EPS Geofoam

An Engineered, Light Weight, Fill Alternative for Road Construction
What is EPS Geofoam?
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- EPS Geofoam is an engineered foam polymer used in road construction applications where a lightweight fill is required to reduce stresses on underlying soils or lateral pressures to retaining walls, abutments or foundations.
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- EPS Geofoam is also used as a thermal barrier under buildings, roads, railways, retaining walls, and underground parking garages to reduce the effects of freezing, to prevent road deterioration and to avoid the collapse of the unstable ground.
- For more than 30 years, Geofoam has been used in engineering and geotechnical applications worldwide.
- EPS Geofoam is a strong, environmentally safe, foamed plastic with a very low density.
  - Weighs approximately 1% of traditional earth materials.
  - At least 20 to 30 times lighter than other lightweight fill alternatives.
- This extreme difference in unit weight compared to other materials makes EPS Geofoam an attractive fill material.
- The surface of EPS Geofoam is affected by UV light and should be covered in storage or cleaned prior to use.
Why Use EPS Geofoam?
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Ideal Conditions for Geofoam:

- Soft soil is the number one driver for using Geofoam in roadway construction
  Soft organic soil, i.e. soft clays, silt, and peat type soils (Most ideal when the soft soil is deep and wet)
  - Geofoam provides excellent foundation stability
  - Geofoam reduces the rate of settlement to nil
- Relieves Lateral Pressure
- Stable protection in high seismic risk areas (California, etc)
Why Use EPS Geofoam?

- EPS Geofoam can be used as an embankment fill to reduce loads on underlying soils, or to build highways quickly without staged construction.
- EPS Geofoam has been used to repair slope failures, reduce lateral load behind retaining structures, accelerate construction on fill for approach embankments, and minimize differential settlement at bridge abutments.
Why Use EPS Geofoam?

- Because EPS Geofoam weighs only 16 to 32 kilograms per cubic meter (1 to 2 pounds per cubic foot), large earthmoving equipment is not required for construction.
- Blocks easily can be trimmed to size and placed by hand.
Why Use EPS Geofoam?

- EPS Geofoam provides:
  - Lot-to-lot product consistency…predictable performance
  - Manufactured to meet ASTM D6817
  - Block size and density customized for job needs
  - Super lightweight compared to other fills and is structurally rigid
  - Inert in long-term burial conditions, no leachates
  - Easily shaped in field or supplied prefabricated
  - Termite protection available (if needed)
  - Cost effective solution for many difficult applications
  - Contains no CFC, HCFC, or HFC
Why Use EPS Geofoam?

- Geofoam is among the most versatile lightweight materials available.
- Traditional earth materials are heavy and can cause settlement, instability, or lateral pressures.
- Other fill materials such as foamed concrete, waste tires, soil, woodchips, wood fiber, etc., have higher densities and are variable in their makeup.
- These alternative fills have limitations in handling and can be weather sensitive, thus requiring staged construction and/or preloading, surcharging and draining, etc.
Why Use EPS Geofoam?

- Geofoam maximizes onsite installation efficiency:
  - Material arrives ready to place
  - No weather delays
  - Material can be prefabricated or cut at the jobsite
  - No staging required
  - Material can be inventoried but should be covered if stored outside for long periods to prevent surface dusting
  - Production efficiency improved
  - Easy to handle
When to Use EPS Geofoam?

- Protect buried utilities
- Congested highways and projects with tight time schedules (Urban Areas)
- Construction embankments or highway expansions over existing utilities
- Projects with limited space and in close proximity to nearby structures
When to Use EPS Geofoam?

- In areas where right-of-way is limited, EPS Geofoam can be constructed vertically and faced, unlike most other lightweight fill alternatives.
- Can be constructed in adverse weather conditions.
- Accelerates foundation construction, which reduces project schedules.

I-15 in Salt Lake City, UT
EPS Geofoam Research Data
## EPS Geofoam Minimum Block/Test Properties

<table>
<thead>
<tr>
<th>NCHRP 24-11 Material Designation</th>
<th>ASTM D-6817</th>
<th>Block Dry Density (pcf)</th>
<th>Elastic Limit Stress (psi)</th>
<th>Initial Tangent Young’s Modulus (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPS 40</td>
<td>I</td>
<td>1.0</td>
<td>5.8</td>
<td>580</td>
</tr>
<tr>
<td>EPS 50</td>
<td>VII</td>
<td>1.25</td>
<td>7.2</td>
<td>725</td>
</tr>
<tr>
<td>EPS 70</td>
<td>II</td>
<td>1.5</td>
<td>10.1</td>
<td>1015</td>
</tr>
<tr>
<td>EPS 100</td>
<td>IX</td>
<td>2.0</td>
<td>14.5</td>
<td>1450</td>
</tr>
</tbody>
</table>
Stress and Strain at Two Foam Densities

Figure 2 - EPS Uniaxial Compression Stress Strain Curves (after Neugussey and Elragi, 2000b)

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Strength vs. Foam Density

Figure 2-4 Initial Tangent Modulus for EPS geofoam

- Miki, 1996a
- Horvath, 1995
- Duskov, 1997
- Eriksson & Trank, 1991
## Lightweight Fill Alternatives and Costs

<table>
<thead>
<tr>
<th>1. Granular</th>
<th>Unit Weight (pcf)</th>
<th>Cost ($/c.y.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood Fiber</td>
<td>35-60</td>
<td>9-15</td>
</tr>
<tr>
<td>Blast Furnace Slag</td>
<td>70-95</td>
<td>6-15</td>
</tr>
<tr>
<td>Fly Ash</td>
<td>70-90</td>
<td>11-16</td>
</tr>
<tr>
<td>Boiler Slag</td>
<td>65-110</td>
<td>2-3</td>
</tr>
<tr>
<td>Expanded Clay or Shale</td>
<td>35-65</td>
<td>30-42</td>
</tr>
<tr>
<td>Shredded Tires</td>
<td>35-55</td>
<td>15-23</td>
</tr>
</tbody>
</table>

### Cohesive

<table>
<thead>
<tr>
<th></th>
<th>Unit Weight (pcf)</th>
<th>Cost ($/c.y.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foamed Concrete</td>
<td>20-50</td>
<td>40-70</td>
</tr>
<tr>
<td>EPS Geofoam</td>
<td>1-2</td>
<td>100-140</td>
</tr>
</tbody>
</table>
EPS Geofoam in Action!
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- After years of searching for permanent solutions to failing slope problems, the New York State DOT and the Alabama DOT turned to EPS Geofoam. By replacing upper sections of the slide area, State engineers significantly reduced the driving forces that were causing the slide and successfully rehabilitated the roadway section.
Delivery to Job-site
EPS Geofoam In Action!

- The Big Dig in Massachusetts, I-15 in Utah, and the Woodrow Wilson Bridge in Virginia utilized EPS Geofoam to construct large embankment sections.
- EPS Geofoam helped the projects maintain extremely tight construction schedules that would not have allowed enough time for conventional embankment construction.
- Both projects illustrated the ease and speed with which EPS Geofoam can be constructed for highway embankments.
Basic Design

Roadway

Geofoam
Retaining Walls
Bridge Abutments/Approach Fills
Boston, MA – The Big Dig
Boston, MA – The Big Dig
Adding Geosynthetic Liner and Covering Fill
Route 23A – Greene County, NY

Before

After
COMPRESSIBLE INCLUSION FUNCTION

Elasticized EPS

Reduced Earth Pressure Wall Concept

Questions?