

# EPS Lightweight Backfill and Landscaping Applications



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## EPS Geof foam Advantages

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- EPS geof foam can be cut and shaped either at plant or site to create any architectural and landscaping profiles.
- EPS geof foam can be used to create topography without adding significant load to underlying structures and services ( e.g., roof gardens for urban buildings).
  - Weight: EPS geof foam is about 100 times lighter than soil and much lighter than other lightweight fills like cellular concrete, shredded tires, pumice, wood chips, etc.
- Despite its low weight, EPS geof foam is strong enough to support traffic and landscaping equipment loads.
  - Compressive Strength: EPS geof foam is engineered for high strength with compressive resistance values of 2 to 15 psi @1% strain. As long as combined dead / live loads do not exceed the compressive strength at 1% strain, the material remains in the elastic range and will not be susceptible to creep or experience plastic yield.

## Material Introduction: What is Expanded-Polystyrene (EPS) Block Geof foam?

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**Geof foam** is expanded polystyrene (EPS) or extruded polystyrene (XPS) manufactured into large lightweight blocks. The blocks vary in size but are often 2 m x 0.75 m x 0.75 m. The primary function of geof foam is to provide a lightweight void fill below a highway, bridge approach, embankment or parking lot. EPS Geof foam minimizes settlement on underground utilities. Geof foam is also used in much broader applications, including lightweight fill, green roof fill, compressible inclusions, thermal insulation, and (when appropriately formed) drainage. (Wikipedia)<sup>1</sup>

# Molding Process



Plant photos: Sutmoller

# Introduction to EPS-Block Geofoam – Block Placement



AL DOT

- Block dimensions  
0.6 x 1.2 x 2.4 m  
(2 x 4 x 8 ft)  
varies
- Density/unit weight  
18.4 to 45.7 kg/m<sup>3</sup>  
(1.15 to 2.85 lbs/ft<sup>3</sup>)  
Soil: ~2,000 kg/m<sup>3</sup>  
(125 lbs/ft<sup>3</sup>)
- Color  
White

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## EPS Geof foam Advantages (cont.)

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- Site preparation is simpler with EPS geof foam because it does not require the surcharging, preloading or staging often necessary with other fills.
- The material is easy for workers to carry and place by hand.
- Geof foam installation does not require much skilled training.
- Custom-sized geof foam blocks to meet project needs can be procured from the manufacturer directly. Workers can trim geof foam at the site using a hot wire cutter or with handsaws.
- Geof foam blocks are laid on a level course of sand or any leveling course material. The blocks are laid in staggered manner so their joints are offset and not located in the same vertical plane. The blocks can be interconnected with either barbed plates or suitable adhesive.

# Ease of Transportation and Placement



photo courtesy of  
BASF- Kuala Lumpur,  
Malaysia



photo source:  
[geojuanjo.blogspot.com](http://geojuanjo.blogspot.com)



photo courtesy of  
<http://www.architecture.org/>



## Primary Uses of EPS Geofoam

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- Roadway construction over poor soils
- Roadway widening
- Bridge abutments
- Bridge underfill
- Culverts, pipelines and buried structures
- Compensating foundations
- Rail embankment
- **Landscaping, architectural, green roofs**
- Retaining and buried wall backfill
- Slope stabilization
- Stadium and theater seating
- Levees
- Airport runway and taxiways
- Foundation for lightweight structures

# Material, Design and Construction Considerations for Landscaping Applications

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- Material Considerations

- **EPS Density**
- **Compressive Strength**
- **Insect Control**
- **Flame Resistance**
- Moisture Absorption
- **Chemical Resistance**

- Design Considerations

- **Design Methodology**
- **Allowable Stress**
- **Concentrated Loads**
- **Drainage / Buoyancy**
- Seismic Loadings
- **Stability of Adjacent Ground**
- Settlement
- Bearing Capacity
- Pavement Design

- Construction Considerations

- **Bedding Material**
- **Compaction**
- **Handling**
- Block Dimensions
- **Block Layout & Placement**
- **Cover and UV protection**

- Quality Assurance/Control

- **Specifications / Provisions**
- **Testing and Sampling**
- **Inspection**
- **Corrective Action**

**Items important for this application are shown in yellow**

## Material, Design and Construction Considerations (Additional Explanation for Landscaping Applications)

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- Buoyancy can be minimized by installing geofoam above the water table and ensuring suitable drainage. In addition, it can be counteracted by placing overlaying soils, pavements, sidewalks to sufficiently offset uplift forces resulting from buoyancy.
- Chemical resistance - EPS geofoam does not decompose nor is affected by road salts. Petroleum products and other chemicals can damage EPS, so incorporation of protective layers or barriers is used (e.g., soil cover, concrete slabs, geo-membranes, etc.).
- Flammability - EPS is combustible when exposed to an oxygen source, so it is important to cover with non-flammable materials (i.e., soil, etc.) and include a flame retardant. Geofoam is usually isolated by membranes, soils, or pavement in the finished application.

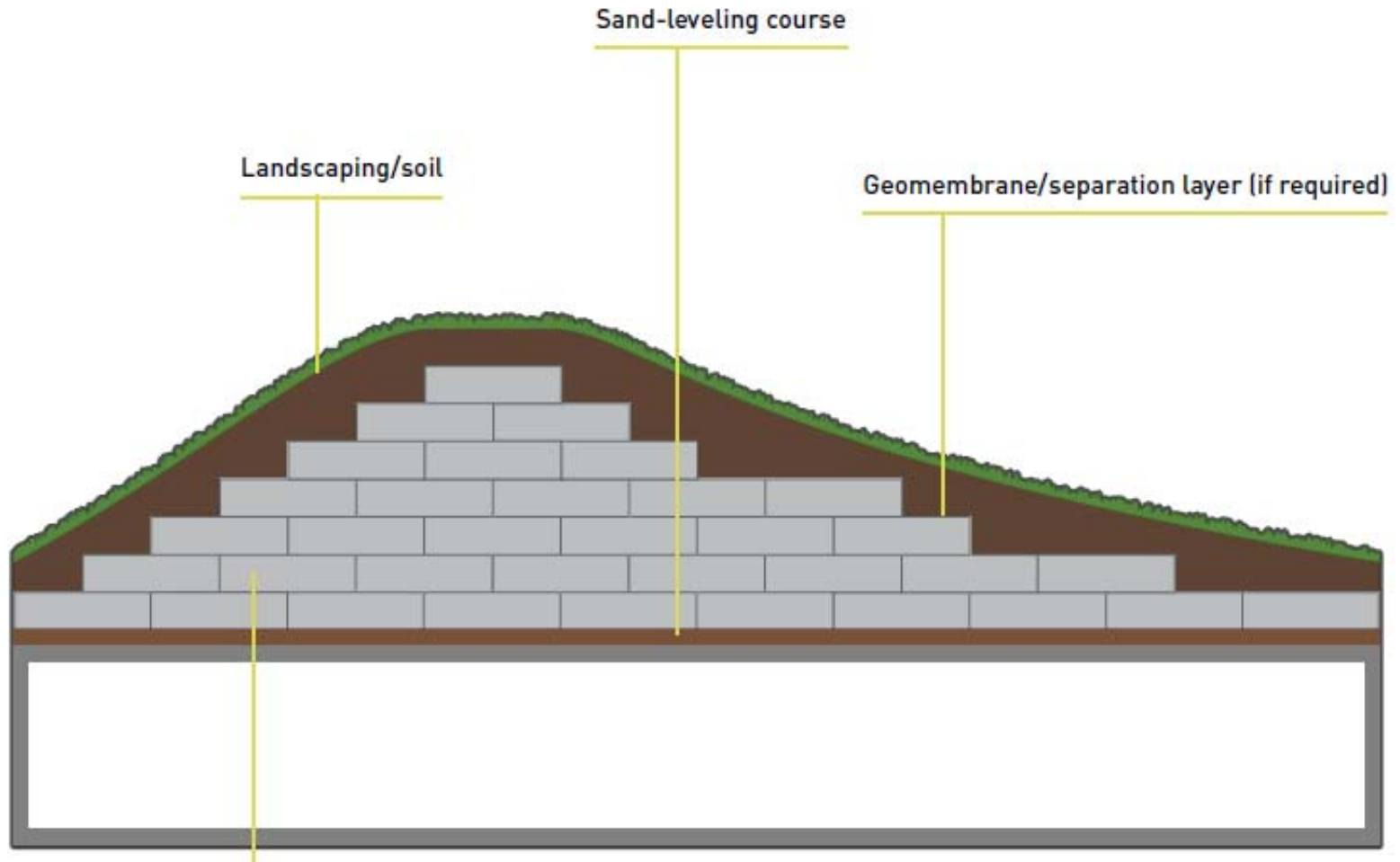
# Topics

## Landscaping and Architectural Uses

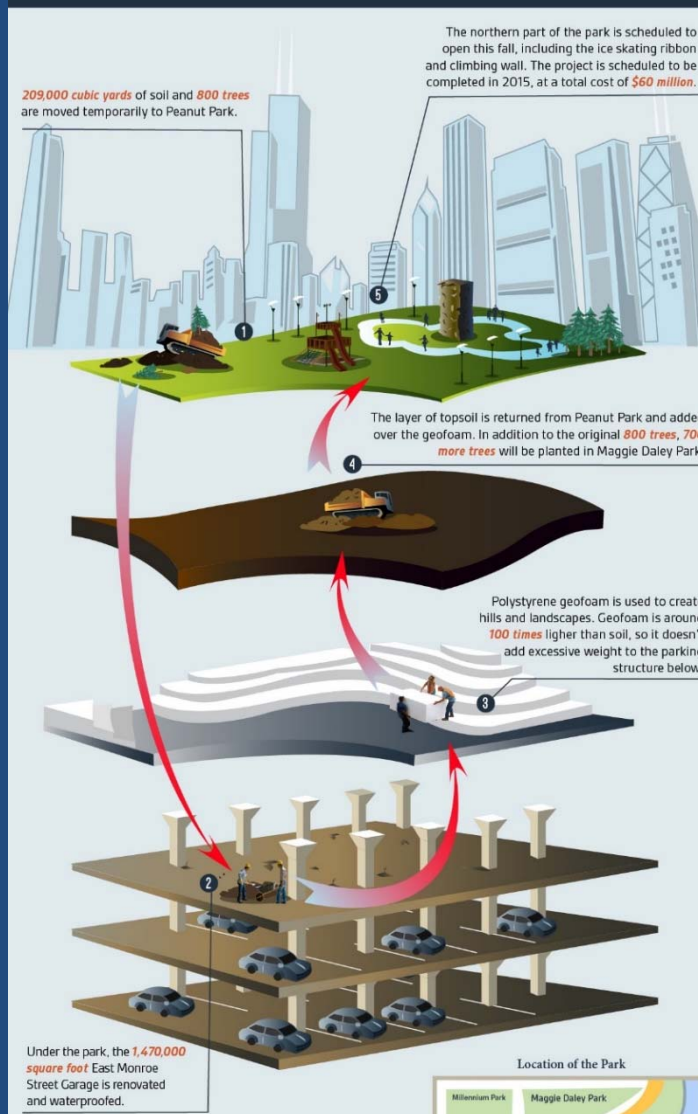
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- **Light-weight terrain and terracing**
- Light-weight fill against buildings
- Protective berms against important facilities
- Floor elevations and concrete void fill
- Green roofs and parking structures
- Stadium and theater seating
- Architectural features

# Lightweight Terrain and Terracing



# Maggie Daley Park – Chicago, Illinois



<http://www.architecture.org/>

•Estimated Volume of Geofram: 70,000 CY



For more information, see

<http://maggiedaleyparkconstruction.org/construction.php>

<http://insulfoam.com/chicagos-maggie-daley-park-is-citys-largest-geofram-project/>

[www.chicagoarchitecture.org](http://www.chicagoarchitecture.org)



<http://blog.gefoam.com/wp-content/uploads/sites/24/2014/11/maggiedaleyparkinfographic.jpg>



# Provo, Utah Tabernacle Reconstruction



Artist rendition of completed renovation.

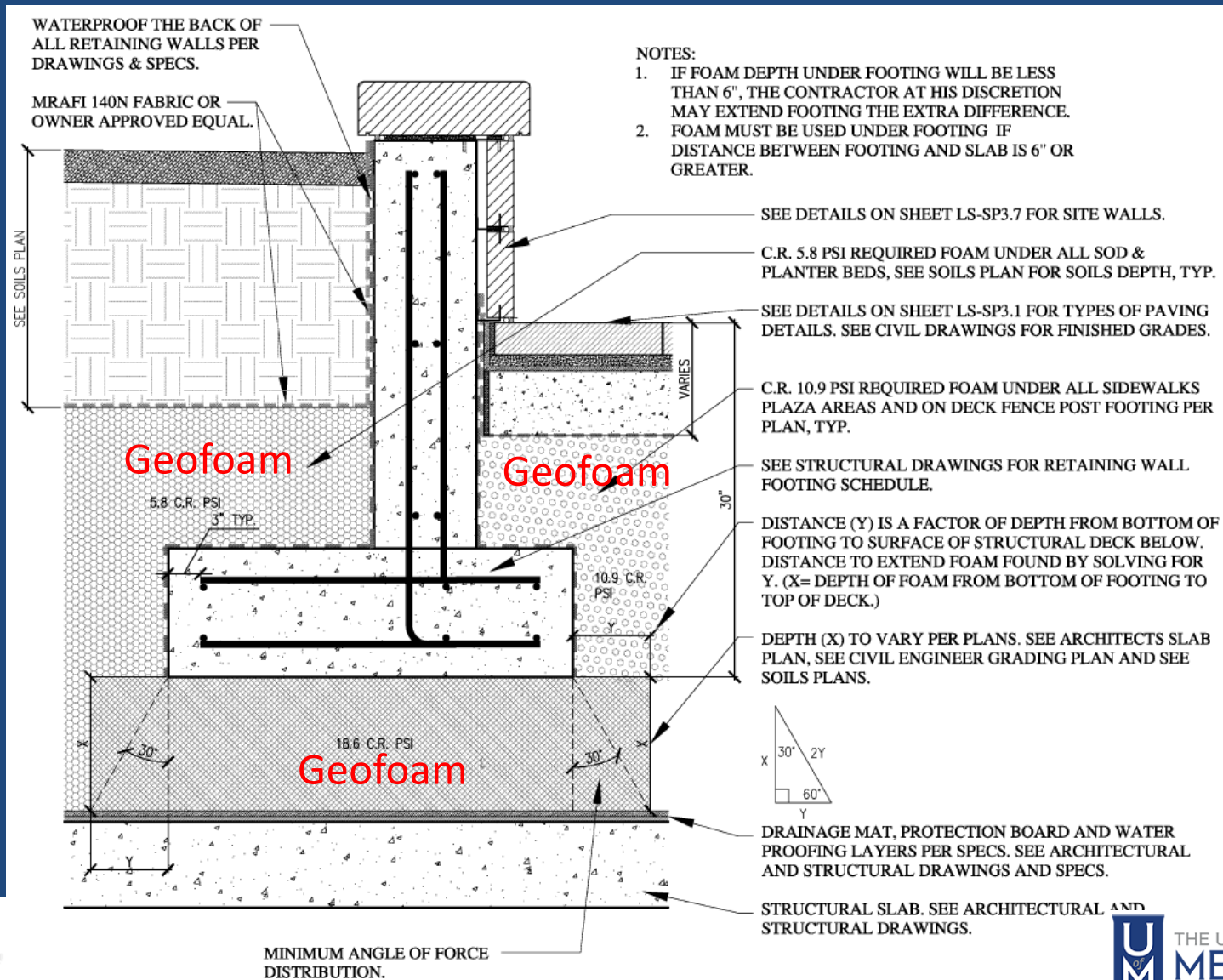
Underpinning and support of Exterior walls of historic building during construction.







# Provo Tabernacle, Typical Detail



# Utah State Capitol Renovation



Two to three layers of EPS 19 Geofoam was installed on the drainage matt. Above the Geofoam a fabric filter was applied to prevent soil from slipping between the cracks of the Geofoam blocks. Two feet of landscaped soil covers the Geofoam. EPS 29 Geofoam was installed under areas where an adjacent roadway passes the capital, which required a higher compressive strength material. Geofoam was also used to create elevation changes for landscaping.



# Provo Tabernacle – Construction Photos

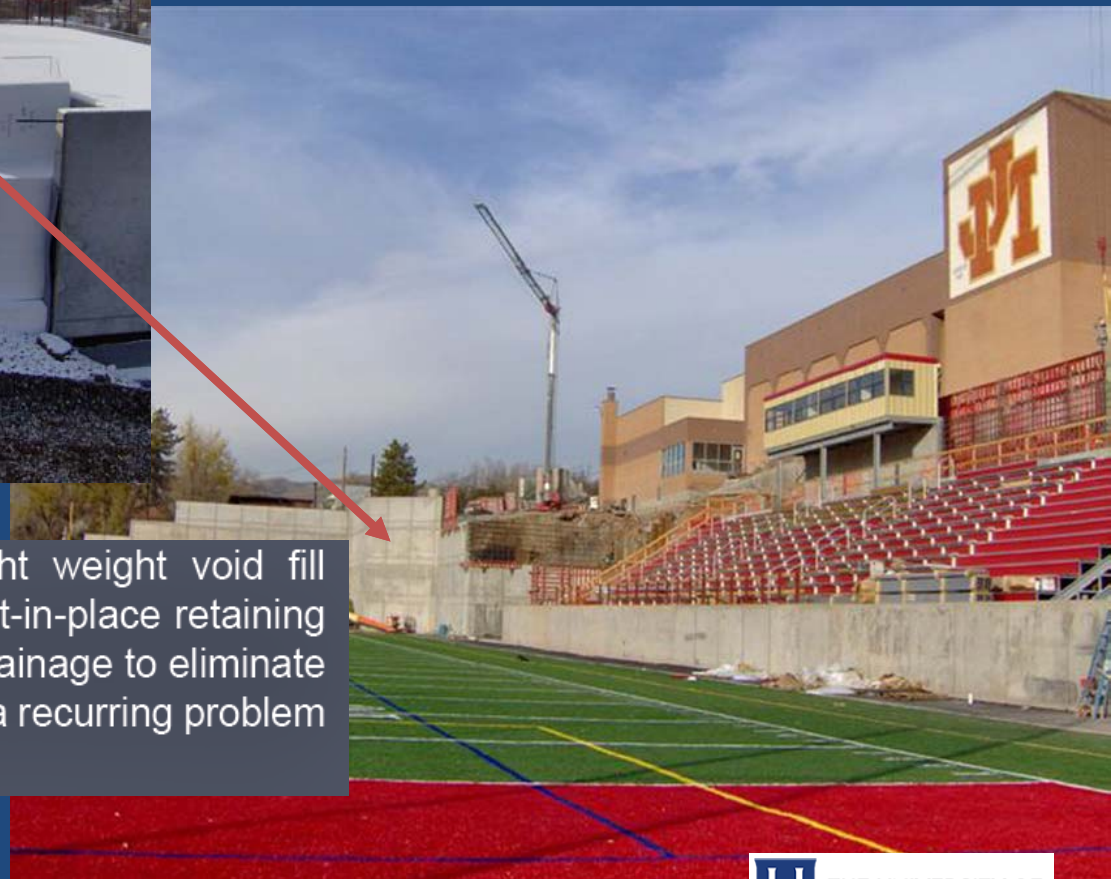


<http://newtempleinprovo.blogspot.com/2014/09/niche-16-and-other-distractions.html>



# Judge Memorial High School, Salt Lake City, Utah

<http://www.achfoam.com/ACH/media/ACH/docs/Projects/Judge-Memorial-High-School.pdf>



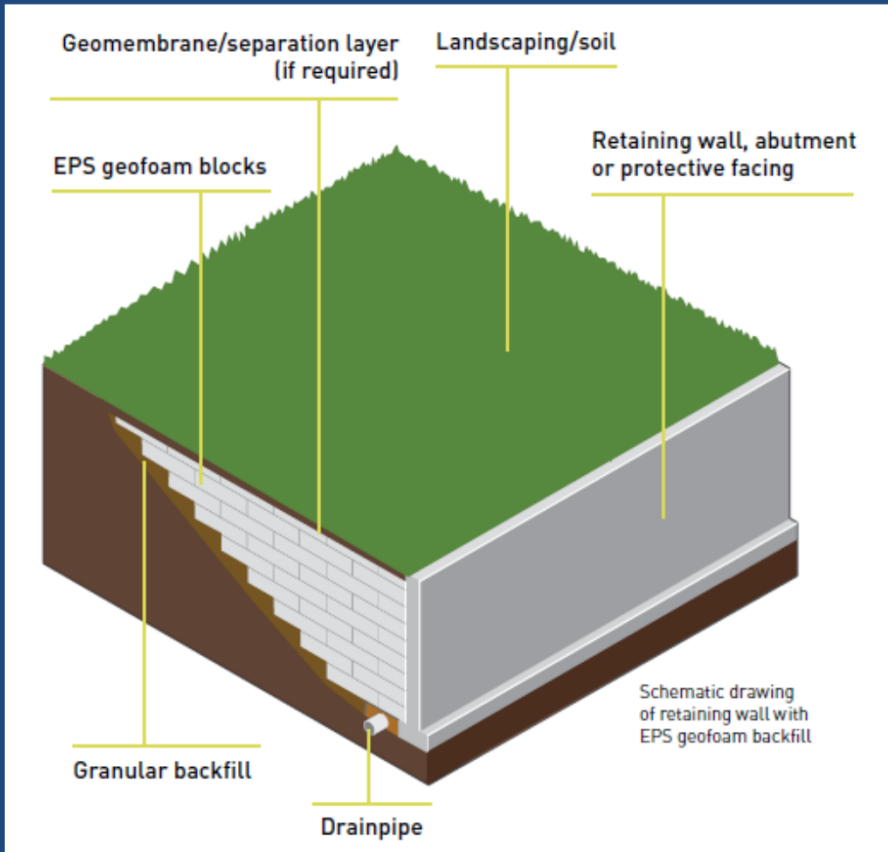
Summer 2006, engineers required a light weight void fill material to protect a 20 foot to 40 foot cast-in-place retaining wall from lateral pressure and to provide drainage to eliminate standing water. Water drainage was often a recurring problem prior to the stadium's renovation.

# Landscaping and Architectural Uses

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# Applications: Retaining & buried wall backfill



(EPS Geofoam Applications & Technical Data by EPSIA, 2012)



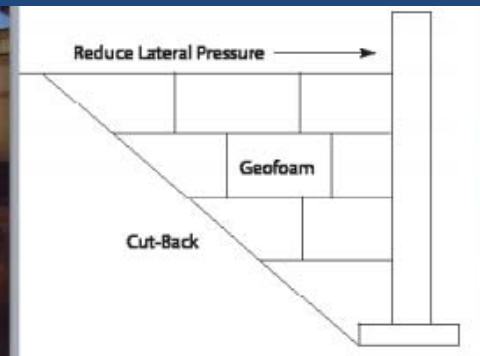
- ▶ EPS geofoam retaining wall backfill for West Virginia University student housing project, Morgantown, West Virginia.

# Inn of the Gods - Reidoso, New Mexico



EPS placed against sides of parking structure to reduce earth pressure on structure and reduce settlement of foundation

<http://www.achfoam.com/ACH/media/ACH/docs/Projects/Inn-at-the-Mountain-Gods.pdf>



# U.S. Federal Courthouse, Salt Lake City, Utah



<http://www.asce.org/magazine/20140527-courthouse-takes-form-of-contemporary-cube/>



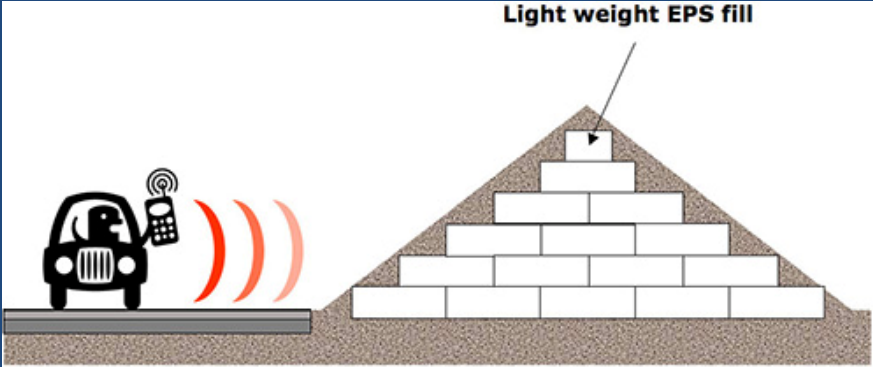


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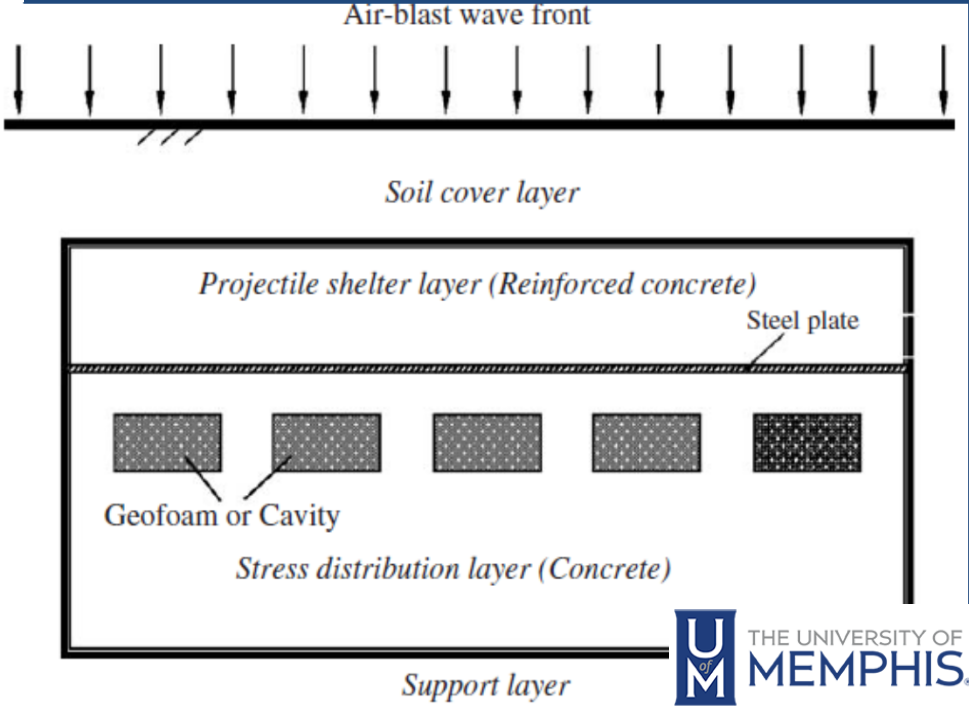
# Sound, Blast and Rockfall Barrier



Light weight EPS can be used as an alternative to traditional fill materials. Given its light weight, embankments can be constructed far steeper than with heavy weight fill materials.

## Sound Barrier

## Blast Protection



# Landscaping and Architectural Uses

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# Floor Elevations – Gateway Mall

## Project Details

From 2001 to 2007 architects and contractors designed and built a mixed use development in Salt Lake City. The Gateway features 105 stores and 152 residences spanning over 3 million square feet. The ongoing project used Foam-Control® Geofoam as landscape fill in the plaza and garden areas, Geofoam to protect below-grade utilities, stadium seating fill for the theatres, and tapered concrete void fill to create varying floor elevations for ramps in the parking structure.

In addition, the project employed Wall Specification Grade EPS for EIFS systems that covered the exterior of the buildings. EPS Geofoam was selected for The Gateway project for its light weight, versatility, high compressive strength, ability to be easily modified on the jobsite, and its labor and material savings.

## The Gateway

- Salt Lake City, UT
- 2001 to 2007
- Geofoam Utility Protection, Landscape Fill & Concrete Fill
- 190,000 Cubic Feet

## Architect

MHTN

## Engineer

Don Williams  
Dunn & Associates Inc.

## Contractor

Glen Larsen  
Big D Construction

Brian Stewart  
EK Bailey Construction



# Floor Elevation – Weber State University

## Project Details

Spring 2008, contractors installed EPS Geofoam to elevate the floors in a hard to access basement area of the student union. According to contractor, Gabe Griffin, "Geofoam saved a great deal of time by not having to bring in regular fill material one wheelbarrow at a time."

Geofoam was also used as a light weight fill material to protect a below-grade utility tunnel that connected between two parts of the building. The light weight yet strong Foam-Control<sup>®</sup> EPS Geofoam reduced soil pressure on the walls and ceilings of the utility tunnel, preventing structural damage.

- Ogden, UT
- Spring 2008
- Geofoam Floor Elevation Fill
- 22,000 Cubic Feet

### Contractor

Gabe Griffin  
Jacobsen Construction

### Architect

Nick Gaviglio  
MHTN Architecture



# Concrete Void Fill – Main Street Plaza

## Project Details

Summer 2000, engineers required a light weight fill material to reduce the weight of the Tabernacle's plaza on a below-grade parking structure. Tapered concrete void fill Geofoam was used in the underground parking garage to create ramps and reduce the volume of costly concrete.

Low density, high strength EPS Geofoam was also used in planter boxes and landscaping above-grade to reduce the weight of the plaza on the 260,000 square foot parking structure below. The plaza features architectural concrete, stone, landscape formations, fountains, statues and a reflecting pool.

## Main Street Plaza

- Salt Lake City, UT
- Summer 2000
- Geofoam Concrete Void Fill & Landscape Fill
- 16,000 Cubic Feet

## Architect

MHTN Architects

## Contractor

Mike Jones  
Jones Excavating



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# Green Roof – Salt Lake Conference Center



Conference Center, Salt Lake City, Utah



Conference Center, Salt Lake City, Utah





# Application: Rooftop Pool Decks



Photos: Sutmoller

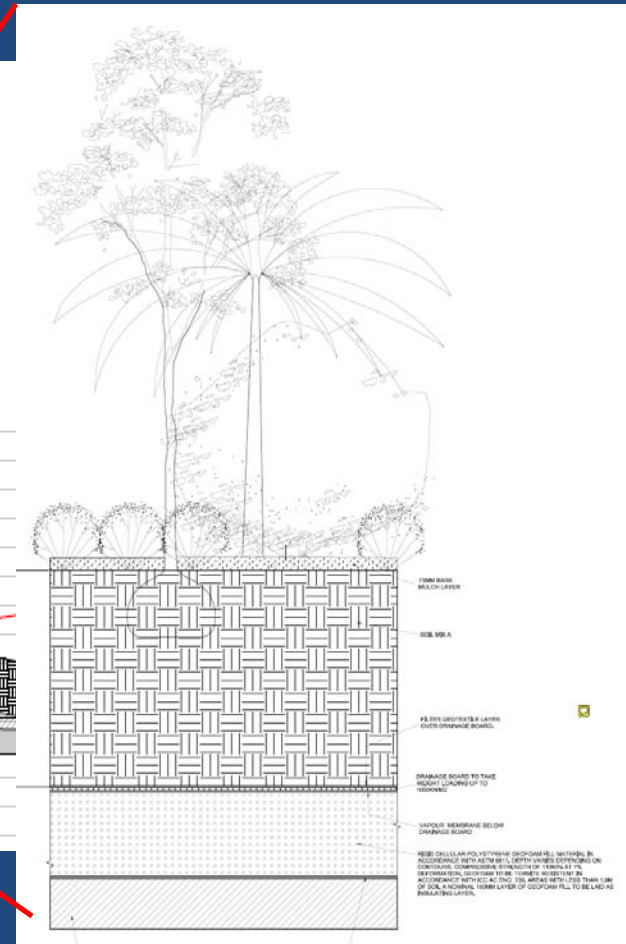
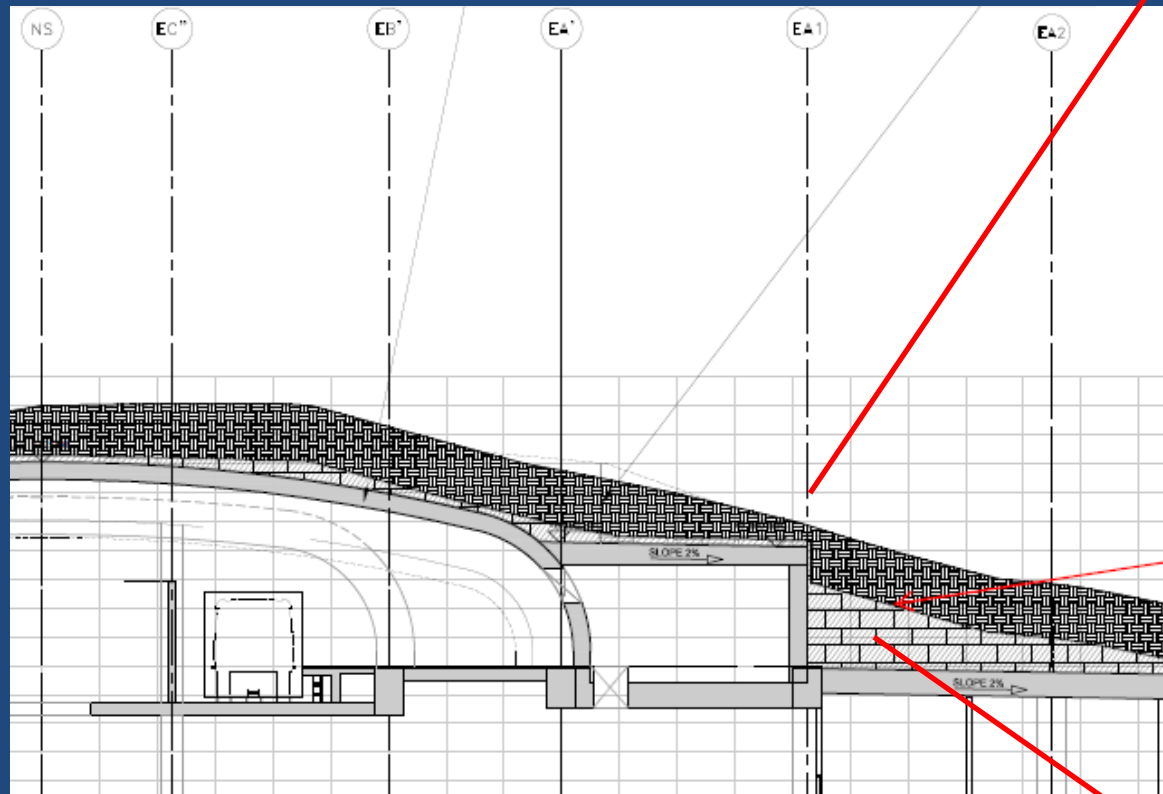


# Moran Eye Center, Ogden Utah



Summer 2006, engineers needed a light weight void fill material to reduce the weight of the plaza on a below-grade parking structure. EPS Geofoam helped to reduce 3 million pounds of weight on the parking structure and provided a flat, level surface for the plaza's landscaping. Below the landscaping, 12 feet of EPS Geofoam was used in the Moran Eye Center project.

# Vegetative Roof of Airport Terminal

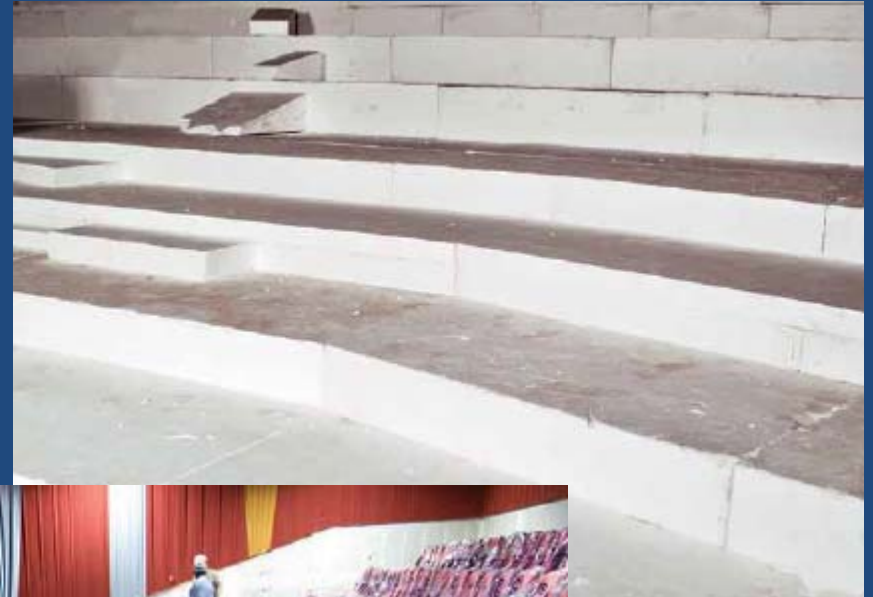


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# Stadium and Theater Seating



EPS Industry.org



# Stairs & Ramps



Photos: Sutmoller

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## Application Resources

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# Expanded Polystyrene (EPS) Geofoam Applications & Technical Data

**The EPS Industry Alliance**

1298 Cronson Boulevard

Suite 201

Crofton, MD 21114

800.607.3772

[info@epscentral.org](mailto:info@epscentral.org)

[www.epsmolders.org](http://www.epsmolders.org)

**Authors: Stark, Bartlett and Arellano, 2012**

**Available from: [www.civil.utah.edu/~bartlett/geofoam](http://www.civil.utah.edu/~bartlett/geofoam)**

