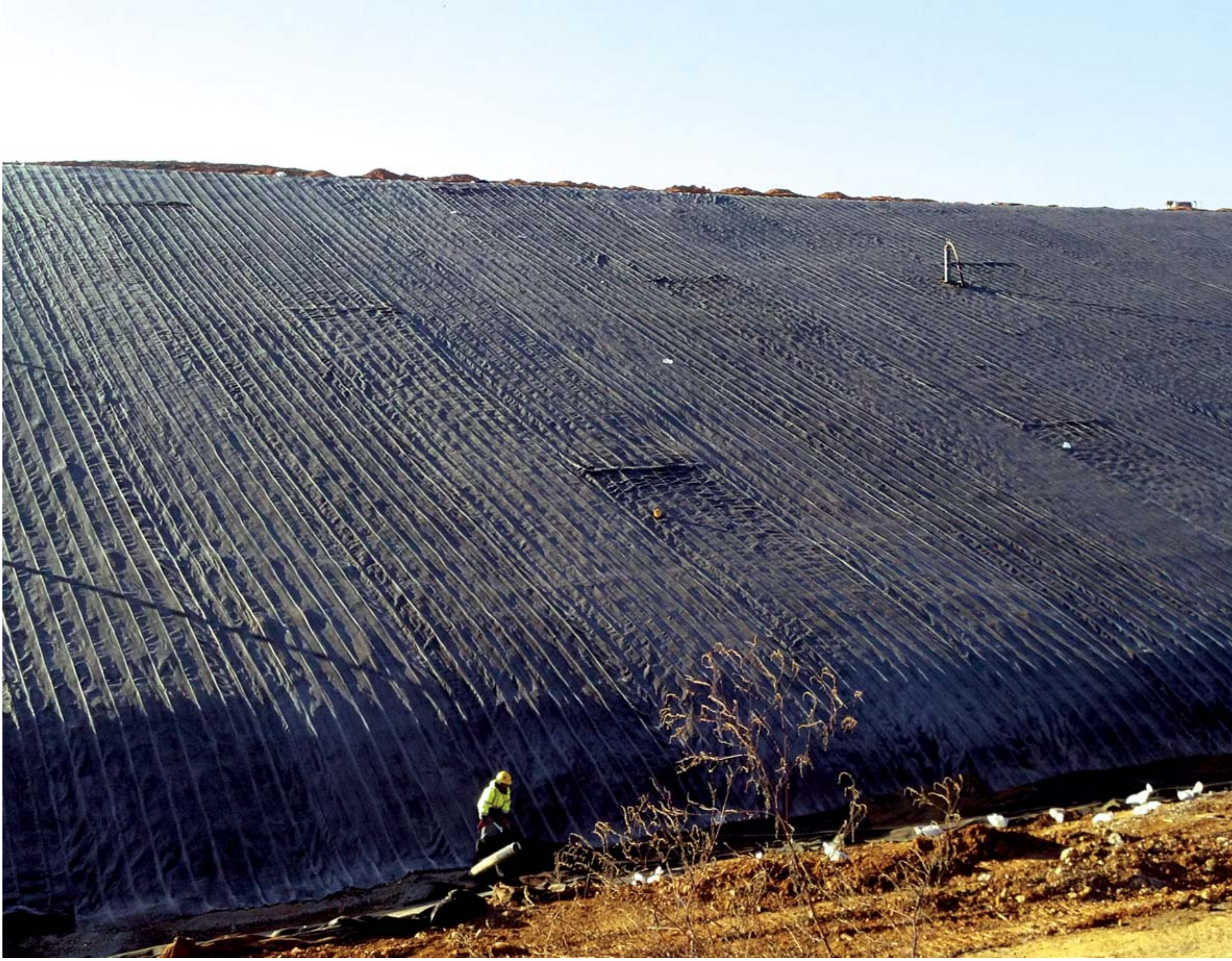

TOP PHOTO The tubular drainage geocomposite was deployed over the subgrade as a gas venting layer. **BOTTOM LEFT** Seaming of adjacent panels consisted of heat-bonding the geotextiles; no ties were needed. **BOTTOM RIGHT** At butt seams, the tubes were joined with mechanical couplers.

PROJECT SHOWCASE

How tubular drainage geocomposite was used in landfill final cover

By Thomas B. Maier, P.E., and Stéphane Fourmont

Introduction

In landfill final cover systems, geocomposite drainage products are frequently used as a drainage layer above the geomembrane layer and for surficial landfill gas collection, either in strips or as a continuous layer, below the geomembrane. For the first time in the southeastern United States, a final cover system has been constructed using a drainage geocomposite that incorporated perforated tubes. Referred to generically as a tubular drainage geocomposite, it was developed in France more than 20 years ago and has grown in use in North America since its introduction in 2008.

Project background

The final cover design for the Grady Road Landfill in Rockmart, Ga. consisted of a 40-mil textured LLDPE geomembrane with a geonet planar geocomposite layer below for gas collection and another geonet planar geocomposite layer above for drainage.

During the bidding process, the design engineers decided to include a tubular drainage geocomposite as an alternative to the specified geonet-based products to increase competition and potentially save their client money. Besides the potential cost savings, this geocomposite also offered potential installation and performance advantages. A minor modification to the permit was submitted by the designers to allow tubular drainage geocomposites as an alternative for geocomposite drainage. After review by the Georgia Department of Natural Resources, the modification was approved.

To meet the project specifications for both drainage and gas collection applications, the manufacturer proposed a tubular drainage geocomposite that includes two layers of a standard 6oz/sy needle-punched nonwoven geotextile and 1-in. diameter corrugated and perforated polypropylene pipes on 20-in. centers running the entire 246-ft length of each roll.

PROJECT HIGHLIGHTS

GRADY ROAD LANDFILL FINAL COVER SYSTEM ROCKMART, GA.

LANDFILL OPERATOR
Waste Industries, Raleigh, N.C.

DESIGN ENGINEERING
Smith Gardner Inc., Raleigh, N.C.

DRAINAGE AND GAS COLLECTION LAYERS
DrainTube™ 606 ST2 D25, Afitex-Texel, Saint-Elzear-de-Beauce, QC, Canada

CONTRACTOR
Brad Cole Construction, Carrollton, Ga.

COMPLIANCE TESTING
Geotechnics, East Pittsburgh, Pa.

GEOSYNTHETICS INSTALLER
Environmental Specialties Intl., Baton Rouge, La.

Tom Maier is a senior project engineer with Smith Gardner Inc., Raleigh, N.C.

Stéphane Fourmont is business development manager with Afitex-Texel, Auburn, N.H.

Photos courtesy of the authors

When bids were opened, the tubular drainage geocomposite alternate was lower in cost and was selected. The contract was awarded, initial compliance testing was completed on Nov. 21, 2012 (the day before Thanksgiving), the geosynthetics installer authorized production of the geocomposite to begin, and the first 10 truckloads (1 million sf) were delivered five days later on Nov. 26.

Since none of the parties had installed a tubular drainage geocomposite before, a preconstruction meeting including all parties was held at the landfill Nov. 27, 2012. Installation began the next day and proceeded without difficulties.

The method of Richardson, Giroud, and Zhao (2000) was used to evaluate the required initial transmissivity for the drainage geocomposite.

Design considerations

Drainage layers for final cover systems are designed to limit the depth of liquid to less than the thickness of the drainage layer. In addition, the drainage layer must have sufficient initial transmissivity such that the long-term (reduced) transmissivity will still meet this hydraulic requirement. For tubular drainage geocomposites, the maximum liquid depth between tubes is limited to the tube diameter (1in.).

An evaluation of tubular drainage geocomposites requires a separate evaluation of the transmissivity of the geotextile component in addition to an evaluation of the transmissivity of the geocomposite as a whole. The method of Richardson, Giroud, and Zhao (2000) was used to evaluate the required initial transmissivity for the drainage geocomposite. This method includes the application of reduction factors for intrusion (of geotextile into geonet core), creep (resulting in reduced thickness of geonet core), chemical clogging and biological clogging, along with an overall factor of safety of 2.

In landfill caps, the recommended values for these factors yield a combined reduction factor of 6 for some geocomposites. However, as presented by Saunier, Ragen, and Blond (2010), for the proposed tubular drainage geocomposite, the reductions for intrusion and creep are not applicable, yielding a combined reduction factor of 3.6 (meaning that the initial transmissivity must be at least 3.6 times greater than the transmissivity required by hydraulic considerations alone).

The required transmissivity of the geotextile component was calculated and hand-checked using equations presented by Arab and Gendrin (2007). The combined reduction factor of 3.6 was applied to the resulting value to account for chemical and biological clogging. Independent laboratory testing under appropriate conditions confirmed that the geocomposite met the calculated transmissivity requirements, both for the geocomposite and for the geotextile component.

The LLDPE geomembrane was deployed over the gas venting layer.

Installation

The tubular drainage geocomposite presented several advantages during installation:

- The rolls are lightweight and easy to handle.
- No plastic ties are needed.
- Adjacent panels are joined simply by heat-bonding the geotextiles of adjacent rolls.
- Butt seams require the additional step of joining the tube ends using mechanical snap couplers, which requires little time.

When installing around corners, care must be used to keep the tubes generally aligned perpendicular to the contours of the slope. The transmissivity in the downslope direction will decrease as the angle away from perpendicular increases. For caps with complicated curvature, a panel placement drawing would be in order for the geocomposite as well as for the geomembrane to assist in achieving optimum pipe alignment.

During placement of overlying cover soil, the geocomposite lies flat without the formation of large waves in front of the advancing dozer. The combined result of all the installation factors mentioned is that, for an experienced crew, the installation time is shortened with the tubular drainage geocomposite, unless the landfill curvature is unusually complex.

TOP PHOTO Placement of cover soil over the drainage layer. **BOTTOM PHOTO** No waves were observed in the drainage geocomposite ahead of the advancing dozer.

Gas collection

The final cover design includes a dual-purpose toe drain that functions to collect and drain any leachate seeps into the leachate collection system and provides gas extraction at the toe of the slope.

With the installation of the gas venting layer, the influence of the vacuum applied at the toe of slope is extended over the full extent of the closure. A potential enhancement for future phases of partial closure would be to directly connect each tube of the gas venting layer to the toe drain pipe. Modified snap couplers are available to facilitate such a connection.

Conclusion

The project participants consider their first experience with this tubular drainage planar geocomposite a positive one. The product met the project's design criteria for both gas collection and drainage, and presented some advantages during installation. Since two of the most common causes of final cover system failures are gas pressure uplift and an inadequate drainage layer, the geocomposite was a vital component of the final cover system, providing resistance to both of these failure modes.

>> For more, search **drainage** at www.geosyntheticsmagazine.com

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