Designation: D6088 − 06 (Reapproved 2022)

Standard Practice for Installation of Geocomposite Pavement Drains[1]

This standard is issued under the fixed designation D6088; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers recommendations and identifies pertinent areas of consideration for the installation of buried geocomposite drains used for highway edgedrains, underdrains, or other pavement drainage applications meeting the requirements of Specification D7001. These recommendations are intended as guidelines for developing a satisfactory construction and installation method to minimize installation-caused deformation or damage and to provide long-term performance of these products. It is also intended as a guideline for ensuring a stable underground environment for these materials under a wide range of service conditions. Because of the numerous and diverse product designs available and the inherent variability of natural ground conditions, achieving satisfactory performance of any one product may require review by the engineer and modification to provisions contained herein to meet specific project requirements.

1.2 The scope of this practice necessarily excludes product performance criteria such as compressibility in any plane, flow capacity, inlet capacity, or geotextile selection and use. It is, therefore, incumbent upon the product manufacturer, specifier, and project engineer to verify that the product specified for an intended application, when installed according to procedures outlined in this practice, will provide satisfactory long-term performance according to criteria established by the owner for that application. A commentary of product performance and installation factors important in achieving a satisfactory installation is included in Appendix X1.

1.3 The values stated in SI units are to be regarded as the standard. The inch-pound units given in parentheses are for information only.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D8 Terminology Relating to Materials for Roads and Pavements
D420 Guide for Site Characterization for Engineering Design and Construction Purposes
D653 Terminology Relating to Soil, Rock, and Contained Fluids
D698 Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
D2321 Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
D2487 Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
D3839 Guide for Underground Installation of "Fiberglass" (Glass-Fiber Reinforced Thermosetting-Resin) Pipe
D4318 Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
D4439 Terminology for Geosynthetics
D7001 Specification for Geocomposites for Pavement Edge Drains and Other High-Flow Applications
F412 Terminology Relating to Plastic Piping Systems

3. Terminology

3.1 *Definitions:*

3.1.1 Definitions used in this practice are in accordance with Terminologies F412, D8, and D653 unless otherwise indicated.

3.2 *Definitions:*

3.2.1 *aggregate*—a granular material of mineral composition such as sand, gravel, shell, slag or crushed stone (see Terminology D8).

[1] This practice is under the jurisdiction of ASTM Committee D35 on Geosynthetics and is the direct responsibility of Subcommittee D35.03 on Permeability and Filtration.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

3.2.2 *dense-graded aggregate*—an aggregate that has a particle size distribution such that, when it is compacted, the resulting voids between the aggregate particles, expressed as a percentage of the total space occupied by the material, are relatively small.

3.2.3 *engineer*—the individual in responsible charge of the work or his duly recognized or authorized representative.

3.2.4 *geocomposite, n*—a product fabricated from any combination of geosynthetics with geotechnical materials or other synthetics which is used in a geotechnical application.

3.2.5 *geosynthetic, n*—a planar product manufactured from polymeric material used with foundation, soil, rock, earth, or any other geotechnical engineering related material as an integral part of a man-made project, structure, or system. (See Terminology D4439.)

3.2.6 *geotextile, n*—any permeable geosynthetic comprised solely of textiles. (See Terminology D4439.)

3.2.7 *manufactured aggregates*—aggregates such as slag that are products or byproducts of a manufacturing process, or natural aggregates that are reduced to their final form by a manufacturing process such as crushing.

3.2.8 *open-graded aggregate*—an aggregate that has a particle size distribution such that, when it is compacted, the voids between the aggregate particles, expressed as a percentage of the total space occupied by the material, remain relatively large.

3.2.9 *optimum moisture content*—The moisture content of soil at which its maximum density is obtained (see Test Methods D698).

3.2.10 *permeability, n*—the rate of flow of a liquid under a differential pressure through a material.

3.2.11 *permeability, n*—of geotextiles, hydraulic conductivity.

3.2.12 *permittivity, (γ), (T^{-1}), n*—geotextiles, the volumetric flow rate of water per unit cross-sectional area per unit head under laminar flow conditions, in the normal direction through a geotextile. (See Terminology D4439.)

3.2.13 *processed aggregates*—aggregates that are screened, washed, mixed, or blended to produce a specific particle size distribution.

3.2.14 *standard proctor density*—the maximum dry unit weight of soil compacted at optimum moisture content, as obtained by laboratory test in accordance with Test Methods D698.

4. Summary of Practice

4.1 This practice outlines the key installation criteria that should be addressed for proper installation and maximum performance of geocomposite edge or underdrain materials, or both. The engineer should review the specifics of the system. Geocomposite drainage materials in this practice are products meeting Specification D7001. Trench excavation, the depth of drain placement, type of backfill, backfill placement, compaction of backfill, product fittings, and equipment used during installation are addressed in this practice.

5. Significance and Use

5.1 This practice is intended to provide installation guidance for designers, specifiers, installation contractors, regulatory agencies, owners, and inspectors who are involved in the planning and installation of geocomposite pavement edgedrains and underdrains. As with any standard practice, modification may be required for specific project conditions or for special local or regional conditions. Fig. 1 shows the proper horizontal alignment of the drain based on various trench conditions outlined in 9.2, and the vertical depth of placement of the drain needed for a geocomposite edge drain to function most effectively as both a collector and conduit.

5.2 Fig. 2 shows the typical type and arrangement of equipment used to install geocomposite highway edgedrains. The combination of these recommended installation conditions, techniques, and equipment are critical to the satisfactory long-term performance of these products.

6. Inspection, Handling, and Storage

6.1 *Inspection*—Upon receipt, inspect each shipment of pipe, geocomposite, and fittings for conformance to product specifications and contract documents, and check for damage. The engineer should reject damaged, deformed, crushed, or nonconforming material and remove from the project.

6.2 *Handling and Storage*—Handle and store the material in such a way as to prevent damage. Protect all geotextile materials from sunlight exposure until immediately before installation.

7. Backfill Materials

7.1 Backfill material selection and placement method should be based primarily on achieving adequate compaction without damaging the drainage panel, while also achieving intimate contact with the trench wall or backfill material, or both. Excessive compaction efforts may damage geocomposite drainage materials and should be avoided. Skid vibratory compactors that are used in the trench adjacent to the panel can damage the panel if not properly aligned and operated. Free-flowing materials, such as pea-sized crushed stone and dry or moist sand is suitable in most cases and should be placed in 150 mm (6 in.) lifts. Placement of sand backfill can be done by flushing or puddling, but this should be used only when approved by the engineer. Post-installation settlement in the backfill will occur if the backfill is not properly densified. Significant settlement can cause shoulder drop-off settlement and other pavement distress problems and structure damage to the panels. Permeability of the backfill material must also be considered; open-graded backfills will promote higher ground water flow to the drainage system, will provide a larger sink for collecting water, and will also provide additional flow area during maximum rainfall events. Soil migration from adjacent soils (trench walls) must be considered when using open-graded backfills.

7.2 *Classification*—Materials for potential use as embedment and backfill of various components of subsurface drainage systems are classified in Fig. 3. They include natural, manufactured, and processed aggregates and the soil types

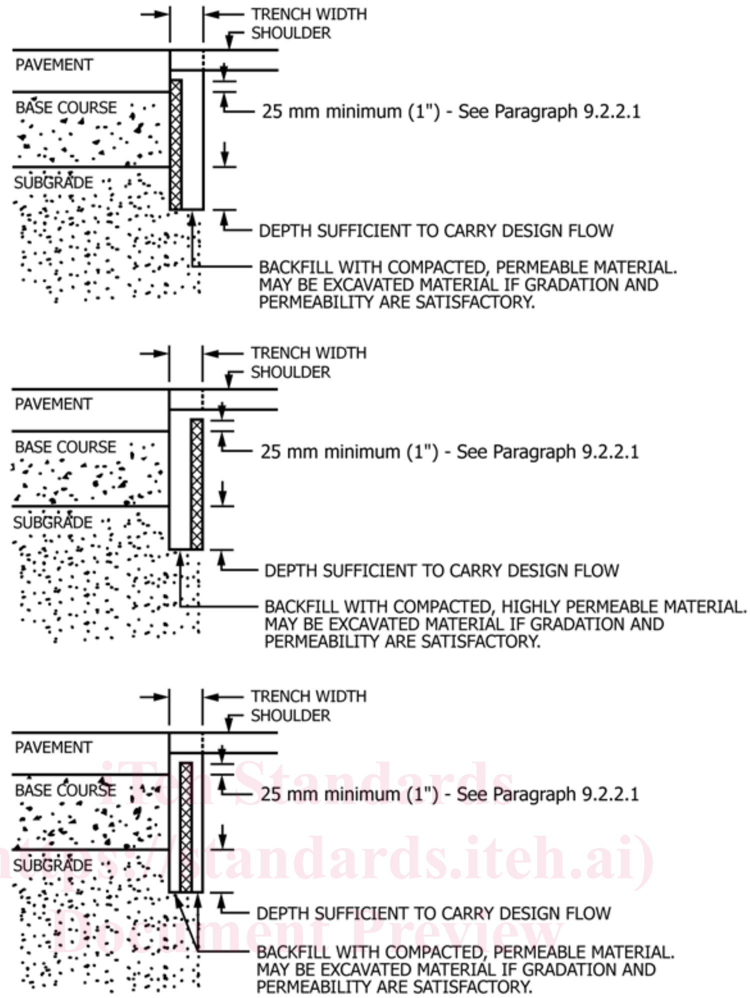


FIG. 1 Typical Type and Arrangement of Drain

classified according to Practice D2487. Processed materials produced for highway construction (including coarse aggregate, base, subbase, and surface course materials) when used for embedment and backfill, should be classified in accordance with this section and Fig. 3 according to particle size, shape, and gradation.

7.3 *Installation and Use*—Fig. 4 provides recommendations on installation and use based on class of soil or aggregates.

7.3.1 *Use of Class III Soils and Aggregates*—These materials may be used as recommended in Fig. 4, provided the permeability of the material is adequate and approved by the engineer.

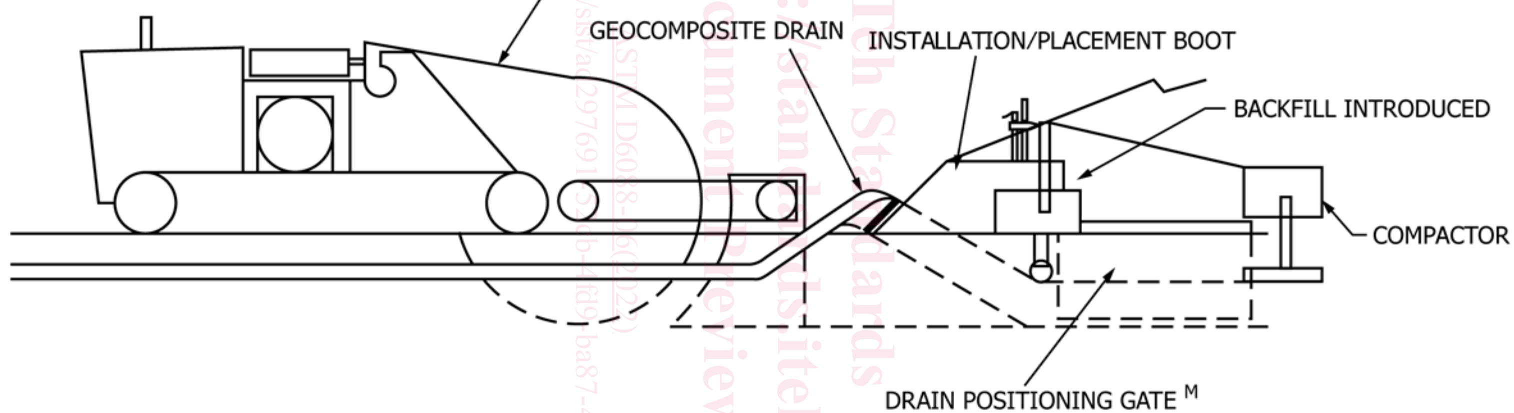
7.3.2 *Use of Class IVA, Class IVB and Class V Soils and Frozen Materials*—These materials are not recommended for backfill and shall be excluded from the final backfill except where approved by the engineer.

7.4 *Description of Backfill Material*—Paragraphs 7.4.1 – 7.4.5 describe characteristics of materials recommended for backfill. Consideration must be given to the potential for migration of fines from adjacent materials into the backfill (see Appendix X1).

7.4.1 *Class IA Materials*—Class IA materials provide maximum stability and support for a given density due to angular interlock of particles. With minimum effort, these materials can be installed in relatively high densities over a wide range of moisture contents. The high permeability of Class IA materials can aid in the performance of these drainage systems. However, careful consideration must be given to the potential for migration of fines from adjacent materials into the open-graded Class IA materials.

7.4.2 *Class IB Materials*—Class IB materials are processed by mixing Class IA and natural or processed sands to produce a particle size distribution that minimizes migration from adjacent materials that contain fines. They are more densely graded than Class IA materials and thus require more compactive effort to achieve the minimum density specified. When properly compacted, Class IB materials offer high stiffness and strength. Class IB materials may be relatively free draining, but the amount and gradation of fines must be controlled.

7.4.3 *Class II Materials*—Class II materials provide a relatively high level of structural support. Open-graded groups may allow migration and gradations shall be checked for



NOTE 1—Drain positioning gate should be located and adjusted to position, and hold the geocomposite drain against the trench wall, to prevent possible “J”-ing or “C”-ing of the drain during backfilling and compaction.

FIG. 2 Proper Horizontal Alignment

Class	Type	Soil Group Symbol D2487	Description	Percentage Passing Sieve Sizes			Atterberg Limits		Coefficients	
				1 1/2 in (40 mm)	No. 4 (4.75 mm)	No. 200 (0.075 mm)	LL	PL	Uniformity Cu	Curvature Cc
IA	Manufactured Aggregates: open-graded, clean	None	Angular, crushed stone or rock, crushed gravel, broken coral, crushed slag, cinders or shells; large void content, contain little or no fines.	100%	<= 10%	<5%	Non Plastic			
IB	Manufactured, Processed Aggregates; dense-graded, clean.	None	Angular, crushed stone (or other Class 1A materials) and stone/sand mixtures with gradations selected to minimize migration or adjacent soils; contain little or no fines (see X1.8)	100%	<=50%	<5%	Non Plastic			
II	Coarse-Grained Soils, clean.	GW	Well-graded gravels and gravel-sand mixtures; little or no fines.	100%	<50% of "Coarse Fraction"	<5%	Non Plastic		>4	1 to 3
		GP	Poorly-graded gravels and gravel-sand mixtures; little or no fines						<4	<1 or >3
		SW	Well-graded sands and gravelly sands; little or no fines.		>50% of "Coarse Fraction"				>6	1 to 3
		SP	Poorly-graded sands and gravelly sands; little or no fines.						<6	<1 or >3
	Coarse-Grained Soils, borderline clean to w/fines.	e.g. GW-GC, SP-SM	Sands and gravels which are borderline between clean and with fines.	100%	Varies	5% to 12%	Non Plastic		Same as for GW, GP, SW and SP	
III	Coarse-Grained Soils with Fines	GM	Silty gravels, gravel-sand-silt mixtures.	100%	<50% of "Coarse Fraction"	12% to 50%		<4 or <"A" Line		
		GC	Clayey gravels, gravel-sand-clay mixtures.					<7 and >"A" Line		
		SM	Silty sands, sand-silt mixtures.		>50% of "Coarse Fraction"			>4 or <"A" Line		
		SC	Clayey sands, sand-clay mixtures.					>7 and >"A" Line		
IVA	Fine-Grained Soils (inorganic)	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, silts with slight plasticity.	100%	100%	>50%	<50	<4 or <"A" Line		
		CL	Inorganic clays of low to medium plasticity, gravely clays, sandy clays, silty clays, lean clays.					>7 and >"A" Line		
IVB	Fine-Grained Soils (inorganic)	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.	100%	100%	>50%	>50	<"A" Line		
		CH	Inorganic clays of high plasticity, fat clays.					>"A" Line		
V	Organic Soils	OL	Organic silts and organic silty clays of low plasticity.	100%	100%	>50%	<50	<4 or <"A" Line		
		OH	Organic clays of medium to high plasticity, organic silts.				>50	<"A" Line		
	Highly Organic	PT	Peat and other high organic soils.							

NOTE 1—The Attenberg Limits shown in this figure are determined per Test Methods D4318.

FIG. 3 Classification of Materials for Potential Use as Embedment and Backfill of Various Components of Subsurface Drainage Systems

compatibility with adjacent material. Typically, Class II materials consist of rounded particles and are less stable than angular materials unless they are confined and compacted.

7.4.4 *Class III Materials*—Class III materials provide less support for a given density than Class I or Class II materials. Higher levels of compactive effort may be required unless moisture content is carefully controlled. These materials provide satisfactory levels of structural support once proper density is achieved. Fines content should be minimized for optimum permeability.

7.4.5 *Class IVA Materials*—Class IVA materials require a geotechnical evaluation prior to use. These materials may not be appropriate due to poor permeability or water caused instability, particularly under wheel loads.