

A solid solution for retaining walls

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Lightweight Geof foam helps accelerate construction schedules.

By Terry Meier

What do Myriad Genetics, the University of Arkansas, Biscuit Creek, and Grove Terrace have in common? Stabilization — using EPS geof foam.

Underlying each of these retaining wall projects was a problem that pointed to geof foam, an incredibly lightweight material with enormous compressive strength that offers a time-saving alternative to traditional fill materials. EPS geof foam is a cellular plastic material that is strong, but has a very low density — 1 percent of traditional earth materials.



What are the standout benefits of geof foam? First and possibly foremost, is its weight. Geof foam weighs in at a whopping 1 to 2 pounds per cubic foot (16 to 32 kilograms per cubic meter), which is 100 times lighter than soil and 20 to 30 times lighter than other lightweight fill materials. This extreme difference in unit weight, compared to other materials, makes geof foam an attractive fill material to significantly accelerate construction schedules.

Geof foam can also be produced in block form and is easily positioned at the work site. The material is unaffected by normally occurring weather at the time of installation and will retain its physical properties under engineered conditions of use.

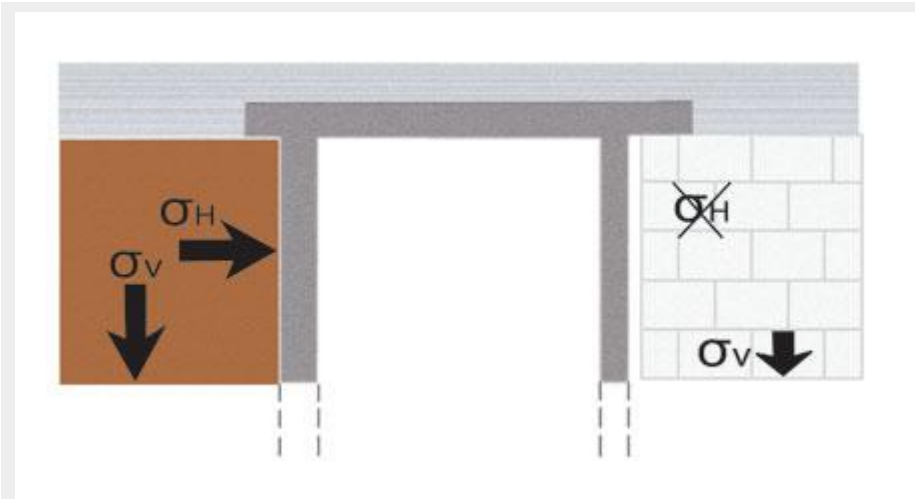
The University of Arkansas built a \$22 million parking structure in the summer of 2009. The underground structure required a lightweight fill material to reduce lateral pressure on the below-grade walls. Making matters more urgent, Baldwin & Shell Construction was faced with an unusually tight schedule — and the firm wanted to deliver. Superintendent Morris Vines found that pre-construction meetings were tense.

"The project staging area was limited and materials would have to be stored offsite. The project required 4,000 cubic yards of geof foam—and there was no way we could store it at the site," he said. "Delivery would have to be staged — and we were concerned that we'd have some loss of time with multiple deliveries. ACH Foam Technologies, our geof foam supplier, was willing to deliver the geof foam in stages, and deliveries were prompt according to our schedule. That allowed us to come through on time, with a perfect installation."

Engineers used 250 cubic yards of EPS 15 Geof foam backfill to repair a retaining wall damaged by heavy rains.



Photo shows original damage to retaining wall, which forced the closure of West 11th Street in Dubuque, Iowa, in the spring of 2008.



Lateral pressure of soil versus geofoam.

EPS geofoam can be used as an embankment fill to reduce loads on underlying soils or to build highways quickly without staged construction. It has been used to repair slope failures, reduce lateral load behind retaining structures, accelerate construction on fill for approach embankments and minimize differential settlement at bridge abutments.

Such was the case of Biscuit Creek Bridge in Rudyard, Mich. From August to November, 2010, the Sullivan Creek Road was closed while the new Biscuit Creek Bridge was being built. Near the completion of the project, the bridge abutment began showing signs of movement during backfill because of lateral loading due to the weight of the soil. Engineers requested that the soil backfill be removed to prevent further movement.



Soil backfill was removed and replaced with geofoam to prevent further damage of the Biscuit Creek Bridge.

Glen Haelka, the contractor, was skeptical when the idea of high density foam backfill was discussed as an alternative.

"I thought, 'no way'. But I was proven wrong," he said. "The compressive strength of the geofoam truly amazed me when, with only 30 inches of cover, we were able to use a 115,000 pound excavator on top of the foam and open the bridge to traffic in just three weeks."

Haelka Construction placed 353,920 board feet of ACH Foam Technologies' Foam Control Geofoam as foundation stabilization fill for the remediation of the bridge without weather delays.

Grove Terrace Road in Dubuque, Iowa, was in serious trouble in the spring of 2008. Heavy rains washed out the road's retaining wall, leaving limestone blocks in the roadway below and prompting the closure of West 11th Street. Engineers had used geofoam in part of West 11th Street's new construction and chose it again for the repair.

The limestone blocks were restored and reused with 250 cubic yards of EPS 15 Geofoam as backfill, reducing lateral pressure on the remediated wall.

Because geofoam weighs only 1 to 2 pounds per cubic foot, large earthmoving equipment is not required for construction. After the blocks are delivered to the construction site, they can easily be trimmed to size and placed by hand. In areas where right-of-way is limited, geofoam can be constructed vertically and faced, unlike most other lightweight fill alternatives. It is also unaffected by adverse weather conditions.

The diagram on this page shows lateral pressure of soil versus geofoam. Note the small gap between the geofoam blocks and the wall of structure. Soil creates approx 40 lbs per cubic foot of lateral pressure. If the structure is below ground level, this lateral pressure increases by a factor of 10. This lateral pressure is eliminated with the use of geofoam.

Using geofoam to backfill against a vertical structure completely eliminates lateral pressure on that structure, whether it is a bridge abutment, retaining wall, or foundation wall. For example, with a foundation wall going 30 feet below grade, the compacted soil will create 3750 pounds of vertical pressure at the wall base and 1250 pounds of lateral pressure at the base of the foundation wall. The use of geofoam will completely eliminate the lateral pressure and dramatically reduce vertical pressure.

Construction of the Myriad Genetics building in Salt Lake City began in the fall of 2009. Its retaining walls were built 20 to 30 feet below grade. Christopher Beckman of Applied Geotechnical Engineering chose EPS Geofoam for its high compressive strength and ability to reduce lateral pressure on the retaining walls. Beckman used geofoam as backfill behind the screen wall to reduce the lateral earth pressure on the screen wall and building perimeter wall.

"The mass of geofoam will perform as expected, with little, if any, movement during the design seismic event," Beckman said.

Geofoam has been used for seismic and utility protection fill, acting as a buffer between movements in subsoils and buried utilities or foundation walls. The Myriad Genetics project used 7,600 cubic feet of Foam Control Geofoam.

Bradford Busath AIA, Associate of Architectural Nexus, said, "The use of Geofoam allows for the final grade to be maintained closer to the original — minimizing the impact to existing utilities."

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