

Geonets Manufactured With Foaming Agents

A drainage geonet is designed to replace or augment soil drainage over a large surface area. Geonets are almost exclusively made of high density polyethylene (HDPE) polymer resin formulations due to HDPE’s excellent chemical durability and compressive creep resistance.

The HDPE resin formulation used in the extrusion process has a density greater than 0.94 g/cm³ and a formulation typically contained 97% polyethylene resin, 2% to 3% carbon black, and 0.5% to 1% other additives such as anti-oxidant and processing stabilizer. For more than 20 years, HDPE resin based geonets with a solid rib structure conforming to 0.94 g/cm³ minimum density (ASTM D1505 or ASTM D792) have proven performance in the field.

In recent years, drainage geonets incorporating foaming agents have become more prevalent in an attempt to reduce resin usage, thus reducing raw material cost. When foaming agents are incorporated into the resin formulation during the manufacturing process, they expand in volume and create numerous air pockets within the geonet ribs.

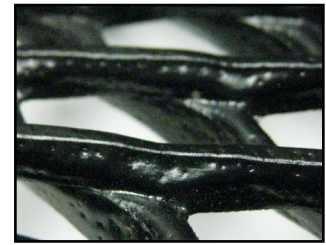
Geonet Density

Project specification for geonet routinely requires a density of greater than 0.94 g/cm³ to conform with HDPE resin definition. Foamed geonets typically do not meet this density requirement. Depending on the percentage of foaming agent incorporated into the resin formulation design, the density can be significantly lower than the 0.94 g/cm³ requirement specified by the engineering community in project specifications. For reference, density test results on a foamed geonet are shown below, performed by an independent third party geosynthetic laboratory.

PARAMETER	TEST REPLICATE NUMBER										MEAN	STD DEV.	
	1	2	3	4	5	6	7	8	9	10			
Density/Specific Gravity (ASTM D 792, Method A)													
Density (g/cm ³)	0.808	0.808	0.808									0.808	0.000

Geonet samples received exhibited numerous air pocket/voids within the Geonet Rib Structure which may have biased test results. Per client's request, density test has been performed on sample material as it was received.

Clearly the density of this foamed geonet does not conform to conventional HDPE resin formulations; as a matter of fact, it is well below conventional linear low-density polyethylene (LLDPE) resin formulations by definition (density between 0.925 to 0.919 g/cm³).



Foamed Geonet (1a)



Solid Rib Geonet (1b)

Physical Appearance

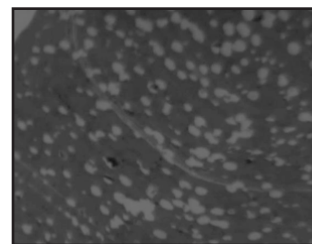
A comparison between a foamed geonet (1a) and a solid rib geonet (2a).

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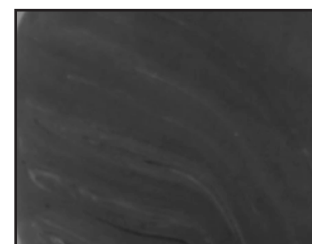
Long-Term Performance Concerns

For more than 20 years, geonet density has proven to be essential for long-term performance related to structural stability, hydraulic transmissivity, compressive creep resistance, chemical resistance to various leachates, and stress cracking resistance under a sustained loading. Therefore, a project specification for a drainage geonet typically includes a material requirement such as “The polymer used to manufacture the geonet component of the GDL shall be polyethylene that is clean and free of any foreign contaminants.”

In addition, geonet density is commonly listed in the property table and specified to be greater than 0.94 g/cm³ per ASTM test method D1505 or ASTM D792. A foamed geonet will not meet the above technical specifications. By requiring geonet density (ASTM D1505 or ASTM D792), compressive strength (ASTM D6364), and conventional long-term compressive creep testing (ASTM D7361 or GRI GC-8) on geonet structures, engineers can identify and prevent foamed geonet use on their projects.



Foamed Geonet (2a)



Solid Rib Geonet (2b)

A cross-section comparison between a foamed geonet and a solid rib geonet by microtome technology.

In this case, the microtomes are thin slices of a geonet rib cut and placed in a microscopy to examine their micro structures. In comparing Photo (2a) to Photo (2b), numerous air voids are visible within Photo 2a. The geonet rib is utilizing a foaming agent in the resin formulation design.

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Our commitment to innovation, our focus on quality and our industry expertise allow us the flexibility to collaborate with our clients to develop a custom, purpose-fit solution.

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