

Federal Construction

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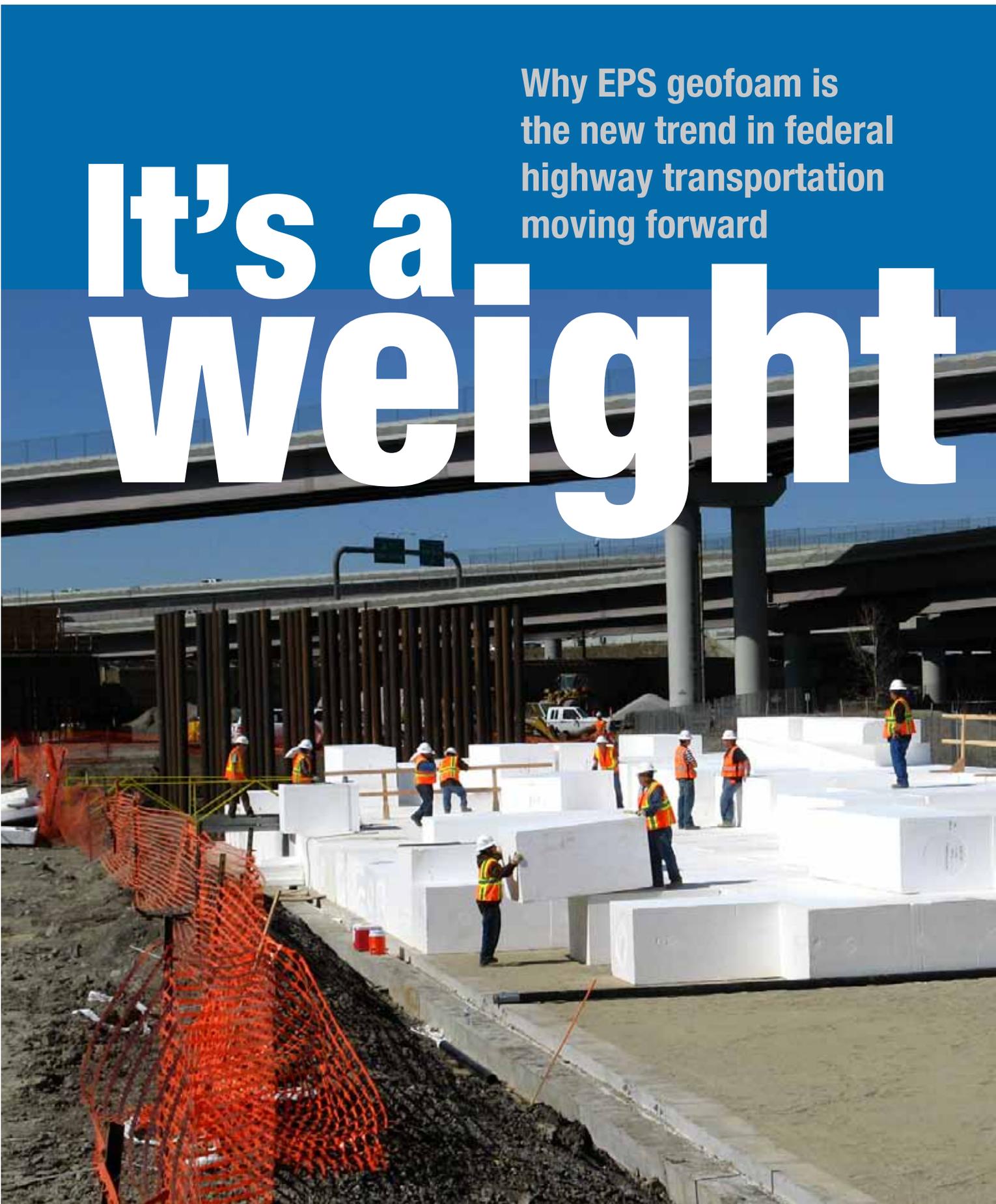
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thing

The mission is clear. The Federal Highway Administration recently issued a National Deployment Statement urging all states to consider using alternative fill materials such as expanded polystyrene (EPS) geofoam when planning fill and embankment projects. The goal, as stated on its website, reads:

“By October 2010, EPS geofoam will be a routinely used lightweight fill alternative for state DOTs on embankment projects where the construction schedule is of concern. By October 2011, all states will have evaluated EPS geofoam as a lightweight fill alternative.”

So, what’s all the fuss over geofoam? First is its weight. Geofoam weighs in at a whopping 1 to 3 pounds per cubic foot (16 to 48 kg per cubic meter), which is 100 times lighter than soil, and 20 to 30 times lighter than other alternative lightweight fill materials. This makes EPS geofoam an attractive fill material to significantly accelerate construction schedules.

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 loads behind retaining structures, accelerate construction on fill for approach embankments and minimize differential settlement at bridge abutments.

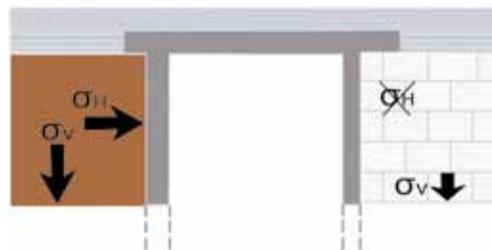
Because it only weighs 16 to 32 kilograms per cubic meter (1 to 3 lbs. per cubic foot), large earthmoving equipment is not required for construction. After the blocks are delivered to the construction site, they can easily be trimmed to size and placed by hand. In areas where right-of-way is limited, geofoam can be constructed vertically and faced, unlike most other lightweight fill alternatives. It also is unaffected by adverse weather conditions

Net Zero Vertical Pressure

When using geofoam, blocks are installed below-grade. EPS geofoam greatly reduces vertical pressure by a 120/1 ratio. Its embankments were designed to produce zero net load on the foundation soils. This was accomplished by full load compensation or removing a volume equal to the weight added by the new construction.

Lateral Weight Reduction

Not only is the vertical pressure decreased by the use of geofoam; it also exerts no



EPS geofoam

horizontal forces on the bridge abutment and supporting walls as with other traditional fill materials.

The diagram (See page 27) shows lateral pressure of soil versus geofoam. Note the small gap between the geofoam blocks and the wall of the structure. Soil creates approximately 40 pounds 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 completely eliminated with the use of geofoam.

The use of geofoam backfilling against a vertical structure completely eliminates lateral pressure on that structure, whether it's a bridge abutment, retaining wall or foundation

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Seven different areas along the West Valley TRAX line required the use of ACH Foam Technologies' EPS Geofoam.

wall. For example, with a foundation wall going 30 feet below grade, the compacted soil will create 3,750 pounds of vertical pressure at the wall base and 1,250 pounds of lateral pressure at the base of the foundation wall. The use of geofoam will greatly reduce lateral and vertical pressure.

The majority of the United States has had experience with geofoam in large and small highway projects. ACH Foam Technologies has supplied geofoam and expertise to the two largest U.S. projects located in Utah: I-15, which was completed in 2001, and the TRAX light rail project, which will be completed sometime in 2012.

The I-15 Project

Geofoam was used as embankment fill and utility protection in the reconstruction of 17 miles of I-15 in Utah from

May 1997 to July 2001. The project consumed 100,000 cubic meters of geofoam. Wasatch Constructors, the engineer and contractor on the project, was pleased with the results.

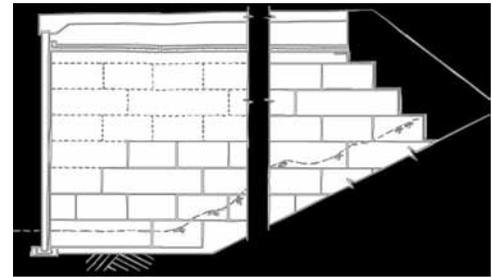
"Conventional settlement solutions for I-15 would have been costly, timely and would have interrupted utility service," says Wasatch's Mark Kimble. "Geofoam was used to reduce settlement on buried utilities, improve the slope stability of embankments, and allow rapid installation in time-critical areas."

Some 100,000 cubic meters of ASTM D6817, Type EPS 19 geofoam measuring 32 ¼-foot thick (plus a small quantity of 16-foot material) was used on the I-15 project.

Settlement under soil embankments not only affects the ground below the embankment, but also the neighboring structures. For example, if you build a conventional embankment on soft soil that is 20 feet in height, the area of settlement can be up to 40 feet away from the embankment – or two times the height of the embankment itself.

Using geofoam for the embankment eliminated the possibility of settlement beneath the structures nearby.

If soil had been used for the embankment, the utility pole would have had to be relocated at a cost of more than \$100,000 per pole. Because the entire alignment of poles must be moved (rather than a single pole), four or five poles would have had to be moved at a cost of roughly \$450,000.



(Left) The geofoam was stepped into the existing soil-filled embankment.

(Above) When geofoam is stepped into the existing fill material at a 1 ½ to 1 slope, horizontal pressure is eliminated.

Installation of wick drains and surcharging speeds up soil consolidation by driving the water and air pockets out of the soil faster. Instead of taking three years, it may only take one year for the subsoil to fully settle.

Regular construction without wick drains or surcharging would take two to three years. With wick drains and surcharging, settlement would be reduced to approximately one year. With geofoam used for fill, there is no settlement and the installation takes just weeks.

The West Valley TRAX Light Rail

On June 18 2008, UTA began construction on a line to a new West Valley city hub. The project is expected to cost \$250 million and will span 5.1 miles. The West Valley line is anticipated to open in 2011 with 3,500 daily commuters.

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TRAX will use an estimated 2,131,256 cubic feet (70,000 cubic yards) or 639 truckloads of geofoam. The first shipments of geofoam arrived in February 2009, with installation completed in January 2010.

“TRAX required construction of embankments up to 40 feet high,” says Ryan Snow, project manager at UTA. “The Lake Bonneville deposits in the area caused the problem. The Salt Lake Basin used to be under Lake Bonneville. That basin left deposits under Lake Bonneville that are subject to settlement. Geotechnical reports stated that in the construction areas, the existing soil could have settled up to 5 feet and that would have taken up to three years. We didn’t have that much time. The existing soil conditions dictated that geofoam would be the most appropriate fill material.”

Snow estimates that the six-month long geofoam installation for TRAX would have taken about three years, had traditional fill been used. “We saved potentially two and a half years. If we had used soil we would have waited for settlement, or maybe filled partially and then waited some more, and then finished construction later. There are geotechnical methods to expedite settlements, such as soil stabilization and wick drains, but those would also add costs. In the end, geofoam proved to be the most economical choice.”

The 2015 program will provide 70 miles of rail in seven years. ■

Terry Meier is the Geofoam Specialist at ACH Foam Technologies, a leading manufacturer of EPS Geofoam. ACH Geofoam has been used in geotechnical applications worldwide for more than 30 years. For more information, call 800-525-8697 or visit www.achfoam.com.

