

# M288-96: The updated AASHTO geotextile specifications

By L. David Suits and Gregory N. Richardson

**D**URING THE PAST YEAR, GFR HAS REPEATEDLY mentioned the simplicity and other benefits derived from the new American Association of State Highway and Transportation Officials (AASHTO) M288-96 Geotextile Specifications. Unfortunately it has been easier for most to read about the benefits of M288-96 than to obtain a copy of the actual specifications. At the end of '97, AASHTO finally published M288-96 within its two-volume *Standard Specifications for Transportation Materials and Methods of Sampling and Testing*, 18th edition. This article reviews the development of the AASHTO geotextile specifications and presents a simple summary table that identifies existing commercial products that fit in each default service category.

## Background

In 1982, the Committee on Materials of AASHTO, the American Road and Transportation Builders Association (ARTBA), and the Association of General Contractors (AGC) formed Joint Task Force 25 (TF 25). The task force was made up of representatives of the geotextile industry, private contractors, and state and federal transportation agencies. TF 25's primary responsibility was to review tables of suggested geotextile property values for the Federal Highway Association (FHWA) Geotextile Manual being prepared at the time.

The material properties included in the original work of TF 25 were based on experience in the use of these materials at the time. The resulting work was published in the AASHTO Specification Book as Specification M-288 on Geotextiles.

Because the use of geotextiles in the United States was new and there were very few, if any, accepted design methodologies for geotextiles, the task force took a conservative approach to its work. The specifications did not cover or encourage designing for the use of these materials and did not promote the performance and economic benefits of following detailed design procedures.

Following their initial review, the task force continued to develop guide specifications for geotextiles used in paving, subsurface drainage, erosion control, sediment control (silt fences) and separation applications. In 1986, the task force approved proposed specifications, including material property values and notes on construction and installation procedures, for each of the five applications. Between 1986 and 1990, the five individual specifications were merged into a single material specification, which no longer included the con-

struction and installation notes that had appeared in the individual documents.

In 1989, this single document was submitted for an AASHTO Subcommittee on Materials ballot as a revision to the existing AASHTO M288 Specification for Geotextiles Used for Subsurface Drainage Purposes. As indicated by the title, the existing specification applied to drainage fabrics alone. The revision represented an enlargement of the applications covered by M288.

The revisions were approved, and the revised specification first appeared in the *Standard Specifications for Transportation Materials and Methods of Sampling and Testing*, 15th edition (AASHTO 1990) as AASHTO Specification M288-90 on Geotextiles. A formal report of TF 25's work was published separately in 1990.

By 1992, geotextile useage had grown at a rapid rate, and the work of Task Force 25 was nearly 10 years old. As such, AASHTO Subcommittee on Materials, Technical Section 4e approved a formal review of M288-90. A preliminary review was done with a small task force in early 1993, and a formal Joint AASHTO-Industrial Fabrics Association International (IFAI) Task Force was established later that year. The task force was composed of academic, industrial, and state and federal transportation departmental representation.

When published in the AASHTO Specification Book, M288-90 had not included the construction and installation notes developed by TF 25. One of the new task force's first responsibilities was to approach AASHTO and work out the logistics of including some form of these notes in M288-92. Once this was accomplished, the task force divided into two sub-groups, one to work on material properties, and the other to work on the construction and installation notes. Both were included when M288-92 was published in 1993.

## Revisions to specifications: M288-96

As experience was gained and design methodologies developed, the need to revisit Specification M288-92 was realized. A joint AASHTO-IFAI Task Force was formed in 1994 to review and revise the specification, and the resulting work was adopted by AASHTO in 1996 and published in 1997. The latest specifications are based on accepted design procedures but also provide default material property values for instances when actual design procedures are not used. **Table 1** lists the M288-96 default geotextile class and design class for the subsurface drainage, permanent erosion control, separation and stabilization applications. The design class is a lesser class that may be

TABLE 1. DEFAULT GEOTEXTILE CLASSES FOR M288-96

Application	Default Class	Design Class
Subsurface drainage	Class 2	Class 3
Permanent erosion control	Class 2 for woven monofilaments Class 1 for all others	Class 2
Separation	Class 2	Class 3
Stabilization	Class 1	Class 2 or 3

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used when field experience, laboratory tests on exhumed samples, and/or certain site configurations are taken into account.

## Material requirements

M288-96 is not focused on design or construction specifications but is, instead, based on geotextile survivability from installation stresses. When the specification is applied, selection of the geotextile is based on knowledge of the anticipated installation stresses to which the material will be exposed. M288-96 covers six geotextile applications: subsurface drainage, separation, stabilization, permanent erosion control, temporary silt fences and paving fabrics.

In M288-92, geotextile survivability was divided into classes A and B. Class A was used where installation stresses—determined by aggregate shape, trench depth, and the size and height of an armor stone drop—were more severe than in Class B installations. There were no definitive mea-

surements set for differentiating between severe and less-severe installation stresses.

In M288-96, the general strength requirements for the subsurface drainage, separation, stabilization and permanent erosion-control applications are broken into three classes of geotextiles. Class 1 represents the most robust and Class 3 the least. Within each survivability class, the strength requirements are established based on elongation at break in the grab-strength test. The highest strength requirement is for materials that break at less than 50 percent elongation (typically woven) and the least for those that break at greater than 50 percent elongation (typically nonwoven). The requirements for the silt-fence application are based on supported or unsupported fences. Paving fabrics are limited to fabrics with elongation at break of greater than 50 percent.

Table 2 compares M288-92 survivability Classes A and B to the default survivability classes listed in M288-96. Table 3 com-

pare the general strength properties of M288-92 and M288-96 for the subsurface drainage, separation, stabilization, and permanent erosion-control applications. The values are shown in SI units; M288-96 made the conversion to SI units while respecting the approximate nature of these numbers.

Table 4 (p. 41) presents a summary of all six applications, including default requirements for the apparent opening size, permittivity, and ultraviolet degradation. This table also lists current commercial geotextiles that satisfy M288-96 default specifications for each application. This information was obtained by polling the respective manufacturers. Additional manufacturers were contacted but did not respond to the inquiry.

No manufacturer currently provides its geotextile properties in a manner that allows a quick M288-96 selection by the designer. A quick review of the geotextile "identifiers" used by the manufacturers shows that the convenience afforded by M288-96 has yet to be adopted by the producers. All manufacturers do produce products that meet and exceed the M288-96 criteria; the use of these specifications does not limit the pool of potential suppliers.

## Construction installation guidelines

After being omitted from M288-90 and M288-92, construction and installation guides are now included as appendices to the current AASHTO specification book. The notes include directions on site preparation, material overlap, armor stone placement, post spacing for silt fences, embedding, damage repair,

TABLE 2. AASHTO SPECIFICATIONS M-288 APPLICATIONS/CLASSES

Application	M288 Version	Survivability Class	
Subsurface drainage	M288-92	A	B
Subsurface drainage	M288-96	2	3
Sediment control	M288-92	Self-supported	Wire fence-supported
Temporary silt fence	M288-96	Unsupported	Supported
Erosion control	M288-92	A	B
Permanent erosion control	M288-96	1	2
Paving fabric	M288-92	-	-
Paving fabric	M288-96	-	-
Separation	M288-92	High survivability	Medium survivability
Separation (CBR>3)	M288-96	2	3
Stabilization (1<CBR<3)	M288-92	1 (default)	2, 3

TABLE 3. AASHTO M288 GEOTEXTILE SURVIVABILITY STRENGTH REQUIREMENTS

Property	ASTM Test Method	Units	M288-92 Geotextile Survivability		M288-96 Geotextile Survivability Class					
			Class A	Class B	Class 1		Class 2		Class 3	
					<50% <sup>(1)</sup>	≥50% <sup>(1)</sup>	<50% <sup>(1)</sup>	≥50% <sup>(1)</sup>	<50% <sup>(1)</sup>	≥50% <sup>(1)</sup>
Grab strength	D 4632	N (lb)	800-1200 (180-270)	356-800 (80-180)	1400 (315)	900 (205)	1100 (250)	700 (160)	800 (180)	600 (115)
Seam strength	D 4632	N (lb)	710-1070 (160-240)	310-710 (70-160)	1260 (280)	810 (185)	990 (220)	630 (140)	720 (165)	450 (100)
Tear strength	D 4533	N (lb)	220-445 (50-100)	110-310 (25-70)	500 (115)	350 (80)	400 (90)	250 (55)	300 (70)	180 (40)
Puncture strength	D 4833	N (lb)	350-445 (78-100)	110-310 (25-70)	500 (115)	350 (80)	400 (90)	250 (55)	300 (70)	180 (40)
Burst strength	D 3786	kPa (psi)	2000-2200 (450-500)	895-965 (200-220)	3500 (510)	1700 (255)	2700 (400)	1300 (200)	2100 (305)	950 (140)

(1) Elongation at break as measured in accordance with ASTM D 4632

preparation, material overlap, armor stone placement, post spacing for silt fences, embedding, damage repair, overlapping, direction of placement in water and on slopes, and installation suggestions for paving fabrics. Proper installation is critical for the long-term performance of any geosynthetic. It is important that the notes and material specifications are published together.

## Summary

The development of construction material specifications is an ever evolving process, because knowledge of performance and the types of available materials are always changing. As a result, the manner in which such materials are specified must evolve with time. AASHTO M288-96 specifications reflect our current knowledge of geotextiles, based on more than two decades of use and available materials. It will most certainly continue to evolve as our knowledge and materials improve. The cooperative process between users and manufacturers in developing M288 guidelines should continue to serve as an example in this evolution.

The importance of standardization is not unique to geosynthetics. An article in the Sept. 15, 1997 *Engineering News Record* on

the use of plastic composites in highway bridge structures laments that, despite cost and service advantages, "the use of the material is still risky business and will be shunned by many owners and engineers." It quotes an industry member: "What we need is more information on the basic mechanical and physical properties of the materials for standards and design specification development," and concludes, "Until then, it's buyer beware, especially for construction." All building products have gone through the type of standards evolution that geosynthetics are currently experiencing. We feel that M288-96 can contribute to the process and lead to fewer unique specifications by the users, thus requiring fewer geotextile varieties from the manufacturers. **GFR**

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**AASHTO Specification M288-96 on Geotextiles is published in the two-volume *Standard Specifications for Transportation Materials and Methods of Sampling and Testing*, 18th ed.**

**To order the set, contact AASHTO at 800/231-3475 and refer to book code HM18. The cost for the two volumes is \$241 for AASHTO members and \$289 for non members.**

**TABLE 4. ASHTO M288-96 GEOTEXTILE SPECIFICATIONS - MARV VALUES**

Application Property (MARV)	Subsurf. Drainage		Sed. Control		Erosion Control			Paving Mass/Area > 4.2 asyd	Separation		Stabilization	
	Elongation <50%	Elongation >50%	Supported Silt Fence	Self-Supported	Woven Monofil.	Other Woven (no slit film)	Nonwoven		Woven	Nonwoven	Woven	Nonwoven
1. Strength Criteria	Survivability Class 2	Survivability Class 2	Grab, lbs 90 x 90	Grab, lbs 125x100	Survivability Class 2	Survivability Class 1	Survivability Class 1	Grab, lbs 100 >50%e	Survivability Class 2	Survivability Class 2	Survivability Class 1	Survivability Class 1
2. AOS, mm	% Fines <15% .43	AOS,mm .25	.60	.60	% Fines 15%< .43	AOS,mm 15-50% .25	N/A	.60	.60	.43	.43	
3. Permittivity, l/sec	% Fines permittivity, l/sec <15% 5	.05	.05	.05	% Fines permittivity, l/sec <15% .7	.22	N/A	.02	.02	.05	.05	
4. UV Stability	50% @ 500	50% @ 500	70% @ 500	70% @ 500	50% @ 500	50% @ 500	50% @ 500	N/A	50% @ 500	50% @ 500	50% @ 500	50% @ 500
5. Asphalt retention <sup>2</sup>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	.2	N/A	N/A	N/A	N/A
6. Melting point, F <sup>3</sup>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	300	N/A	N/A	N/A	N/A
Amico	<15%: 2016	4552	2130	2130	NP	15% ≥ 1199	4552	4598	2006	4552	2006	4553
Carriage Mills	<15%: Cart 10% >15%: Cart 6%	FX-60HS	FX-35HS	FX-35HS	<15%: Cart 10% >15%: Cart 6%	NP	FX-80HS	FX-42OL	FX-60	FX-60HS	FX-70	FX-80HS
LINQ	GTF 400EO	Typar 3401	GTF 170	GTF 180	<15%: GTF 400EO >15%: GTF 400E	<15%: GTF 400EO >15%: GTF 400E	180EX	AOH	GTF300	TYPAR 3501	GT375N	225EX
Mindl	<15%: FW400 >15%: FW700	160N	100CX	100X	NP	<15%: PW403	180N	NP	600X	160N	600X	180N
Synthetic Industries	104F <sup>3</sup>	601	351	301	104F	200ST	801	PaveDry461	300ST	601	NP	801
TNS Mills	<15%: W404	R060	W100	W100	M706	W300	R060	CD40	W300	R060	W300	R080

(1) with exception of permittivity requirements for <15% fines

(2) Texas DOT Item 3099

(3) ASTM D276