

Geotextile trends and developments

Mark L. Marienfeld

ABSTRACT: *The North American geotextile market has grown to over 400 million square yards per year. The growth is due to wider acceptance of traditional products and to new products or applications. The author reviews the geotextile market by applications and discusses current trends and opportunities for each area. There is special consideration of nonwoven geotextiles and an update of industry activities associated with the geotextile market.*

KEYWORDS: *End use, geotextiles, marketing, nonwovens, North America, trends.*

The North American geotextile market is famous for its vast opportunities. It is also infamous for its small reward for geotextile manufacturers. Although most of the geotextile potential markets have less than 10–20% penetration, an excessive supply of material remains manufactured. This is because geotextiles, although highly technical and specialized fabrics, are sold as commodity items. Commodity-type product margins do not allow manufacturers to devote adequate marketing resources to expand their use. The market has grown mostly by word of mouth extolling the good field performance of the materials.

This paper will give an overview of today's geotextile market with a brief examination of each significant market segment or application. The total North American geotextile market was approximately 420 mil-

lion square yards in 1994. **Table I** shows the categorization of geotextiles by end use for 1993, and **Fig. 1** presents the information as a pie chart.

Figure 2 shows the percentage of dominant use of nonwoven compared to woven geotextiles for 1993. This paper will describe where and why nonwovens find use as the predominant geotextile fabric. Years ago, there were extensive battles between woven and nonwoven fabric manufacturers. Woven manufacturers touted the highest strength per weight and high modulus. Nonwoven manufacturers proclaimed the advantages of higher permeability, better friction, better conformability, and construction survivability. Largely through the efforts of the Geotextile Division of the Industrial Fabrics Association International (IFAI), geotextile manufacturers

now work well together. They recognize that certain products are more suitable for specific uses. Several manufacturers now offer both woven and nonwoven geotextiles.

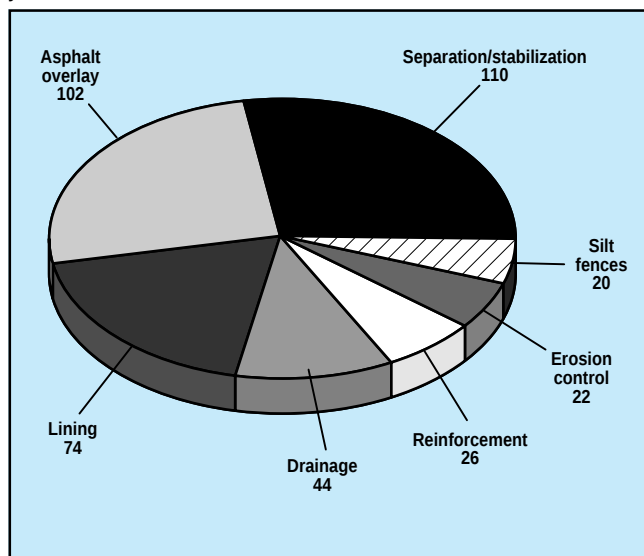
From a raw material viewpoint, geotextiles are still approximately 85% polypropylene. The remainder is polyester. This is due to the lower cost of polypropylene feedstock. There is almost 50% more resin per pound for polypropylene compared to polyester due to the difference in their specific gravities. Chemical resistance is generally better with polypropylene. Polyester can be stronger in some constructions. Polyester has recently made advances in the politically correct use of post consumer waste (soda bottles) in the manufacture of geotextiles.

Separation/stabilization geotextiles

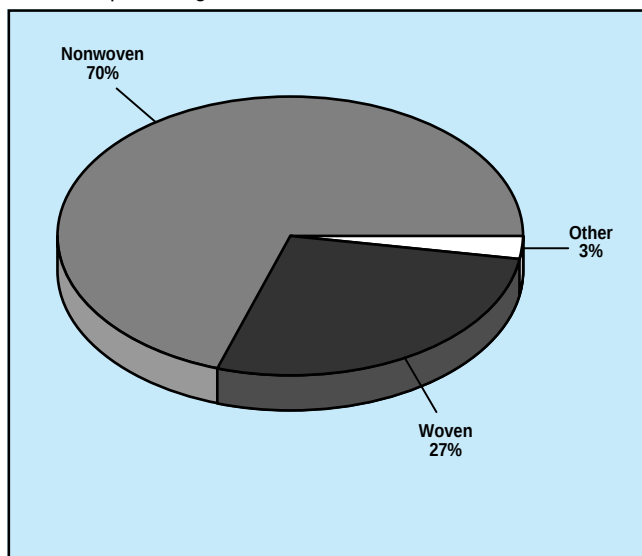
The largest segment of the market is separation/stabilization geotextiles. This market comprises approximately 115 million square yards per year in North America. It continues to grow in both the public (roads) and the private (parking lots) sectors. The use of a separation/stabilization geotextile keeps the subgrade soil from pumping up into the aggregate that supports the pavement or unpaved aggregate surface. The stabilization benefit also allows the geotextile to replace up to one-third of the structural materials for the road or parking lot. These performance benefits are achieved with very inexpensive geotextiles. A customer therefore gains significant

Geotextile Trends

1. 1993 North American geotextile applications in millions of square yards



2. Market share for 1993 geotextile material structures showing estimated percentages



project savings. The most recognized specification for this and the other end uses below is the American Association of State Highway and Transportation Officials specification M-288. This allows comparable woven and nonwoven geotextiles with two different strength property specifications for the same separation and stabilization use.

Recent developments in the separation/stabilization market have included studies on geotextile installation and construction survivability and on long-term survivability. The studies indicate that there are certain minimum geotextile strength properties required to survive project construction. Once in place, however, these materials are showing extremely long life. The trend in this market is away from price-driven, low-cost fabrics, toward the use of the best fabric for the proposed project conditions. There might be a nonwoven in a wet area to provide proper drainage or a heavier weight fabric where installation conditions are harsh.

Geogrids are tending toward this large market, but studies have shown few advantages for this higher cost approach. Without an accompanying geotextile, these open geogrids do not provide the separation function.

The current push by the industry through IFAI is for better recognition of the geotextile benefits by public agencies. These groups are supposed to identify products such as geotextiles that can lower construction and long-term maintenance costs. This means lower highway expenditures and more efficient use of tax dollars.

Paving fabrics

The next largest market is the paving fabric market. It consumes about 105 million square yards per year. Paving fabric is the generic term for nonwoven geotextiles combined with asphalt cement in the field. The use is as an interlayer system in paving or repaving operations. Placed between layers of asphalt concrete, this interlayer system waterproofs and retards reflective and fatigue cracking in pavements. Significant developments in this market are lacking. Some documentary type endorsements by highway agencies show that the system provides a very cost-effective way to increase pavement life. This decreases construction and maintenance costs.

Because of the size of the market, there are several alternative products available. Strip products that

combine asphalt and paving fabrics in the factory as a preformed, ready-to-install system have had successful application. Their use is growing as an alternative to full-width paving fabric for small pavement distress areas. Other products such as high-strength woven fabrics and geogrids are also available. Their installation quality control and cost-to-benefit advantages are questionable. By themselves, the geogrid products do not provide the necessary waterproofing. Again, the IFAI emphasis is for adequate recognition and endorsement of the benefits of paving fabrics by agencies responsible for spending highway dollars.

One current issue that may have a negative impact on this business is a government mandate for states to use crumb rubber from waste tires in some of their asphalt concrete. The only real benefit here is the disposal of tires. The cost of the asphalt concrete may double. This "linear landfilling" will probably divert some funds that would have been available for paving fabrics.

Liner geotextiles

The third largest and the fastest growing segment of the geotextile market is liner fabrics. Here

I. North American Geotextile market size by application in estimated millions of square yards (Courtesy of IFAI 1994)

<i>Application</i>	<i>1992</i>	<i>1993</i>	<i>1995</i>	<i>2000</i>
Separation/stabilization	105	110	120	175
Asphalt overlay	102	102	107	123
Lining	65	74	85	131
Drainage	43	44	46	55
Reinforcement	20	26	30	47
Erosion control	19	22	24	33
Silt fences	19	20	23	32
Total	373	398	435	596

geotextiles are used in layered geosynthetic and natural liner and drainage systems. These go under and over landfills and beneath reservoirs. The purpose of the geotextile can be geomembrane protection, drainage and filtration, or simple separation of materials. The unique aspect of this market is the large influence of regulations concerning landfill design and construction. The U.S. Environmental Protection Agency recognized the benefits of geotextiles and mandated their use as part of any compliant landfill design. This market is predominantly nonwoven. Very heavy nonwovens up to 16 oz/square yard are necessary where protection is the primary function. The trend is toward even more robust nonwovens for added geomembrane protection and support. European uses have already increased to approximately 40 oz/square yard.

This is a new market that is very technical. Development activity includes geotextile and bentonite clay composites for use as protection and secondary containment, geotextile and drainage geonet composites, geotextile and geomembrane composites, and polyethylene geotextiles. The composites are made to over-

come the low-friction angle between the different geosynthetic materials on a slope. There are still several landfill design and construction problems that the development of new technical geotextiles must overcome.

Drainage geotextiles

The next market segment is drainage-related geotextiles. Although drainage is a function of geotextiles in many applications, there are about 45 million square yards sold just for drainage applications. These applications include trench drains, drain boards, drain pipe wrap, highway edge drains, blanket drains, etc. In these applications, the geotextile is a filter between the soil to be drained and the drainage media. The drainage media could be sand, gravel, or a variety of synthetic drain structures such as geonets, waffle boards, or pipes. Studies of existing drain structures have examined both the construction survivability and the long-term performance of drain systems. There was some clogging in rare soil conditions. Improper installation was the usual cause of any problem, however. Some biological clogging occurs in drainage geotextiles that are filtering nutri-

ent rich water. Both the physical and the biological clogging present a product development opportunity to eliminate these problems.

The drainage market segment will continue to grow. There is an increasing awareness by pavement designers and maintainers that water in pavements causes the most damage and shortens pavement life. Nonwoven fabrics predominantly serve this market segment, although there is a small amount of woven monofilament in use. The state of the practice in soil drainage design is not as advanced as other areas of filtration. In other filtration areas, the engineering of nonwovens results in distinct particle size filters. Here soils can vary considerably, and geotextile uniformity is poor.

Erosion control geotextiles

The last significant market segment which uses predominantly nonwoven geotextiles is the erosion control and slope protection application. The geotextile acts as a filter to allow water to pass while retaining soil. This retards erosion on slopes, shorelines, and stream banks beneath rip-rap stone or other armor systems. Drainage and filtration are also the key performance features of this application. The preference for nonwovens is increasing. Although a woven monofilament could provide a good filter, it is more costly, more susceptible to damage, and slicker. This allows rip-rap stone to shift making the system unstable.

Market growth will continue in this area due to increasingly strict laws on pollution and environmental protection. Trends in this market are to manufactured armor systems instead of rip-rap stone. These systems allow developments in composite erosion control products and special fabrics for use with different erosion control systems.

Silt fence and reinforcement geotextiles

Woven fabrics dominate the last two significant market areas—silt fences and reinforcement. Silt fences are probably the most nontechnical of all geotextiles. They simply form a check dam to slow runoff and erosion. Woven geotextiles provide low cost, resistance to UV light degradation, and high modulus when stretched as a fence. High-strength woven geotextiles and geogrids share the reinforcement market segment. High modulus is important in this end use. There is a perception that nonwoven geotextiles have a low modulus, since their testing is without confinement. When tested in confinement, the nonwovens show drastic increases in strength and modulus. The reinforcement func-

tion applies to uses such as geosynthetic reinforced soil walls and embankment reinforcement over weak soil.

Other applications

There are a variety of small, specialty uses for geotextiles not mentioned above. They often fall under the market segments already discussed. There are two other related applications not considered under the geotextile umbrella. They are the temporary and permanent erosion control (vegetation growth mats) and landscape separation fabric placed under mulch to prevent weed growth. These are large markets. The vegetative growth and erosion control products vary widely in structure and cost. The weed control and landscape separation fabrics are pre-

dominantly nonwovens or modified wovens due to permeability and frictional requirements.

Summary

The geotextile market is surviving, but the supply continues to outpace the demand. This is due to steady capacity increases by manufacturers. Most of the new capacity is nonwoven, since these fabrics dominate the market. The market growth is greatest in areas where environmental regulations are driving high-quality civil construction. Growth in the other areas is steady but limited. This results from a lack of effective marketing and limited marketing forces due to low product margins. New product development opportunities will continue to be greatest in specialty applications where they can solve technical design and construction problems. Convenience will also drive development as geotextiles combined with other materials will make better and easier-to-use composite products. 

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