handled and the transmissivity performance of the drainage geocomposite will be at its least.

In recognizing the relationship of the leachate generation rate and waste height as it relates to a bottom liner collection layer performance, The Florida Department of Environmental Protection in 2001 adopted the following language into their solid waste regulations, Chapter 62-701.400, subparagraph (3)(d)8., F.A.C.: “The testing for the geonet in the liner system shall be conducted using actual boundary materials intended for the geonet at the maximum design normal load for the landfill, and at the design load expected from one lift of waste.”

It is recommended that for transmissivity testing of a drainage geocomposite to be used in a bottom liner system, testing be performed at both a load representative of the initial placement of waste (1,000psf is appropriate for 15-ft waste with a unit weight of 65pcf) where the drainage performance must be its greatest and at the maximum anticipated normal pressure at closure design height to confirm that the product will meet the design requirements.

Vertical expansions:

Landfill owners are always looking for ways to increase the available airspace of their landfills. Vertical expansions and increased permitted waste heights are two methods applied to accomplish this. With the increased weight height, the design applied pressure on the geocomposite increases. This loading on the drainage geocomposite can be a limiting factor if the product can no longer meet the design hydraulic performance or even collapse at the increased loading. It is recommended that a factor of safety be applied to the maximum specified load for transmissivity testing to prevent future design limitations due to the specified drainage geocomposite’s performance characteristics.

References

ASTM D4716, GRI Standard GC 8, 2001, Standard Guide for “Determination of the Allowable Flow Rate of a Drainage Geocomposite”, 11 p.

Florida Administrative Code (F.A.C), Chapter 62-701, Solid Waste Management Facilities

Tedder, R.B, 2005, “Use of Geosynthetic Drainage Materials at Landfills in Florida”, Geo-Frontiers 2005, Austin, TX,