

A Park With ~~SOIL~~?

Lightweight geofoam enables earthworks for new park located atop Chicago parking garage

BY NICO SUTMOLLER

Throughout the summer, Chicago residents and visitors saw what looked like acres of piled snow at a construction site bordering Lake Michigan, despite the city's typical sweltering June and July temperatures.

The "snow" was actually large, white blocks of expanded polystyrene (EPS) geofoam that contractors were installing to form berms and landscaped contours for the new Maggie Daley Park.

Site Prep Challenges

The Chicago Park District decided to develop a 28-acre site adjacent to the city's renowned Millennium and Grant parks as a "world-class public landscape at a keystone location" to meet the "evolving open space needs of downtown Chicago." The Maggie Daley Park, scheduled for final planting in spring 2015, occupies the former Daley Bicentennial Plaza. The site was a railyard and surface parking lot for cars until the early 1950s, at which time



Photo credit: Insulfoam



The "snow" on Chicago's famed waterfront in the heat of summer is actually EPS geofoam, being used to construct Maggie Daley Park atop a parking garage that cannot hold heavy soil.

the city moved the parking spaces underground.

Therein lies one of the key site preparation challenges for Maggie Daley Park, which will be located on top of the 3,700-car East Monroe Street Parking Garage. The park's landscape architects, Michael Van Valkenburgh Associates of Brooklyn, N.Y., envisioned extensive earthworks, which they described as "curvilinear, topographically dramatic and relentlessly heterogeneous." Contractors typically would use soil to form such landscape contours, but that was not feasible for this project because the upper slabs of the sprawling, decades-old parking garage were not designed to accommodate that much weight.

Instead, crews with Chicago-based Walsh Construction used EPS geofoam as an ultra-lightweight yet durable fill to form the park's hills and valleys. Geofoam is approximately 100 times lighter than soil (0.7-2.85 lbs./cu.ft. for geofoam compared to 110-120 lbs./cu.ft. for soil), so it enabled the Maggie Daley Park designers to create a visually interesting landscape and still keep the garage in place. Walsh installed 65,000 cu. yds. of geofoam, along with some geofoam that had been previously installed in Daley Bicentennial Plaza.

"It allows you the freedom to be creative," landscape architect Peter Schaudt, whose company Hoerr Schaudt Landscape Architects has used geofoam in other Chicago projects, commented in a recent Chicago Sun-Times article.

What Makes Geofoam Special?

Despite its low weight, EPS geofoam is strong enough to support heavy loads, such as those imposed by jet aircraft and locomotives, as demonstrated by its successful use as a subgrade for runways, taxiways and rail beds. Following are the material's key physical characteristics.

Weight: In addition to weighing far less than soil, EPS geofoam is much lighter than other lightweight fills, as per the chart below.

Fill	Typical weight (lbs./ft³)
EPS Geofoam	0.7 - 2.85
Wood Chips	15 - 30
Cellular Concrete	35 - 100
Shredded Tires	38 - 56
Pumice	40
Soil	110 - 120

Compressive Resistance: EPS geofoam is engineered for high strength with compressive resistance values of 317-2,678 lbs./sq.ft. at a 1-percent strain. The material's Westergaard modulus of subgrade reaction "k" values indicate that EPS geofoam has better bearing capacity than most foundation soils. As long as combined dead/live loads do not exceed 1-percent strain, the material will not creep or experience plastic yield.



Photo credit: Cooper Hong Inc.

Being built at the foot of Chicago, Maggie Daley Park is being construction using EPS geofoam that will allow the parking garage below to remain in place.

Buoyancy: Although this is not an issue in most applications because EPS geofoam is buoyant, it is important to consider uplift forces in applications where the material will be partially or fully submerged. Buoyancy can be minimized by installing geofoam above the water table and ensuring suitable drainage. Additionally, the surcharge from overlying soils or pavements is frequently sufficient to offset uplift forces. Where high water exposure cannot be avoided, supplemental restraints like restraining straps might be required. The fact that the material's buoyancy can be readily addressed is seen in its successful use in several levees in the U.S.

Damaging Elements: EPS geofoam does not decompose, nor is it affected by freeze-thaw cycles or road salts, and is considered permanent in civil engineering applications. Petroleum products and other chemicals can damage EPS, so geofoam designs should include a compatible geomembrane or a continuous load distribution slab to protect the material from fuel spills or exposure to hydrocarbons in contaminated soils in applications where these conditions might exist. EPS is combustible, so it is important to check with the particular manufacturer if the geofoam includes a flame retardant. Flammability is typically only a concern if open flames are present during installation, as geofoam is usually isolated by membranes, soils or pavement in the finished application.

Working With Geofoam

EPS geofoam greatly simplifies site prep, because it does not require the surcharging, preloading or staging often necessary

with other fills. The material is also easy for crews to place by hand or with small mechanical equipment. A reputable geofoam manufacturer will provide contractors with detailed information on working with the material, and producers like Insulfoam will provide on-site consultations.

... geofoam is **lightweight, durable, easy to use and more consistent** than other fills ...

Geofoam installation does not require much training. Among the installation factors to keep in mind:

- **Sizing:** Standard-size blocks are 4 ft. by 8 ft., at various thicknesses. A well-equipped manufacturer can produce custom sizes and shapes to meet any project need, or crews can easily trim geofoam on the jobsite using a hot wire cutter (which some manufacturers will supply) or with handsaws or chainsaws.
- **Block Placement:** Typical geofoam designs call for installing the blocks on a level course of sand, pea gravel or any locally available permeable leveling course material. Similar to how brick walls are configured, geofoam blocks usually are staggered so their joints are offset and not located in the same vertical plane. Depending on the engineering requirements, the blocks can be interconnected with either barbed plates or polyurethane adhesive.

- **Wind Protection:** Geofoam is lightweight, so it is important contractors weigh or tie down stockpiles on windy jobsites.

A Wide Range of Applications

Because geofoam is lightweight, durable, easy to use and more consistent than other fills, it is being used by building professionals as a fill alternative in numerous large civil projects, as well as in residential and commercial buildings. Among example installations:

- **I-80 / I-65 Interchange,** Gary, Ind.: To reduce excavation volumes of high-organic content soils at the south end of Lake Michigan, Walsh Construction instead used EPS geofoam for the road subgrade. "There's no comparison to using traditional fill," says Walsh Construction site supervisor Gary Walsh. "There are no lifts needed; we just unloaded the blocks and it installed fast."
- **Alaskan Way Viaduct,** Seattle, Wash.: The Seattle waterfront has notoriously soft soils, since much of the downtown area was built on fills created by re-grading the city in its early days. As part of embankment construction for the Alaskan Way Viaduct replacement, project engineers had to ensure that new ramps would not induce settlements on the underlying soft soils, which could impact the stability of adjacent elevated structures. EPS geofoam provided the necessary load support at a low weight and eliminated the need to surcharge the soil.
- **CRH-UBH Freeway Interchange,** Valsayn, Trinidad: As

discussed in an earlier Site Prep article ("Standing on Solid Ground," March, 2014), contractors used geofoam as a lightweight embankment fill on top of the pile cap for an existing flyover ramp pier, to avoid any modification of the pier's seismic behavior in the earthquake prone region.

Beyond such road applications, geofoam is an ideal lightweight void fill on vegetated roofs, which is a similar application to the landscape contouring of Maggie Daley Park on top of the East Monroe Street Parking Garage in the heart of Chicago. **SP**

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Photo credit: Cooper Hong Inc.

Crews with Walsh Construction use EPS geofoam as an ultra-lightweight yet durable fill to form the hills and valleys that will comprise Maggie Daley Park on Chicago's waterfront.