Runoff from glycol deicing operations at airports has long been seen as detrimental to rivers and streams as the decomposition of glycol occurs. As glycol decomposes in water, the biological oxygen demand (BOD) increases, thus depleting the available oxygen that supports aquatic life. This environmental issue is currently being addressed at state and local levels with increased scrutiny, and will likely result in tighter controls on the use of deicing fluids.

If you find yourself on an airplane that is being deiced at the Pittsburgh International Airport, you need not worry about the impact the deicing fluid runoff may have on local streams. This is due to the construction of a $22 million widebody deicing facility that was built in 2001 from funds made available by the Federal Aviation Authority (FAA), and revenues from a $3.00 passenger facility charge imposed on every ticket sold.

With the necessity to reduce departure times of the newer widebody aircraft that required deicing, it was imperative that two widebody aircraft be deiced side-by-side, which meant constructing a new deicing facility. Also driving this decision to construct a new facility was a November 2000 consent order issued by the Pennsylvania Department of Environmental Protection, requiring the Allegheny County Airport Authority to provide an environmentally friendly deicing facility for these aircraft by late 2001. Therefore, in December 2000, plans were under way to construct the new facility with a mandatory operational date of 15 December 2001. This required completion date represented a 50% schedule compression of what would normally be a two-year design and construction process.

**Widebody deicing facility design**

Design objectives stipulated by the Allegheny Airport Authority included:

- A deicing pad to accommodate two widebody aircraft positioned side-by-side;
- Containment and recovery of the propylene glycol used for deicing;
- Incorporation of the stockpiled repairs into the base course section; and,
- Incorporation of Best Available Technology (BAT).

On 6 June 2001 the Notice to Proceed was issued to a Joint Venture Company of Trumbull Corporation and Hi-Way Paving Inc. to begin the $22 million fast-track 15-acre (6-ha) widebody deicing facility (also known as the Sierra Pad) located adjacent to Taxiway Echo. Faced with a stringent construction deadline, the project work schedule consisted of two 10-hour work shifts, 6 days a week, with one 10-hour shift on Sunday.

Prior to construction of the new facility, demolition of an existing Fixed Based Operation was required, as it occupied the new location of the widebody deicing facility. Concrete pavement recovered from the demolished taxiway and aircraft parking apron of the Fixed Based Operation was crushed on-site and reused within the new pavement section.

The location of the new widebody deicing facility is adjacent to Taxiway Echo, minimizing the taxing time between deicing and takeoff. The widebody deicing facility's concrete pad was designed to collect all surface runoff from the deicing process along with normal precipitation into a trench-drain system. The trench drains connect to a subsurface collection system of reinforced concrete pipes as large as 66 in. (1.7 m) in diameter, which extend across the deicing pad, connecting to a diversion-collection structure. The reinforced concrete pipes also serve as retention for nearly 500,000 gal. Underlying the collection system is a high-density polyethylene (HDPE) smooth liner which prevents propylene glycol from migrating into subsurface soils and groundwater. The computer controlled au-
tomatic/manual switching valves located at the diversion-collection structure divert non-propylene glycol laden runoff to storm water when deicing activities are not performed. During months when deicing activities are conducted, all surface runoff is diverted into two above-ground storage tanks which have total capacities of 1.4 million gal., where it is stored for recycling. Recycled propylene glycol is not used at the Pittsburgh International Airport.

The deicing facility pad design (Figure 1) incorporates the use of a polypropylene 16 oz./yd.\(^2\) needlepunched nonwoven placed directly above a compacted base layer of recycled crushed concrete. Above the 16 oz./yd.\(^2\) nonwoven layer, a 60-mil HDPE smooth liner was installed. To protect the liner from being damaged by the recycled crushed concrete subbase material, a polypropylene 60 oz./yd.\(^2\) needlepunched nonwoven was placed above the liner. The deicing pad section above the 60 oz./yd.\(^2\) nonwoven consists of a 14-in. recycled crushed concrete subbase, a 7-in. bituminous concrete base course, and 16 in. of Portland cement.

### Design and installation of the geosynthetics

The use of a heavy weight nonwoven to protect the 60-mil HDPE liner at this site was not surprising. Many landfills in Europe incorporate the use of 60 oz./yd.\(^2\) nonwoven geotextiles to protect their liners. Protecting the liner is vital to safeguarding aquifers and streams from potential contamination which could affect the environment.

The project specifications required that the 16 oz./yd.\(^2\) and 60 oz./yd.\(^2\) have the physical properties shown in Table 1.

Recent published specifications by the Geosynthetics Research Institute for Test Methods and Properties for Nonwoven Geotextiles Used as Protection (or Cushioning) Materials GRI Test Methods GT12 are shown in Table 2.

A aware of the project construction time constraints, the 91,000 yd.\(^2\) (76,090 m\(^2\)) of the 16 oz./yd.\(^2\), and the 91,000 yd.\(^2\) of the 60 oz./yd.\(^2\) were custom-manufactured in roll widths of 25-ft. (7.6 m). Typical nonwoven roll widths range up to 16 ft. (4.9 m). This larger roll width not only shortened the installation time of the material, but also reduced the number of specified hot wedge welded seams. The specifications required that the nonwoven materials have a minimum 4-in. overlap and be continuously hot wedge welded at all roll edges and ends. Hot wedge welding was performed at temperatures of 400–450°F, at a speed of 20–30 ft./min.

### Summary

Completion of this fast-track project on 15 December 2001, as specified, required an extraordinary team effort by all manufacturers, suppliers, and personnel. Excellent project management and communications with all parties also proved vital in completing such a complex project.

The design of this new widebody deicing facility incorporates materials and technology that many refer to as “state of the art”. This new facility not only functions as a safeguard to the flying public, but also to the environment.

### Project Information

**Engineering consultants:** Michael Baker Jr. Inc. and Camp Dresser & McKee Inc.

**General contractors:** Joint venture of Trumbull Corporation and Hi-Way Paving Inc.

**Construction managers:** Parsons Brinckerhoff

**Geotextile installer:** Landsaver Environmental, Richmond, Va.

**Geotechnical Laboratory:** Geotechnics Inc., Pittsburgh, Pa.

**Liner:** 60-mil HDPE from GSE Lining Technology Inc., Houston, Texas

**Geotextile:** Needlepunched nonwovens from Huesker Inc., Charlotte, N.C.

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### Table 1. Required values for the project’s 16 oz./yd.\(^2\) and 60 oz./yd.\(^2\) fabrics

<table>
<thead>
<tr>
<th>Property</th>
<th>Test method</th>
<th>ASTM</th>
<th>Unit</th>
<th>MARV</th>
<th>MARV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>D 3776</td>
<td>oz/yd(^2)</td>
<td>16</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Thickness</td>
<td>D 1777</td>
<td>mils</td>
<td>120</td>
<td>540</td>
<td></td>
</tr>
<tr>
<td>Grab tensile strength</td>
<td>D 4632</td>
<td>lb</td>
<td>300</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>Puncture strength</td>
<td>D 4833</td>
<td>lb</td>
<td>200</td>
<td>800</td>
<td></td>
</tr>
<tr>
<td>Mullen burst strength</td>
<td>D 3786</td>
<td>psi</td>
<td>500</td>
<td>1400</td>
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</tbody>
</table>

### Table 2. GRI GT12. Test Methods and Properties for Nonwoven Geotextiles Used as Protection (or Cushioning) Materials.

<table>
<thead>
<tr>
<th>Property [1]</th>
<th>Test method</th>
<th>ASTM</th>
<th>Unit</th>
<th>10</th>
<th>12</th>
<th>16</th>
<th>24</th>
<th>32</th>
<th>60</th>
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</thead>
<tbody>
<tr>
<td>Mass per unit area</td>
<td>D 5261</td>
<td>oz/yd(^2)</td>
<td>230</td>
<td>300</td>
<td>370</td>
<td>450</td>
<td>500</td>
<td>630</td>
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<tr>
<td>Grab tensile strength</td>
<td>D 4632</td>
<td>lb</td>
<td>95</td>
<td>115</td>
<td>145</td>
<td>200</td>
<td>215</td>
<td>290</td>
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<tr>
<td>Trapezoidal tear strength</td>
<td>D 4355</td>
<td>%</td>
<td>120</td>
<td>140</td>
<td>170</td>
<td>250</td>
<td>300</td>
<td>390</td>
<td></td>
</tr>
<tr>
<td>UV Resistance [2]</td>
<td>D 4355</td>
<td>%</td>
<td>70</td>
<td>70</td>
<td>70</td>
<td>70</td>
<td>70</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>Puncture (pin) strength</td>
<td>D 6241</td>
<td>lb</td>
<td>300</td>
<td>12</td>
<td>16</td>
<td>24</td>
<td>32</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Puncture (CBR) strength</td>
<td>D 6241</td>
<td>in.</td>
<td>700</td>
<td>320</td>
<td>410</td>
<td>440</td>
<td>510</td>
<td>760</td>
<td></td>
</tr>
</tbody>
</table>

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[1] All values are MARV except UV resistance; it is a minimum value.

[2] Evaluation to be on 2-in. strip tensile specimens after 500 hours exposure.

*Alternate tests to ASTM D4833 (pin)