

# Lighten Up

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## USING GEOFOAM TO SIMPLIFY COMMON SITE PREP CHALLENGES

By Nico Sutmoller



Projects built with geofoam include road beds, bridge approaches, levees and other jobs. Photo courtesy of Insulfoam

Contractors have successfully used expanded polystyrene (EPS) geofoam to simplify site preparation since the 1960s. Projects built with the material include road beds, bridge approaches, levees and other civil jobs. Now, geofoam is increasingly solving a host of construction challenges in commercial buildings and large residential applications.

### GEOFOAM OVERVIEW

Geofoam is an ultra-lightweight, engineered, closed-cell rigid foam. The material is about 100 times lighter than soil and weighs substantially less than other lightweight fills.

Even though it is very light, geofoam is high strength, with compressive resistance values of 317 to 2,678 lbs/ft<sup>2</sup> at a 1 percent strain. Geofoam is suitable for a range of heavy loading conditions, including sub-base for pavements and railroads bearing jet aircraft and locomotives.

EPS geofoam changes the traditional soil compaction phasing method in which contractors mechanically compact soil to a percentage of dry density and pay for multiple samples and laboratory tests. Unlike other lightweight fills such as shredded tires or wood chips, EPS geofoam is homogenous, which provides uniform load transfer and eliminates differential settlement.

### GEOFOAM APPLICATIONS AND BENEFITS

The combination of lightweight and high strength makes geofoam the ideal material for many building applications, including:

- Creating level building pads on steep-sloped lots
- Stabilizing steep slopes
- Remediating soft soils

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#### Creating level building pads on steep-sloped lots

Given its lightweight, contractors can use geofoam to simplify construction of retaining walls needed to level steep-sloped lots. Geofoam drastically reduces or can eliminate the lateral load on retaining walls, so walls do not need to be as robust. Material and labor costs are much lower due to reducing forming, structural steel and concrete volume, and lessening or eliminating the need for geogrids or mechanical tiebacks.

Eckhart Construction Services, a Carolinas AGC member, used geofoam to create a level building site for a McDonald's restaurant. There, a retaining wall was needed that could accommodate the change in grade, as well as reduce the load over extremely soft soils. Typical soil fill would have caused unacceptable settlement of the retaining wall. The use of EPS geofoam allowed for incorporation of a traditional keystone retaining wall while eliminating the need to use the typical geogrid material to reinforce the retaining wall.

#### Stabilizing steep slopes

Geofoam's lightweight makes it an excellent option for stabilizing steep slopes, without the need to change the final slope geometry. Since the material is much lighter than other fills, it greatly reduces the weight of a slope's driving block and lowers the risk of costly and dangerous landslides. An additional advantage of using lightweight geofoam blocks on slopes is that crews can move and place them by hand. This eliminates the need for heavy earth moving and compaction equipment on steep and uneven terrain.

#### Remediating soft soils

Ground with soft soils or soft clay makes building construction notoriously difficult. To eliminate or greatly reduce the need for time-consuming and costly surcharging of soft soils, EPS geofoam provides high load support at a low weight for projects of all sizes.

An example is the renovation of an existing office building into a city hall in the Pacific Northwest. Building codes required installation of new handicap ramps as part of the upgrade. The challenge was the project site is situated on extremely soft glacial till at the south end of a lake. As such, the ramps needed a very lightweight void fill to avoid post-construction settlement. After evaluating various lightweight fill options, the project team chose EPS geofoam. Crews installed 5,000 cubic yards of geofoam, which played a role in helping the project be completed two months ahead of schedule and nearly \$600,000 under budget.

#### Forming swimming pools and pool decks

Contractors use geofoam to simplify construction of swimming pools in residential, commercial and institutional uses, including hotels, schools and community centers. Project teams can order the blocks pre-cut to precise dimensions or can easily cut them to size and shape on site. This simplifies the concrete forming process, and greatly reduces weight for construction of rooftop pools or on sites with poor load-bearing soils. Once crews form the pool basin and decks with geofoam, they can apply shotcrete directly to the foam.

#### Landscaping

Because crews can readily form geofoam into a host of shapes, the material provides a simple way to create landscape topography and berms. This is particularly beneficial when loads must be minimized on underlying structures and utilities. Examples include rooftop gardens and landscaped spaces with shallow buried utilities that cannot bear the weight of soil fills.

#### Creating theater/stadium seating

Geofoam provides contractors a fast and simple way to change slopes within buildings – either creating tiered seating as in auditoriums, movie theaters, churches or gymnasiums, or leveling out such a sloped space for other uses.

For stadium style seating, crews hand place row upon row of geofoam blocks to achieve the necessary profile. They can then either place concrete over the geofoam as shotcrete or as pre-cast panels. Using geofoam greatly simplifies the forming process and eliminates the need for complex tiered compacting of soil to form the stepped profile of stadium seating.

Crews can also use geofoam to quickly level an existing sloped elevation in a building. For example, a university wanted to convert a sloped floor lecture auditorium into a surgical suite at a hospital. The project engineers specified EPS geofoam as a structural void fill to reverse the slope. The EPS supplier cut the blocks to minimize field fabrication on the job site. Because the enclosed auditorium did not have space to accommodate heavy equipment, and as noise from mechanical compaction of soil would have disrupted hospital patients and staff, geofoam was an ideal alternative. The lightweight structural fill provides a strong, stable sub-base for the new, level concrete floor slab.

#### WORKING WITH GEOFOAM

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Although geofoam can be manufactured in many sizes and shapes, standard blocks are typically 4 feet wide by 8 feet long, and of varying thickness. If contractors do not order geofoam pre-cut to specified dimensions, they can easily trim geofoam to size using a hot wire cutter (which some manufacturers will supply) or with a handsaw or a chainsaw onsite.

When placing geofoam, the blocks are staggered so their joints are not located in the same vertical plane. At times, the blocks are interconnected with either barbed plates or polyurethane adhesive, in accordance with engineering specifications.

Due to geofoam's lightweight, crews can maneuver and place the blocks by hand or with small mechanical equipment. A typical installation is to place geofoam blocks on a level course over sand, pea gravel or any locally available permeable leveling course material.

Following are points to keep in mind when working with geofoam:

- Geofoam is subject to damage when exposed to certain hydrocarbon chemicals or solvents. If needed, crews can protect the material with hydrocarbon-resistant geo-membranes or concrete slabs.
- Manufacturers treat geofoam with a fire retardant to avoid the rapid spread of fire. However, the material is combustible at high temperatures, so it is important to be cautious when conducting hot work, such as welding, around geofoam.
- Exposing geofoam to sunlight for extended periods can cause superficial discoloration, which does not impact the product's integrity and can be removed with a broom or very light pressure-washing, if desired.
- Because geofoam is lightweight, it is important to take care when stockpiling the material on job sites where windy conditions exist. Contractors should weigh or tie-down stockpiles, as necessary.

**CONCLUSION**

Soil fills will continue to factor prominently in construction given their ubiquity and familiarity, but for challenging projects, geosynthetics like geofoam are increasingly popular. Geofoam offers contractors a simple-to-use, engineered alternative to traditional earthen fills. The material solves a host of site preparation challenges in commercial and large residential building projects.

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Even though it is very lightweight, geofoam is high-strength and suitable for a range of heavy loading conditions. Photo courtesy of Insulfoam

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