

Durafill™ geofoam provides essential weight reduction for resort project built on Lake Michigan peninsula



Project:

The Blue Harbor Resort on the Lake Michigan shoreline in Sheboygan, Wisconsin.

The project includes 183 family-sized suites, a 40,000 square-foot indoor water park and a 24,000 square-foot conference center. It is a \$54 million project, involving 300,000 square-feet of construction on a 16.75-acre site.

Product:

Durafill ultra lightweight EPS geofoam. Large blocks of expanded polystyrene commonly known as geofoam.

Application:

The primary application of Durafill on the Blue Harbor project is as lightweight fill. The significant reduction in fill weight and the unmatched weight-to-strength load bearing characteristics of expanded polystyrene help prevent specific components of the structure from subsiding or settling over time.

Due to a layer of compressible silt and clay underneath the site, a peninsula between Lake Michigan and the Sheboygan River, the reduced weight burden on the underlying soil provided by Durafill is essential to executing the Blue Harbor project design.

Project Participants:

Developer:

The Great Lakes Companies
Eric Lund, Principal
Madison, WI

Architect:

Architectural Design Consultants, Inc.
Robert W. Nagel, P.E. – President
Lake Delton, WI

General Contractor:

Kraemer Brothers, LLC
Kevin Kraemer – President
Bill Kolar – Project Manager
Ed Wynhoff – Site Manager
Plain, WI

Site Preparation Contractor:

C.W. Purpero, Inc.
Phil Purpero – President
Al Wojtasiak – Project Manager
Milwaukee, WI

Water Park Contractor:

Neuman Pools, Inc.
Gary Brill – Project Manager
Beaver Dam, WI

Geotechnical Engineering Consultants:

Miller Engineers & Scientists
Roger Miller – President
Sheboygan, WI

Timeframe:

Construction began in July 2003 with completion targeted for June 2004. A grand opening is planned for July 2004.



The Challenge:

Despite its valuable features and prime location, the previously undeveloped 42-acre site has been used for decades as coal and oil storage. A thick layer of compressible organic silt and clay underlies a stratum of medium dense sand at the surface. The sand provides adequate bearing capacity for conventional foundations, but the silt and clay layer would compress and cause settlement if standard weight materials were used to raise grades to the required elevation above the flood level.

Several prominent areas of the Blue Harbor complex, therefore, require that the fill weight be significantly reduced in order to maintain the necessary structural integrity:

- **Water Park:** One of North America's largest indoor water parks, spanning 40,000-sq. ft. and holding 200,000 gallons of water. Several layers of Durafill were placed underneath the reinforced pool structure inside the water park. Additionally, several layers of geofoam were placed 8' to 24' feet around the foundation, reducing the lateral pressure from the surrounding soil on the perimeter walls.
- **Elevated Driveway:** The main entrance driveway, 300 feet in length and ranging between 50 and 150 feet in width, is gradually elevated to 13 feet to meet the second floor main entrance. Durafill is used as the primary fill for the driveway build-up, saving over 30 million lbs. of potential weight compared to standard aggregate fill.
- **Lakeside Terrace and Steps:** The main terrace build-up and the grand steps to the lake are also supported by Durafill, saving another 12 million lbs. in fill weight.

The Performance

"Geofoam provides tremendous weight savings over standard fills while still providing the necessary load bearing strength," said Roger Miller, principal of Miller Engineers & Scientists. Miller conducted a thorough geotechnical exploration of the site and subsequently recommended the use of geofoam in their report.

"If not for the use of geofoam, the Blue Harbor design features and configuration would have been compromised in some rather significant ways," said Miller. "The weight savings are substantial."

"The challenge is to get as much strength with as little weight as possible," said George Palmer of Plymouth Foam. "Durafill is really the only choice."

Production and delivery were coordinated to coincide with the installation schedule, eliminating the need to store excess inventory on site. Durafill for the water park was easily cut on site to fit around the numerous structural columns and plumbing fixtures.

Product Specs

Amount: Over 16,000 cubic yards of Durafill, comprising 150+ full trailer loads.

Type: A variety of geofoam types: Durafill 15 (EPS 15), Durafill 19 (EPS 19) and Durafill 29 (EPS 29).

Block Size: Standard billets of 49" x 41" x 194", some delivered at full size and others pre-cut to 10", 20" and 30" thicknesses.

Common Applications for Durafill

Durafill has very low density, good insulation, low hydraulic conductivity, and a superior compressive strength-to-weight ratio. It is suited for a wide range of geotechnical engineering applications including:

- Lightweight fill for building and road construction on unstable soil
- Roadway and runway sub-grade and foundation insulation
- Slope stabilization
- Retaining wall and abutment backfill: lateral pressure reduction
- Landscape design



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