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125 YEARS YOUNG ACCURACY IN THE ALPINE HORIZONTAL INFRASTRUCTURE, VERTICAL PRICE TAG
Dale Mullikin is used to answering questions. He gets a lot of them. He is a Sr. Product Representative for ACH Foam Technologies and for the last 20 years he has been answering questions of every sort from designers, engineers, contractors, field crews, owners, and inspectors about molded polystyrene foam products.

“Molded polystyrene foam is a very versatile material that solves a lot of common construction challenges, but it’s also a little misunderstood,” says Mullikin.

He works with designers and contractors across the Midwest to understand issues, answer questions, and provide proof of performance through technical data, and examples of past applications. From roofing and building envelope insulations to lightweight structural and precast panel fills – because molded polystyrene foam is often a surprisingly simple solution to very complex challenges – Mullikin must often overcome an initial sense of disbelief in client conversations.

“I was forwarded some of your technical brochures regarding the properties of your Foam-Control PLUS+ insulation. I wanted to verify if you had technical information regarding the insulation foundation modulus (equivalent modulus of subgrade reaction) for your product. We are expecting very high point loads on the slab for this project, so I’d like to have that information available for verification, and for future reference.

Foam-Control PLUS+ rigid foam insulation is manufactured in block form across a wide range of compressive strengths that begin at 15 pounds per square inch (psi) all the way up to 60 psi. “Even with the heaviest equipment structural loading is never really an issue, but occasionally proving it can be.”

Just such a question arose on a recent project for a protein-focused food company interested in building a large cold storage facility at a Midwestern distribution center. When Mullikin approached the potential customer about using Foam-Control PLUS+ insulation beneath the building’s cold storage slabs he got a little more than expected back from the owner’s engineer.

The engineer’s reply by email, read in part:

Foam-Control Plus+ 400 molded polystyrene provides a dense, lightweight structural solution beneath a concrete slab intended to support large refrigeration units at a commercial processing plant.
“This was a first for me,” says Mullikin with amusement. “The term modulus of subgrade reaction was not something I was familiar with.”

Fortunately, Mullikin had a reliable resource at the ready in Todd Bergstrom, Ph.D., of AFM Corporation. Bergstrom has a Doctorate in material science and engineering from Northwestern University and spent the last 22 years researching, developing, and testing molded polystyrene materials against variables of every sort. From proving R-values to conducting water absorption testing, and quantifying structural performance, Bergstrom has spent his career on the front lines of molded polystyrene material science.

“Modulus of subgrade reaction refers to the relative stiffness of the layers of support beneath a concrete slab,” says Bergstrom. Quantified, the modulus of subgrade reaction assists engineers in selecting the appropriate molded polystyrene foam to support the pressure of the loaded slab. “In this case, the engineering proved that Foam-Control PLUS+ molded polystyrene insulation would support the same loads as a subgrade composed using XPS.”

Foam-Control PLUS+ rigid foam insulation is available in four standardized compressive strengths ranging from 150, nominally rated at 15 pounds per square inch (psi) all the way up to 600 at 60 psi. The highest strength materials can be integrated into situations where structural requirements mean accommodating vehicles as heavy as fire trucks. As Bergstrom points out, some of the reason for the confusion surrounding rigid cellular polystyrene materials is that rigid cellular polystyrene can be used as both an insulation and a structural fill, known as geofoam. Though the materials are identical, within ASTM International standards there are two separate designations, ASTM C578 for insulation and ASTM D6817 for geofoam.

Rigid cellular polystyrene was first used in commercial construction more than 50 years ago as insulation throughout the building envelope. It was first tested by the ASTM and published in their standards under ASTM C578 “Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.” Rigid cellular polystyrene products include both extruded polystyrene and molded polystyrene materials whose practical purposes in commercial construction have grown well beyond the original thermal insulation objectives to now prominently include structural support.

“All rigid cellular polystyrene fell under C578 until 2002 when ASTM D6817 was introduced specifically to account for structural applications using geofoam,” says Bergstrom. “Many architects still think of these products exclusively as insulations and problematically, the original structural capacities listed in the insulation standard for XPS materials are inadequate without adjustment factors. Structural loading should always be specified using the structural capacities in ASTM D6817.”

ASTM D6817 “Standard Specification for Rigid Cellular Polystyrene Geofoam” determines the structural capacity of rigid cellular polystyrene by compressing the material until it is deformed by only one percent. Conversely, the insulation specification, ASTM C578, compresses the same material until it is deformed by 10 percent.

“C578 is meant to compare two types of materials against one another,” said Bergstrom. “D6817, however, defines the loading capacity the material can support indefinitely when used structurally.”

While both Foam-Control Plus+ molded polystyrene and extruded polystyrene materials are capable of supporting the intended structural load at the Midwestern cold storage facility, Foam-Control PLUS+ is much more efficient to build with. XPS insulation is manufactured in flat, rigid sheets a few inches thick and must be stacked. Foam-Control Plus+ is molded in blocks as large as 8’ x 4’ x 36”-thick. Despite their size, blocks this large can easily be moved by hand, allowing builders to quickly and easily install large sections of structural fill using only manual labor. Using hot wire cutters, the blocks are easy to customize to fit around obstacles like pipes or columns.

“Twenty-plus years of working with clients on insulations and structural solutions and they never run out of questions,” says Mullikin with a chuckle. “ACH Foam Technologies wants to make sure owners, engineers, architects, and contractors understand the incredible capacity, resiliency, and versatility of molded polystyrene foam and we’ll do it one project at a time.”

SEAN O’KEEFE writes design and construction industry stories based on 20 years of experience and a keen interest in the people who make projects happen. He can be reached at sean@sokpr.com.