For Construction, Civil Engineering
and Architectural professionals

DURABILITY

Long Life Durability and Cost Effectiveness

Expanded Polystyrene (EPS) is proven in use over decades across the globe for construction, insulation and civil engineering applications. It has many advantages including light-weight, strength, durability, low environmental impacts and brings exceptional cost-effectiveness.

EPS STANDS FOR ECONOMY, PERFORMANCE AND SUSTAINABILITY

Used in buildings and civil engineering applications for over 30 years, expanded polystyrene (EPS) is a well-proven construction material. Enduring strength, physical integrity and sustained thermal insulation are key characteristics of its long term performance – as evidenced by independent in-situ inspection and laboratory testing of aged material in actual use.

Enduring Strength

Strength testing of EPS used in bridge embankments and highway foundations in Norway showed that after three decades it was just as strong as the day it was first laid. The sustained loading applied to the EPS bridge foundations showed a 'creep' deformation of less than 1.3% and the Norwegian report concluded that "...no deficiencies are to be expected from EPS fills placed in the ground over a normal life cycle of 100 years".

And independent tests conducted for BASF show deformations ranging from an initial 0.5-1.0% to 0.8-2.0% after 200,000 hours under typical operational loadings – confirming the long-term structural strength of EPS.

Long Term Integrity

Material taken from one of the oldest applications of EPS (insulation panels in the flat roof of a factory building constructed in 1955 at BASF Aktiengesellschaft) showed that panel joints were still tightly sealed and that there were no signs of shrinkage, contraction, deformation or buckling and "...were still in excellent condition" after 31 years' service.

These findings extended to an exhaustive study undertaken by the Holzkirchen branch of the Fraunhofer Institute of Physics of 93 buildings throughout Germany. "In all cases, the [EPS] foam panels remained dimensionally stable and retained their functions".

Sustained Thermal Insulation Performance

Thermal conductivity testing of EPS from the Aktiengesellschaft building to DIN 52612, under the auspices of the Forschungsinstitut fur Warmeschutz in Munich, confirmed that its insulation efficiency at 0.345 Wm^2K was still well within the originally specified standard requirement of 0.040 Wm^2K .

This excellent long-term thermal performance is in part attributable to the very low level of water content – less than 0.02%. The project also found that the moisture content of aged EPS insulation was "...sub-critical, i.e. 0.06% maximum by volume" – further endorsing EPS in its long-life insulation role.

BPF EPS Construction Group,
6 Bath Place, Rivington Street,
LONDON EC2A 3JE

www.eps.co.uk
t: 0207 457 5000

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ECONOMY PERFORMANCE SUSTAINABILITY

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Water Resistance

Parallelling the low moisture content of EPS in conventional insulation applications, the EPS used in the Norwegian test road and bridge foundations showed similar resistance to water ingress. Material samples taken from locations as little as 200mm above groundwater level all had less than 1% water content by volume, whilst those which had been subjected to periodic flooding showed less than 4% water content – performance notably superior to most other foamed plastic insulation materials.

Water resistance is also an important factor when considering EPS insulation performance.When fully submerged, EPS will only absorb between 4%-8% of water by volume over a period of 7 days. It is important to note that although there will be a light loss of thermal performance whilst the EPS subsequently dries, the mechanical strength is completely unaffected.

So flooding will not compromise its structural strength, or its return to full thermal efficiency.

Compatibility with other Building Materials

Cement, lime, gypsum, anhydrite and mortar modified by plastics dispersions have no effect on EPS, so that it can confidently be used in conjunction with all conventional types of mortar, plaster and concrete encountered in building construction.

FACTORS AFFECTING LONGEVITY

Temperature
EPS is dimensionally stable to within 0.2% at 23°C and 50% RH, when tested in accordance with BS EN 1603:1997. Where there is no mechanical load, EPS can be exposed to temperatures of up to 90°C.

There are no lower temperature limits for EPS unless structural circumstances indicate that a volume change would be critical.

Hot bitumen is a particularly suitable adhesive for roofing and cold store applications – the very short term exposure to temperatures of over 100°C has practically no effect.

Vermin
EPS provides no nutritional benefits to vermin, however, and does not attract rodents.Installation of EPS should be configured to prevent access by vermin – a cement screed or containment within the vermin-proof envelope of a building conventionally provide a sound solution.

Fire and Chemicals
Like many materials used in building and construction, EPS is combustible, but the flame-spread with fire-retardant EPS is markedly reduced and generally meets the requirements of Class E when tested in accordance with BS EN ISO 13501-1:2002 – a small flame will extinguish on removal of the igniting flame.

EPS is extremely resistant to chemical attack. It can be attacked by contact with solvent-based cold bitumen, surface coatings, oily wood preservatives and tar products, but not by bitumen itself.

Solar radiation
Any yellowing of the material in the short term (i.e. a few weeks) has no significant effects. Long-term exposure to direct sunlight and UV radiation may cause slight embrittlement of EPS.

Direct contact between PVC cables and EPS should be avoided as the plasticizers found in PVC may migrate into the EPS, causing the EPS to shrink and the cables to become brittle. This potential problem is easily overcome by sheathing PVC cables with plastic conduit.

Cost-effective
Far from incurring a cost premium, the cost of insulating a new-build with EPS, rather than polyurethane, polyisocyanurate or mineral wool, is typically 20% less. EPS does not require dry storage on site, whilst its light weight makes it easy to manhandle large pieces into place. And cutting to size can be done without recourse to gloves and breathing masks. So EPS is both cost-effective and convenient.

Environmentally sound
No ozone-depleting CFCs or HCFCs feature at any time in the life of EPS. When used as insulation, EPS also saves over 200 times as much fossil fuel as it takes to make it.
In its civil engineering applications, the lightness of EPS means that the fuel energy and cash costs of transporting it are a tiny fraction of those incurred hauling bulk aggregate fills.

This is one of a series of Technical Briefings for building and architectural professionals. It accompanies our new Specifier Guide. Please visit our web site for copies of all these publications.

BPF British Plastics Federation

BPF EPS Construction Group,
6 Bath Place, Rivington Street,
LONDON EC2A 3JE

www.eps.co.uk
t: 0207 457 5000

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