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Geofoam: An Innovative Construction Material

Abdullah Ansari [1*], Dr. Prashant B Daigavane[2]

[1]Research Scholar, Department of Civil Engineering, Indian Institute of Technology Delhi, Hauz Khas, New Delhi - 110016 India

[2]Professor and Dean (Infra & Liaison), Department of Civil Engineering, Government College of Engineering Nagpur, Nagpur – 441108 India

E-mail:

aamomin183@gmail.com / prashant.daigavane@gmail.com

*Corresponding Author:

Ansari Abdullah

Research Scholar, Department of Civil Engineering, Indian Institute of Technology Delhi, Hauz Khas, New Delhi - 110016 India

aamomin183@gmail.com

Abstract

Geofoams are one type of geosynthetic materials used for several geotechnical applications such as slope stabilization, foundation and retaining wall or abutment backfill. They are lighter in weight and can be mounted everywhere comfortably. They are also useful in roadway and runway subgrade insulation and foundation settlement in case of swelling soils. This paper discusses about the geofoam material, its specifications and applications.

Keywords: *Geofoam, Slope, Retaining wall.*

1. Introduction

The most commonly used geosynthetic materials are geotextile, geogrids, geonets, geomembranes, geofoam, geocells, geosynthetic clay liners and geocomposites. Presently these materials are used at a large scale in infrastructure industry because of their polymeric nature [1, 2]. Geofoam is made using polystyrene (EPS) or extruded polystyrene in the form of large, lightweight blocks (XPS). Geofoam blocks are 2 m × 0.75 m × 0.75 m, the most widely available dimension. Geofoam's primary purpose is to have a lightweight void fill under a roadway, bridge approach, embankment, or parking lot. Geofoam layering may be used to help with the settling of the underground system.

2. Benefits of Geofoam

Following are the benefits of geofoam.

1. Thermal Insulation Value
2. Reduced Construction Time
3. Ease of Handling
4. Lower Construction Cost
5. Stability
6. Compressive Strength

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7. Lightweight
8. Limited Water Absorption
9. Low Density
10. Long Life Performance

3. Material Specifications

Geofoam is made using a polystyrene polymer known as a synthetic material. This polystyrene resin is formulated in large containers and then moved to a hopper for geofoam formulation in compliance with the requirements to be accomplished. Since geofoam is manufactured using polymeric materials so it can be reused after the completion of recycle phase [3]. During the polymerization process, the shape and size can also be changed as per design standard. Geofoams cab be manufacture with different values of density based on applied heat and pressure [4, 5].

A specification for the minimum properties of geofoam is given by ASTM International. ASTM D6817, i.e., is the appropriate ASTM specification for EPS Geofoam. Rigid Cellular Polystyrene Geofoam Standard Specification. The D7557 Basic Procedure for Sampling of EPS-based Geofoam Specimens and the D7180 Standard Guide for the use of EPS-based geofoam in geotechnical problems are several other ASTM guidelines.

4. Applications of Geofoam

The most common applications of the geofoam are listed below:

a. Slope Stabilization

Landslide hazard and slope failure is the most common issues in cases of mountainous areas. In these localities, the geofoams help to handle the problem regarding stabilization of slopes. Geofoams being lighter in weight can be easily handled and transferred from one location to another location. It reduces overall cost needed for construction time and labor charges.

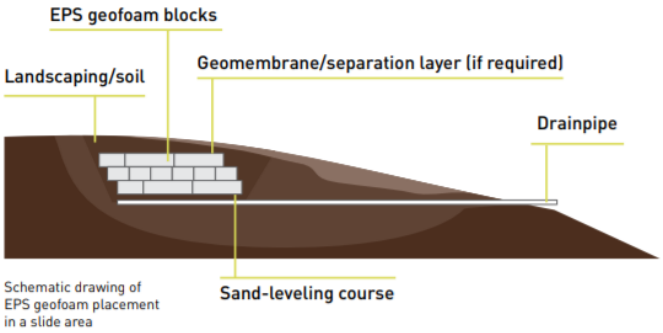

Figure 1. Application of geofoams in slope stabilization

b. Foundation

The conventional pile footings on peat soils can be replaced by geofoams based on EPS because they deliver advantages including cost savings, construction ease and reuse transportability. Geofoams may be used to deal with problems of base settling resulting in the event of swelling soils, e.g. BC Soils.

c. Retaining Structures

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Geofoam installation for the retention of buildings allows a decrease in lateral friction, as well as the avoidance of settling and the enhancement of waterproofing. Owing to the lighter weight of the geo foams, the lateral stress on the retaining wall can be minimized.

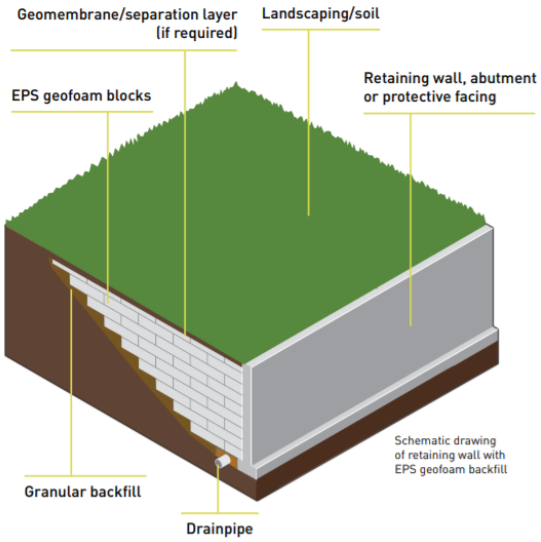

Fig. 2. Application of geofoams in retaining structures

d. Utility Protection

Geofoam can be used to reduce the vertical stresses on pipes and other sensitive utilities by Utility Protection. By applying the geo-foam layers, the vertical stresses on pipes and other conducting bodies can be reduced. It also helps to handle the problems dealing with leakage and filtration.

e. Bridge Abutment

The geofoams can be used to construct approach fills for bridge abutments. The high magnitude compressive resistance offered by geofoams will be helpful to support highway loading without overstressing the underlying soils. It helps in reducing the differential movement at the bridge or approach fill interface. With the use of geofoams, the lateral stress on foundations and retaining structures get reduced.

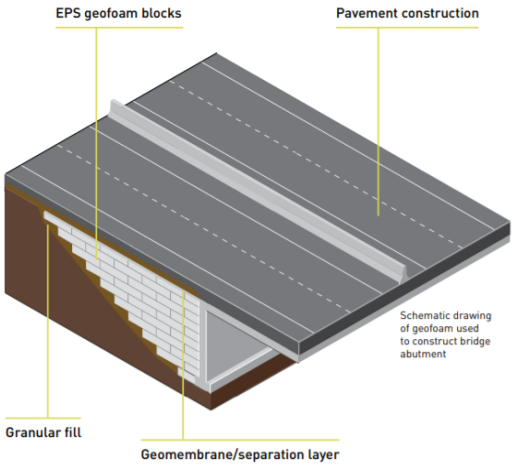

Fig. 3. Application of geofoams in bridge abutment

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f. Reduced Digging

The weight of the desired structure can not be sustained by any poor and soft soil; an overpass bridge in the nearby picture. If it were made from conventional earthwork filling, the thin soil below would have been too hard and deformed and the bridge would have been destroyed. Geofoam is used for the internal filling of the bridge in order to minimize costs by not drilling into the bedrock.

5. Conclusion

Geofoams are lighter in weight manufactured using polymeric materials. Geofoams are used for lots of civil engineering and infrastructural projects involving complex problems related to retaining wall, bridge abutments, digging, slope stabilization and foundation. They reduce time required for construction and overall cost. It is always flexible to work with lighter materials as compared to traditionally used construction materials. Geofoams can withstand various external factors such as weather and climate, making it a durable and reliable solution in all different types of construction and building contexts.

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