TECHNOPOL SA
ENERGY SAVING MATERIALS

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TECHNICAL DESIGN GUIDE

Geofoam — EPS Lightweight Structural Fill

Moulded closed-cell EPS block, 12–30 kg/m³, placed dry as engineered lightweight fill so the weight of an embankment or backfill is designed out instead of the ground being improved.

DOCUMENT	ISSUED	PRODUCT	STATUS
TP-DG-GEOFOAM	2026-09-08	geofoam	Issued for use

INTRODUCTION

This guide covers Technopol EPS geofoam used as engineered lightweight fill: how the type is chosen, what the sustained-stress limit is, and which checks govern. The design method is ASTM D7180 - the 1%-strain sustained-load limit, the flotation check and the sliding check. Where the fill is load-bearing, demonstrate the delivered type by sampling and testing the block that arrives on site, to ASTM D7557, before the design is signed off. That is the right way to buy geofoam from anybody.

DESIGN VALUES

PARAMETER	VALUE
Compressive resistance @1% strain — 12SD (THE design load limit)	**15** kPa (min)°
Compressive resistance @1% strain — 15SD	**17** kPa (min)°
Compressive resistance @1% strain — 16DV	**21** kPa (min)°
Compressive resistance @1% strain — 20DV	**45** kPa (min)°
Compressive resistance @1% strain — 24DV	**70** kPa (min)°
Compressive resistance @1% strain — 30DV (the strongest grade Technopol makes)	**100** kPa (min)°
Compressive stress @10% strain (12SD / 15SD / 16DV / 20DV / 24DV / 30DV) — FAILURE-REGION, not a design load	**60 / 65 / 80 / 110 / 160 / 200** kPa (min)°
Nominal density (12SD / 15SD / 16DV / 20DV / 24DV / 30DV)	**12 / 15 / 16 / 20 / 24 / 30** kg/m³°
Minimum density (12SD / 15SD / 16DV / 20DV / 24DV / 30DV)	**11.4 / 14.3 / 15.2 / 19.0 / 22.8 / 28.5** kg/m³°
Unit weight of the fill, for the load take-down	**0.12–0.30 (use the grade specified; 20DV → 0.20)** kN/m³
Cross-breaking (flexural) strength (12SD / 15SD / 16DV / 20DV / 24DV / 30DV)	**80 / 100 / 140 / 150 / 205 / 250** kPa (min)°
Thermal conductivity λ @10 °C (12SD / 15SD / 16DV / 20DV / 24DV / 30DV)	**0.045 / 0.040 / 0.038 / 0.035 / 0.034 / 0.033** W/m·K (max)°
Water absorption	**< 4** %°
Water vapour transmission @38 °C / 88% RH (15SD / 16DV / 20DV / 24DV / 30DV)	**8.0 / 6.9 / 5.0 / 4.2 / 4.2** ngm/Ns (max)°
Water vapour resistivity (15SD / 16DV / 20DV / 24DV / 30DV)	**125 / 145 / 200 / 238 / 238** MNs/gm (min)°
Dimensional stability, 7 days @ 80 °C (all grades)	**≤ 1.0** %°
Sustained service temperature	**Below 70–80 °C. EPS softens and creeps above roughly 70–80 °C. The datasheet's short-term 100 °C figure is not a working temperature.** °C°
Interface friction coefficient, moulded and cut faces (μ)	**≈ 0.5** –°
Buoyant uplift on submerged geofoam (30 kg/m³ / 12 kg/m³)	**≈ 9.5 / ≈ 9.7** kN/m³ of submerged volume

PARAMETER	VALUE
Flotation factor of safety	**Set by the project engineer. Permanent dead load ≥ FS × buoyant uplift, checked for the permanent, flood AND construction-stage cases.** –°
Typical block size	**2550 × 1250 × 960 (other sizes cut to order; set a dimensional tolerance in the contract)** mm°
Governing standards	**ASTM D6817 (material) / ASTM D7180 (geotechnical design) / ASTM D7557 (sampling)** n/a°
Manufacturing quality system	**ISO 9001:2015; scope includes EPS Blocks and EPS Sheets. A quality-system certificate, not a product performance approval.** n/a°
ASTM D6817 type equivalence (verified against Table 1 of the standard)	**12SD, 15SD, 16DV = EPS12 | 20DV = EPS19 | 24DV, 30DV = EPS22. Technopol grade names denote NOMINAL density and are not ASTM type designations.**

° Catalogue or declared value. Where a figure is load-bearing in your design, confirm it for the material supplied — on a load-bearing application, by testing the product delivered to your site.

DESIGN AND DETAILING

1 · The design principle — you are removing mass, not adding strength

Settlement, bearing demand and lateral earth pressure are all proportional to the unit weight of the fill. Geofoam does not improve the ground. It deletes the load that was going to overload it.

A soil fill at γ ≈ 19 kN/m³ delivers σ = γ·H to the subsoil — 66.5 kPa from 3.5 m of soil. Geofoam at 12–30 kg/m³ has a unit weight of 0.12–0.30 kN/m³, so 3.2 m of 20DV block delivers 0.6 kPa. Round it off: the fill self-weight is gone. What remains, and must still be carried by the subsoil, is the load-distribution slab, whatever covers it (pavement or soil) and the live or traffic surcharge. Those do not shrink, and they are usually what governs.

That is the whole design move, and it is why geofoam is presented as a load take-down, not as a settlement prediction. Settlement is not a property of the block: it depends on the site's Cc, e0, OCR and layer thickness. Do the take-down, hand the reduced Δσ to the geotechnical engineer, and let them do the consolidation.

COMPONENT	CONVENTIONAL SOIL FILL	EPS GEOFOAM FILL (20DV, 0.20 KN/M³)
Fill self-weight — 3.5 m soil @ 19 kN/m³ / 3.2 m geofoam block	3.5 × 19 = 66.5 kPa	3.2 × 0.20 = 0.6 kPa
RC load-distribution slab, 0.3 m @ 24 kN/m³	not required	0.3 × 24 = 7.2 kPa
Pavement, 0.5 m @ 20 kN/m³	0.5 × 20 = 10.0 kPa	0.5 × 20 = 10.0 kPa
Traffic surcharge (transient)	12.0 kPa	12.0 kPa
Δσ delivered to the subsoil	≈ 88.5 kPa	≈ 29.8 kPa

COMPONENT	CONVENTIONAL SOIL FILL	EPS GEOFOAM FILL (20DV, 0.20 KN/M³)
Sustained (non-transient) stress at the top of the block	n/a	7.2 + 10.0 = 17.2 kPa — carried by 16DV (21 kPa) and up

Load take-down. Both columns build 4.0 m from the prepared subgrade to the finished surface. Illustrative build-up — substitute your own layer thicknesses and unit weights.

2 · The six-grade ladder — what Technopol manufactures

Technopol moulds six geofoam grades. This is the table to design from. Every value in it is Technopol's per-grade datasheet figure.

The design limit is the compressive resistance at 1% strain. That is the point of the whole table. Nothing else in it is a working load.

Order by the numeric grade code — 12SD, 15SD, 16DV, 20DV, 24DV, 30DV — and by the 1%-strain resistance in kPa. The letter names (SD, HD, EHD) are used loosely across the industry and are not a safe way to place an order; the numeric code and the kPa figure are unambiguous.

GRADE	NOMINAL DENSITY (KG/M³)	MINIMUM DENSITY (KG/M³)	DESIGN LIMIT — COMPRESSIVE RESISTANCE @1% STRAIN (KPA, MIN)	COMPRESSIVE STRESS @10% STRAIN (KPA, MIN) — NOT A DESIGN VALUE	CROSS-BREAKING STRENGTH (KPA, MIN)	Λ @10 °C (W/M·K, MAX)
12SD	12	10.8	15	60	80	0.045
15SD	15	13.5	17	65	100	0.040
16DV	16	14.4	21	80	140	0.038
20DV	20	18.0	45	110	150	0.035
24DV	24	21.6	70	160	205	0.034
30DV	30	27.0	100	200	250	0.033

Technopol geofoam grades. Source: Technopol datasheet, Physical Properties for Expanded Polystyrene (per-grade).

3 · Specifying it — ASTM D6817, D7180 and D7557

Three standards carry a geofoam specification, and they do three different jobs.

ASTM D6817 is the material standard: it defines the geofoam types and the physical properties each type must meet. ASTM D7180 is the geotechnical design practice: it is the route by which the fill is designed — stress at the top of the block, flotation, sliding. ASTM D7557 is the sampling standard: it is how the blocks that arrive on site are sampled and tested.

Write all three into the specification, and write the conformance route with them. On this product, conformance is demonstrated on the delivered blocks: sample to ASTM D7557 and test for density and for compressive resistance at 1%, 5% and 10% strain. Set the sampling frequency in the contract — one sample per stated volume, minimum one per delivery. On a load-bearing fill this is the step that ties the blocks that arrived to the design that was signed.

One hard limit on supply. The ASTM ladder runs above the range Technopol manufactures. The heaviest grade Technopol moulds is 30DV — 30 kg/m³ nominal, 100 kPa at 1% strain. Do not specify EPS39 or EPS46 against Technopol supply; they cannot be delivered. If the design needs more than 100 kPa of sustained

resistance at the top of the block, thicken the load-distribution slab, spread the load further, or change material.

4 · The design load limit: 1% strain, and why the 10% figure will hurt you

EPS behaves close to linear-elastic up to about 1% strain. Beyond that it yields, and it creeps, and creep under a permanent load does not stop.

The design rule. The total SUSTAINED stress at the top of the block — dead load: slab, pavement, cover soil, any permanent building load — must be less than or equal to the compressive resistance at 1% strain of the grade specified. Transient peaks (traffic, plant on the completed slab) are checked separately, against a higher-strain resistance and with the engineer's judgement, but they must never be allowed to become the sustained case.

Do not design to the 5% or 10% values. The 10% row (60–200 kPa) is two to four times the 1% row — 4.0x at 12SD, and about 2x at the DV grades most likely to sit under a slab (20DV 110/45 = 2.4; 24DV 160/70 = 2.3; 30DV 200/100 = 2.0). It looks like extra capacity and it is not: it is a failure-region strength. A fill sized on it will settle continuously for the life of the pavement above it, and the settlement will be blamed on the ground.

Allow for immediate elastic compression of the block stack on first loading when you set your levels. It is a placement allowance, not a defect. The magnitude is the engineer's to set from the block's elastic modulus at the specified grade, or from a project-specific test. On a deep stack it is worth building into the surveyed levels rather than chasing it afterwards.

5 · Flotation — usually the check that governs

Submerged, 30 kg/m³ geofoam carries a net uplift of about 9.5 kN/m³ of submerged volume — (1000 − 30) kg/m³ × 9.81 m/s². For the lightest grade, 12 kg/m³, it is about 9.7 kN/m³. Near water, uplift and not bearing is normally what limits a geofoam design.

The check. Permanent downward dead load — load-distribution slab + pavement + cover soil + the self-weight of the block above water — must be greater than or equal to FS × the buoyant uplift on the submerged volume. The factor of safety is the project engineer's to set; for a flood case with life-safety consequences it should be set higher than for a permanent groundwater case.

Run three cases, not one.

(a) The permanent case at the design groundwater level, with the full cover on.

(b) The design flood or rapid-rise case. This is usually the critical one.

(c) THE CONSTRUCTION CASE. Between placing the blocks and casting the slab there is no ballast at all, and the factor of safety against flotation is far below 1. A rainstorm that ponds water in an open excavation will lift a placed geofoam fill bodily out of it. This is the case that actually goes wrong on site.

Keep the base of the fill above the design groundwater level wherever the levels allow, and drain positively under and around the fill so that water cannot pond in it.

6 · Placement — the rules the drawing and the specification must carry

Placement is part of the design, not site preference. Put these rules on the drawing.

Trim the subgrade or the structure top to a plane surface at the design level, and lay a thin sand or fine-graded levelling course, screeded true. Geofoam is a rigid block. It will not conform to a rutted platform; a high spot punches a point load into a block that carries 15–100 kPa; a block left bridging a low spot cracks when the slab goes on.

Lay the blocks dry, with tight butt joints, and keep gaps to a minimum. Stagger the vertical joints by at least half a block from course to course, and rotate alternate courses 90°, so that no continuous vertical joint runs through the fill in either direction. A continuous joint is a plane of weakness and a path for water and fines.

Field-cut with a hot-wire cutter, hand saw or chain saw. Pack any residual gap with cut EPS, never with soil. Soil in a joint puts back the mass the design exists to remove.

Fit barbed connector plates between courses on slopes, in uplift zones and wherever a horizontal load acts. Plate type, size, capacity and spacing are the project engineer's specification and must appear on the detail.

Cast the load-distribution slab and get the cover on promptly. Never run plant on bare blocks. Nothing is compacted, wetted or vibrated.

7 · Load distribution, sliding, connectors and transitions

Load distribution. Concentrated loads — wheels, footings, plant — must be spread before they reach the block. That is the job of the reinforced-concrete load-distribution slab. A stiff slab spreads a point load far more efficiently than the foam does, and it is what keeps the peak stress on the block inside the 1%-strain limit. Design the slab for that duty. Never run construction plant on bare blocks: it crushes and gouges them, and the damage is buried and invisible afterwards.

Sliding. The Technopol brochure gives an interface friction coefficient of $\mu \approx 0.5$ on moulded and cut faces. Use it for preliminary sliding checks. Where sliding or seismic action governs the design, take the design value from an interface test or from the engineer's own justification, and check sliding on every interface — including block-to-levelling-course and block-to-slab.

Connectors. Wherever there is a slope, a horizontal load (traffic braking, seismic), an uplift condition, or a construction-stage wind exposure, tie the courses together with barbed connector plates. Plate type, size, capacity and spacing come off the project engineer's detail. If there is no detail, ask for one before the fill is built.

Seismic. Low mass means low inertial force, and that is a real advantage of geofoam. What it does not do is remove the need to check inter-layer sliding under the design horizontal acceleration.

Transitions. Where geofoam meets conventional fill there is a large stiffness step. Step the block courses down over a transition length so that the change is spread out. A vertical face against soil fill reads through the pavement as a differential-settlement crack.

8 · Water, hydrocarbons, heat, UV and fire

Water. Water absorption is < 4% (Technopol Geofoam Product Brochure). Prolonged submergence still lets EPS take up moisture, which adds mass and degrades the (already incidental) thermal value. Drain the fill; do not let it sit in water.

Hydrocarbons and solvents. Petrol, diesel, oils and aromatic solvents dissolve EPS. This is not a durability nuance; it is a rapid destruction mechanism, and the lost volume becomes a void under the pavement. Wherever a spill is credible, a continuous impermeable geomembrane is a design requirement, not an optional protection. Where the exposure cannot be reliably excluded, use a mineral lightweight fill instead.

Heat. Keep the sustained service temperature below 70 °C. EPS softens and creeps above roughly 70–80 °C, and 70 °C is the figure to design to. Hot-applied bitumen is far hotter and will melt straight through a block on contact — bitumen goes onto the base course above the slab, never onto the blocks. Sleeve or box any hot service in a mineral material.

UV. EPS degrades under sunlight. Cover placed and stockpiled block.

Fire. All EPS is combustible, and flame-retardant treatment does not change that. But geofoam is BURIED: in the permanent works it is permanently covered by the load-distribution slab, pavement or soil, so it has no exposed surface and no reaction-to-fire scenario in service. No reaction-to-fire class is claimed for it and none is needed - the question a Euroclass answers is not one this application asks. There is likewise no fire-resistance (REI) rating for a fill material, and there never will be: an REI is a property of a tested assembly.

The fire exposure that IS real is on site, before the fill is covered - a large concentrated combustible stockpile with a hot-wire cutting operation at the face of it. Store it at a separation distance, cut in a designated area under permit with extinguishers to hand, and bag and remove offcuts daily.

Order flame-retardant (FR) grade. ASTM D6817 sets a minimum oxygen index of 24.0 volume % for every type, and FR grade is what delivers it - a block that does not meet it is not the type, whatever its density.

9 · Thermal — incidental, and not a compliance route

Geofoam does insulate. It cannot be used to claim insulation.

The λ values in section 2 (0.033–0.045 W/m·K at 10 °C, by grade) are the Technopol datasheet figures. Geofoam is not sold or rated as an insulation product: there is no declared R-value or U-value per thickness for it, and nothing may be claimed toward SANS 10400-XA on it.

Where thermal performance is the objective rather than a by-product — under-slab insulation, an XA compliance case — specify a board product with a declared λ and a stated thickness. Do not build a compliance argument on geofoam.

10 · What to put in the specification, and what to check on delivery

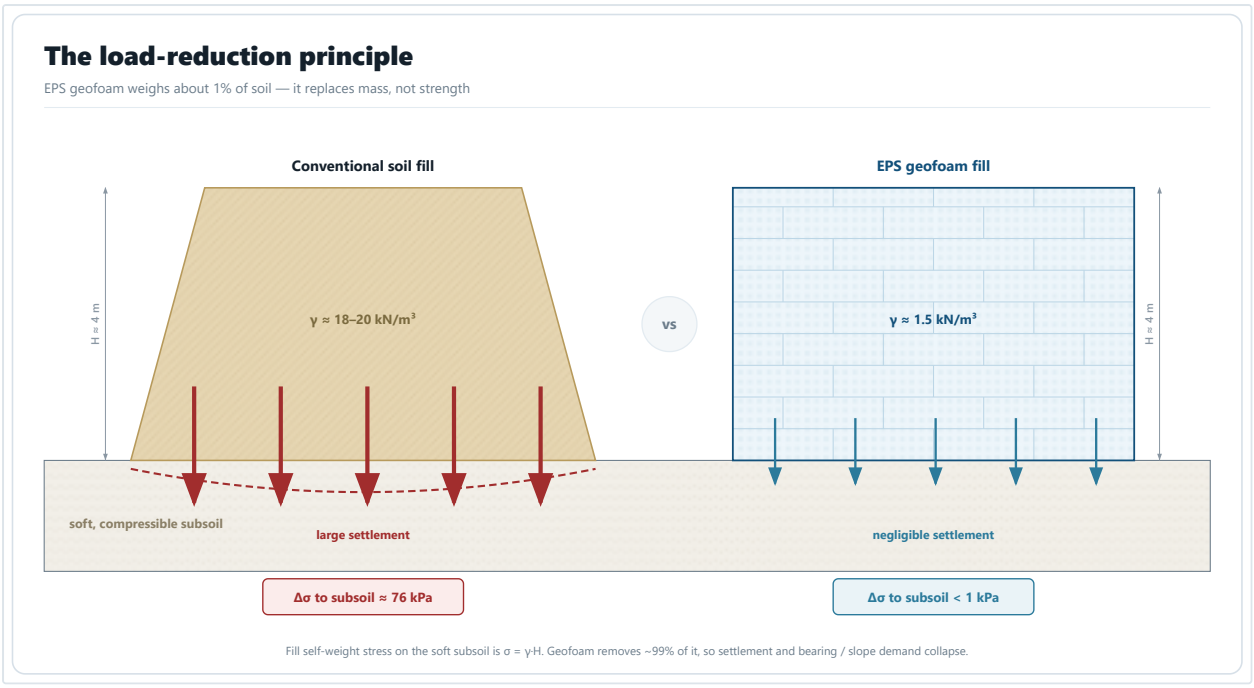
A defensible geofoam specification for this supplier reads roughly as follows. Adjust to project.

'The lightweight structural fill shall be moulded expanded-polystyrene block to Technopol grade ____ (minimum density ____ kg/m³, minimum compressive resistance at 1% strain ____ kPa), flame-retardant (FR) grade, supplied and identified as such. Conformance shall be demonstrated by sampling and testing to ASTM D7557 at a frequency of one sample per ____ m³ (minimum one per delivery), reporting density and compressive resistance at 1%, 5% and 10% strain. Blocks shall be laid dry on a prepared, screeded levelling course with tight butt joints, vertical joints staggered by at least half a block between courses, successive courses laid perpendicular, and barbed connector plates between courses on slopes and in uplift zones to the engineer's detail. A separation fabric to the engineer's detail, and — where any hydrocarbon or solvent spill is credible — a continuous impermeable geomembrane, shall be laid beneath and around the fill. A reinforced-concrete load-distribution slab shall be cast over the fill before any construction plant, base course or surfacing load is applied. The sustained design stress at the top of the block shall not exceed the specified grade's compressive resistance at 1% strain. Buoyancy shall be checked to ASTM D7180 for the permanent, flood and CONSTRUCTION-STAGE conditions. Geofoam shall be protected from open flame, hot works, hot-applied bitumen, hydrocarbons and prolonged UV, and shall be permanently covered by slab, pavement or soil in the completed works.'

On delivery, check three things and record them. The grade marked on the block face matches the order. The block dimensions match — set a dimensional tolerance in the contract, because there is no published tolerance to fall back on. And a sample from the delivery goes to a laboratory for density and compressive resistance. On a load-bearing fill, that last one is not optional.

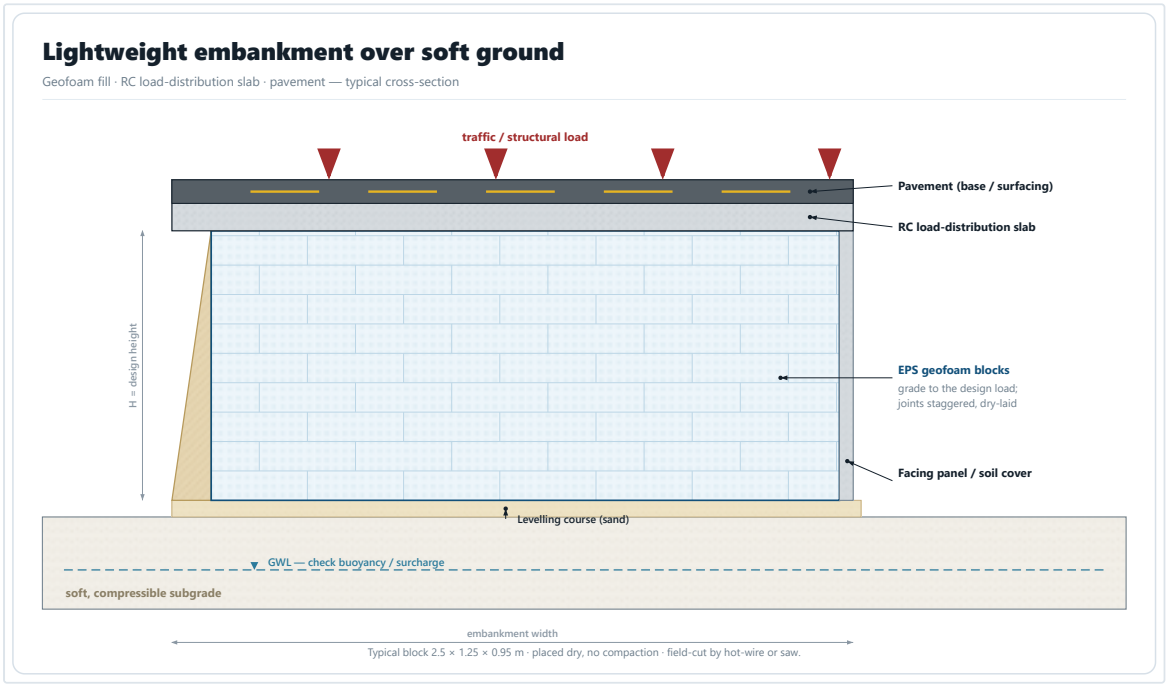
WHERE NOT TO USE THIS PRODUCT

- Under a fuel forecourt, tank farm, refinery, workshop apron, oil-filled cable trench or hydrocarbon-contaminated ground with no continuous impermeable geomembrane designed in. Petrol, diesel and aromatic solvents dissolve EPS on contact; the dissolved volume becomes a void and the pavement above drops without warning. Alternative: full geomembrane encapsulation signed off by the geotechnical engineer, or a mineral lightweight fill (foamed concrete, expanded clay aggregate) where the exposure cannot be reliably excluded.
- Below the design groundwater or flood level, or anywhere the fill can be submerged, without ballast designed for uplift. At 12–30 kg/m³ the blocks float: submerged, the net uplift is about 9.5–9.7 kN/m³ of submerged volume, so buoyancy governs, not strength. Alternative: raise the fill above the water table, design permanent overburden ballast, or use foamed concrete below water.
- Where the sustained design stress exceeds the specified grade's compressive resistance at 1% strain — including any fill sized off the 10%-strain figures. Beyond about 1% strain EPS creeps under permanent load and does not stop. Alternative: move up the grade ladder, thicken the load-distribution slab to spread the stress, or use structural lightweight concrete.
- Where the sustained stress at the top of the block exceeds 100 kPa. That is the limit of 30DV, the strongest grade Technopol makes. ASTM lists EPS39 and EPS46 above it; Technopol does not manufacture those grades and cannot supply them. Alternative: spread the load further through a thicker or stiffer load-distribution slab, or change material.
- As permanently exposed fill, or under a surface that will be left open — no slab, pavement or soil cover. EPS is combustible, UV-degradable and mechanically soft, and geofoam is not rated as a fire-resisting element. Alternative: design the permanent cover as part of the works, or use a non-combustible mineral fill.
- In contact with heat — hot-applied bitumen poured onto the blocks, steam or hot-process pipework, boiler and flue penetrations, hot works during construction. EPS softens and creeps above roughly 70–80 °C. Alternative: bitumen goes on the base course above the slab; sleeve or box hot services in stone wool or concrete.
- Under construction plant running on bare blocks. Traffic and plant loads must be spread by the load-distribution slab and base course before they reach the foam. Plant on exposed EPS crushes and gouges it, and the damage is then buried.
- As the answer to a thermal requirement — claiming geofoam toward a SANS 10400-XA roof, ceiling or wall R-value. Geofoam is not rated as an insulation product: no R-value or U-value per thickness is declared for it. Alternative: a board product with a declared λ and a stated thickness.
- Where the specification demands an Agrément SA certificate for the fill. There is no Agrément certificate for geofoam; certificate 2020/609 covers the LiteCore Building System as a non-load-bearing wall and is not cover for this product. Alternative: specify to ASTM D6817 / D7180 / D7557 with a project-specific geotechnical design and batch verification of the delivered grade to ASTM D7557.
- Where the client requires third-party certified ASTM D6817 conformance on delivery and will not accept project batch testing. On this product, conformance is demonstrated by sampling and testing the delivered blocks to ASTM D7557.



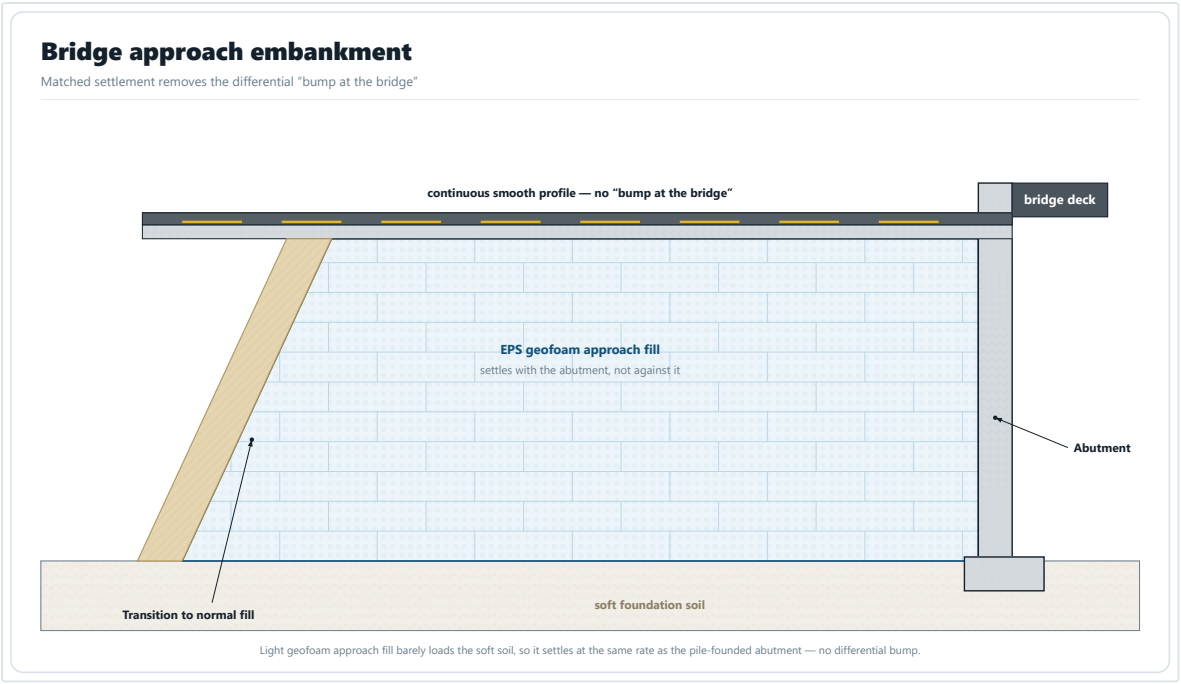
The load-reduction principle

EPS geofoam weighs about 1% of soil - it replaces mass, not strength.



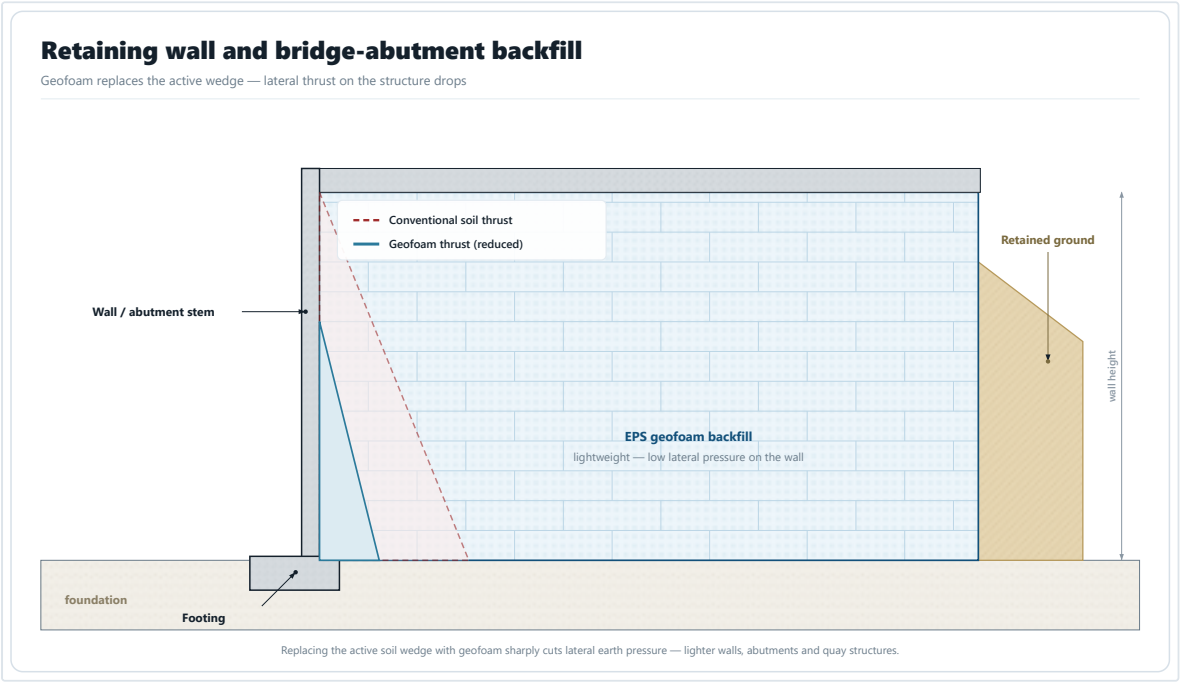
Lightweight embankment over soft ground

Geofoam fill, an RC load-distribution slab and the pavement - the typical cross-section.



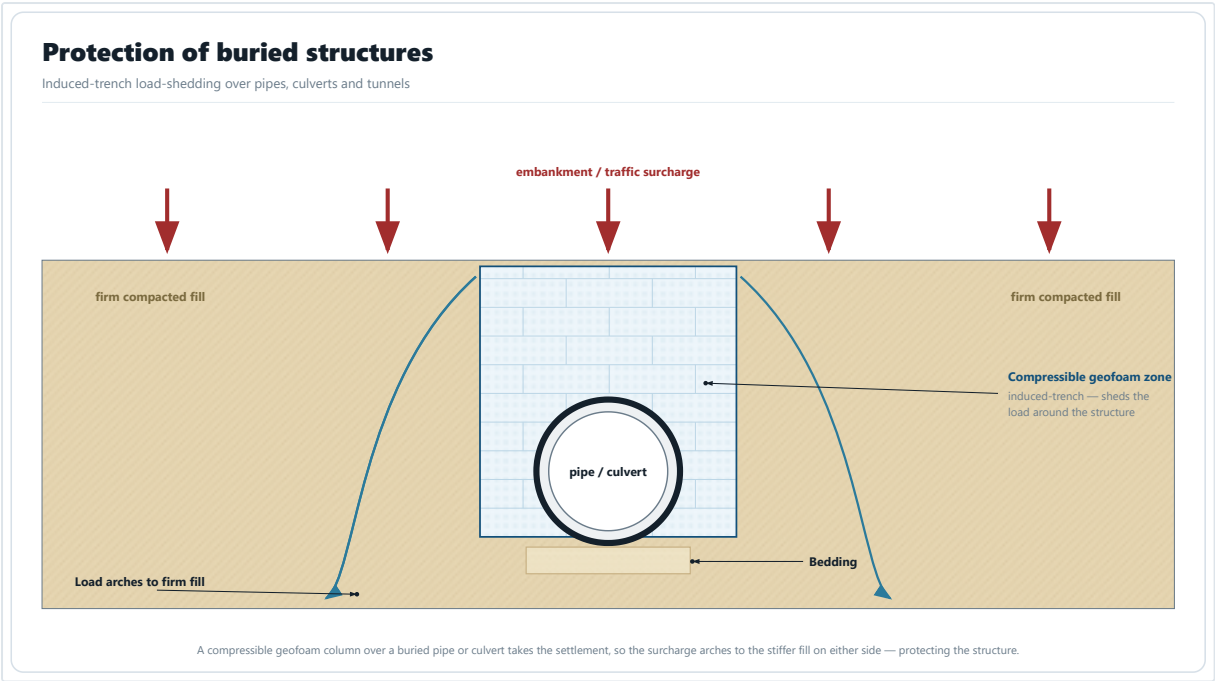
Bridge approach embankment

Matched settlement removes the differential 'bump at the bridge'.



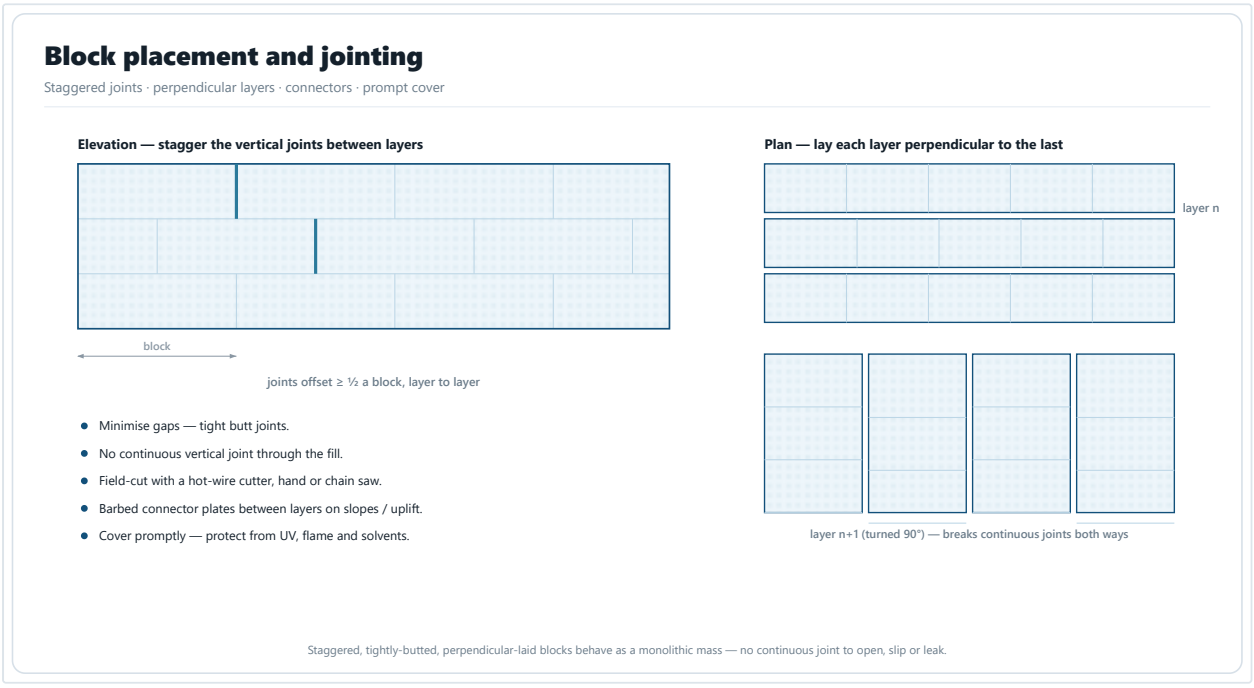
Retaining wall and bridge-abutment backfill

Geofoam replaces the active wedge, so the lateral thrust on the structure drops.



Protection of buried structures

Induced-trench load-shedding over pipes, culverts and tunnels.



Block placement and jointing

Staggered joints, perpendicular layers, connectors and prompt cover.

How to read this document. Where a figure is load-bearing in your design, confirm it for the material actually supplied — on any load-bearing application, by testing the product delivered to your site. That is the right way to buy from anybody, including us.

This is product information, not a design. It does not replace a competent person. Technopol SA (Pty) Ltd · info@technopol.co.za · +27 11 363 2780 · The test reports and certificates cited here are held by Technopol and their current status is available on request.