Geosynthetic-strip reinforced walls for dam expansion

South Bend, stormwater, and the St. Joseph River

Geofoam solution for coal mine tunnel

Coal ash regulations and geosynthetics
PHOTO 1 View of Convulsion Canyon entrance showing the underground mine tucked in at the far end of the canyon.

PHOTO 2, INSET New haulage and belt line carries more than 6 million tons of coal each year.
Geofoam solution for underground coal mine tunnel

By Terry Meier

About 30 miles east of Salina, Utah, nestled in the western bituminous region of Sevier County, is Convulsion Canyon (Photo 1). This is home for a productive Southern Utah Fuel Co. (SUFCO) underground coal mine, where a longwall mining system and continuous miner units extract more than 6 million tons of coal each year (Photo 2).

New haulage and belt line tunnels were constructed in 2011 to increase production. In the fall of 2012, the mining company determined that it would be advantageous to construct a storage building above the underground tunnels. But the haulage tunnel, which was buried an average of 12ft below the existing grade, was not adequate to support the necessary loads.

The mine assigned the project to Jones & Demille Engineering, where project manager Kendrick L. Thomas, P.E., took the helm. According to Thomas, several options were evaluated, including:

- a micropile and grade beam system.
- a structural retrofit of the tunnel.
- geofoam.

“Calculations for the micropile and grade beam system showed that it was a feasible option,” Thomas said. “Calculations for the structural retrofit were performed as a quick check and indicated that it would be very difficult to get that option to work structurally.

“An analysis of the cost and construction schedule for each option revealed that geofoam could be installed much quicker and for far less money than the other two,” Thomas said.

“During the decision-making process, we could see that geofoam would also give us the most flexibility for the positioning of the building. The mine was looking at several possible locations for the building and geofoam allowed them the flexibility to position the building any way they wanted (Photo 3), whereas micropiles and grade beams would have tied the building location down to one spot that they were not sure they wanted to stick with,” Thomas explained.

The installation of expanded polystyrene (EPS) 29 geofoam, with a termite resistance treatment, looked like a good solution. So the construction company installed 28,000ft³ of the termite-resistant EPS 29 geofoam. In keeping with the mine’s commitment to environmental stewardship, the geofoam was manufactured with 5% recycled content, then it was transported from the Murray, Utah, plant to the mine site.

PROJECT HIGHLIGHTS

LOCATION
Convulsion Canyon, Utah

OWNER
Southern Utah Fuel Co. (SUFCO)

ENGINEERING
Jones & Demille Engineering Inc.

CONTRACTOR
Mickelson Construction Inc.

GEOFOAM
ACH Foam Technologies LLC

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Photos courtesy of ACH Foam Technologies
It is unusual for a client to ask for recycled content in geofoam applications. Although EPS geofoam can be manufactured with up to 35% recycled content, recycled EPS is more often used in packaging applications. The recycled EPS geofoam is the most environmentally sound product possible for that kind of application.

EPS geofoam blocks were installed 8ft deep for a length of 80ft, and two layers of the blocks were stacked 6ft deep for the width of 50ft to reduce weight on the underground tunnel (Photos 4). A 6-in. concrete load distribution slab was then placed on the top surface of the geofoam (Photos 5a and 5b).

Each project using EPS geofoam should be designed by a professional engineer. The engineer or the project’s specifications should be consulted to determine the ASTM D6817 type required for the project loading conditions.

For most applications, long-term design loads should not exceed the linear elastic range of EPS geofoam. Combined live and dead load stresses should not exceed the compressive resistance at 1% strain. In general, earthwork applications—such as levees, dikes, and berms—have uplift buoyancy forces that must be counteracted with overburden or restraint devices, such as geogrids, geomembranes, or hold-down devices.

Geofoam has been used in geotechnical applications worldwide for more than 30 years. “Geofoam’s popularity has begun to grow exponentially in the past decade,” said Frank Kiesecker, senior vice president at ACH Foam Technologies. “This is due to its strong and lightweight physical properties and, in part, to the ‘greening’ of the construction industry. Geofoam has properties that fit the green model: It can be recycled, it is impervious to weather, it is produced without CFCs, HFCs, HCFCs, or formaldehyde and with very little waste. Any clean postindustrial scrap or recovered product can be ground and turned into new EPS products or thermally processed into a resin to make other products such as garden furniture, coat hangers, and disposable cameras,” Kiesecker said. ☞
PHOTO 3  EPS 29 geofoam allowed the mine more flexibility in the positioning of the storage building over two underground tunnels. The new building will sit in the sandy left-hand portion of this photo.

PHOTO 4, LEFT  Installation of the stacked geofoam blocks over the mine tunnel. ABOVE Cross section of the staggered geofoam blocks in a 6ft-deep, 50ft-wide underground mine tunnel.

PHOTO 5A & 5B,  A 6-in. concrete load distribution slab covered the top of the geofoam to secure the blocks and keep them in place while also distributing the load for a new storage building built on the geofoam/concrete foundation.