Unibloc®

GeoFoam by Unipod®

Technical Product Brochure

unipod® Engineered performance

In order to meet the ever-changing needs of its valued clients and the market, Unipod® continually tests, validates and improves its Unibloc GeoFoam® product range. As a function of this, the information contained in the Unibloc GeoFoam® technical product brochure is regularly updated and may have changed. To ensure review of the most up to date version of the brochure, please visit the Unipod® website at www.unipod.com.au to download the latest version of the Unipod® Unibloc GeoFoam® technical brochure.

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GeoFoam Introduction

Unibloc GeoFoam® by Unipod® is a lightweight high-performance fill material that exhibits exceptional load bearing characteristics, specifically designed for application in technical civil engineering applications. GeoFoam has been used as a material in geotechnical applications in Australia and the USA since the early 1990's and in various parts of Europe (Norway) since the 1970's.

Unibloc GeoFoam's® exemplary strength to weight ratio makes it the ideal choice for absorbing heavy structural and mechanical loads in various civil infrastructure construction applications such as roads, steep embankments, bridge abutments and other applications.

For the same occupied volume, Unibloc GeoFoam's® block typically weighs approximately 1-2% of the weight of most soil and rock types that are typically used as fill materials and approximately 10% of the weight of some other light weight fill materials.

Unibloc GeoFoam® is also a highly versatile material that can be easily used as a quick and easy cost-saving method for concrete form work or weight reduction on building foundations. It has numerous potential uses.

Unibloc GeoFoam® is manufactured from thousands of individual EPS beads that have been expanded and fused together under the controlled influence of heat and pressure to form solid rectangular blocks. This precise manufacturing process results in the creation of a durable, chemically inert, high performance, civil construction material that is completely safe to handle and exhibits a unique set of structural properties such as, exceptional strength to weight ratio, high resistance to water absorption and resistance to bacterial and fungal attack.

The unique, highly stable, cellular structure of Unibloc GeoFoam®, results in the superior absorption and dissipation of high compressive or crush loads, as the physical properties and performance of the material are isotropic, meaning that the physical properties are the same in all directions.

These are just some of the superior characteristics of Unibloc GeoFoam® that ensure the durability and long-term continuous performance of the product when installed in various complex civil construction applications that demand long operational life spans.

Unibloc GeoFoams® unique properties have seen its popularity grow, as the ever-increasing numbers of civil engineers and construction specifiers recognise its enhanced performance and significant cost saving benefits when compared to the use of traditional fill materials. Simply put, Unibloc GeoFoam® is your complete, high performance fill solution.

How does Unibloc GeoFoam® work?

The advanced technology used in the manufacture of Unibloc GeoFoam® results in a unique material that is comprised of 96-98% stabilised air (by volume) captured within a 2-4% cellular Polystyrene matrix.

It is this highly stabilised and rigid cellular structure that provides Unibloc GeoFoam® with its unique set of attributes, those being very high compressive strength, controlled dimensional stability, light-weight nature and overall structural rigidity. The combination of these unique characteristics, enables an even distribution of compressive load forces to be achieved, resulting in minimal to no deformation or creep occurring to the product over time.

In most cases, the versatile Unibloc GeoFoam® outperforms other traditional fill materials structural stability performance, thus making it suitable to be used in a wide variety of civil construction applications.

Is Unibloc GeoFoam® a proven product?

For nearly 50 years, GeoFoam has proven itself to be a widely used, reliable and dependable material that has been used in civil, as well as many other applications all over the world. The specific use of GeoFoam in civil engineering applications commenced in Norway back in 1971. Since that time, GeoFoam has been used in geotechnical applications throughout the world.

GeoFoam was first used in geotechnical applications in Australia in 1992, commencing with the construction of Lynch's Bridge in Maribyrnong, Victoria. Since that time, it has been extensively researched and exhaustively tested and as a result, meets many of the civil construction industries most rigorous standards both here in Australia, but also in Europe and the United States.

Listed below are some recent large scale Australian civil infrastructure construction projects where GeoFoam has been used:

- **Victorian Water Desalination Plant Wonthaggi project**
  (Approx. 4000 m^3 of GeoFoam).
- **Victorian Sky Road Peninsula Freeway Link project**
  (Approx. 1000 m^3 of GeoFoam).
- **Perth Crown Casino Project**
  (Approx. 6000 m^3 of GeoFoam).
- **Perth Royal Children's Hospital upgrade project**
  (Approx. 1000 m^3 of GeoFoam).
- **Adelaide Convention Centre Montiefiore Bridge Project**
  (Approx. 260 m^3 of GeoFoam).

Unibloc GeoFoam® moulded blocks are manufactured at Unipods® state of the art manufacturing plant in Truganina Victoria, enabling support of a wide range of load bearing capacities that would normally be required in most civil infrastructure applications, as well offering a unique set of characteristics and physical performance properties that the Australian civil infrastructure industry demands.

Once the load bearing constraints of the project are understood, (maximum combined live and dead loads that a given project is likely to encounter during its serviceable life), a specific Unibloc GeoFoam® block grade will be selected that best matches the project load bearing requirements.

Unibloc GeoFoam® also offers unique opportunities for application in a wide range of civil infrastructure construction requirements such as for road and airfield pavements, slope stabilisation, in the use of bridge abutments, retaining walls, railway track systems, landscaping and tiered seating construction requirements for theatres and sports arenas.

The following information covers the application of Unibloc GeoFoam® in the most common civil applications as mentioned above, as well as some more specialised applications.

Unibloc GeoFoam® can be supplied in a range of standard block dimensions:

- **1.2m width.**
- **2.5m, 3.0m, 5.0m, or 6.0m lengths.**
- **75mm up to 1.20m thickness.**

Where unique project requirements exist, Unibloc GeoFoam® blocks can be supplied in specific custom lengths, widths and thickness to suit. As part of Unipods® ongoing commitment to quality, innovative product development and superior customer service, we have achieved and are fully ISO 9001 Certified. Together with our industry first, complete product traceability system and our customer portal- Foam hub, Unipod® continues to lead the Australian EPS industry in providing innovation, quality, consistency, visibility and continuous improvement in all EPS products that we manufacture, including the Unibloc GeoFoam® product.

With amazing strength and flexibility characteristics, the use of Unibloc GeoFoam® offers innovative solutions to a range of common civil engineering challenges that structural engineers and designers commonly face every day, these include but are not limited to, high load bearing capacity requirements, protection from earthquake shock and noise and vibration dampening.

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Civil Engineering Applications

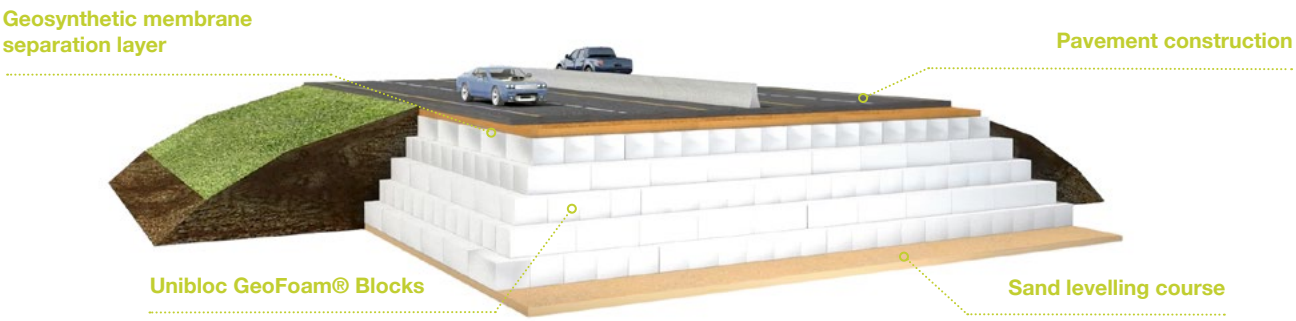
Road construction

As Australia's population continues to rapidly expand, the need for the construction of new roads and the supporting civil infrastructure will also continue to grow. The ever-increasing pressure for lead time reduction in these construction projects, especially in heavily populated urban areas, necessitates the need for highly innovative, non-traditional civil infrastructure building processes and materials such as Unibloc GeoFoam® to be adopted and specified.

The requirement for traditional road construction to be built over soft or loose soils or other poor performing fill materials presents unique engineering challenges. Low quality soils / fill materials may be incapable of supporting the projected traffic loads in the area where the new road is planned to be constructed. In situations such as these, designers and engineers must apply the use of innovative materials and construction techniques in order to address the problem of building on soft soils or where sensitive existing utilities or wetlands may be present, whilst at the same time, ensuring that they are able to meet ever more demanding project timelines.

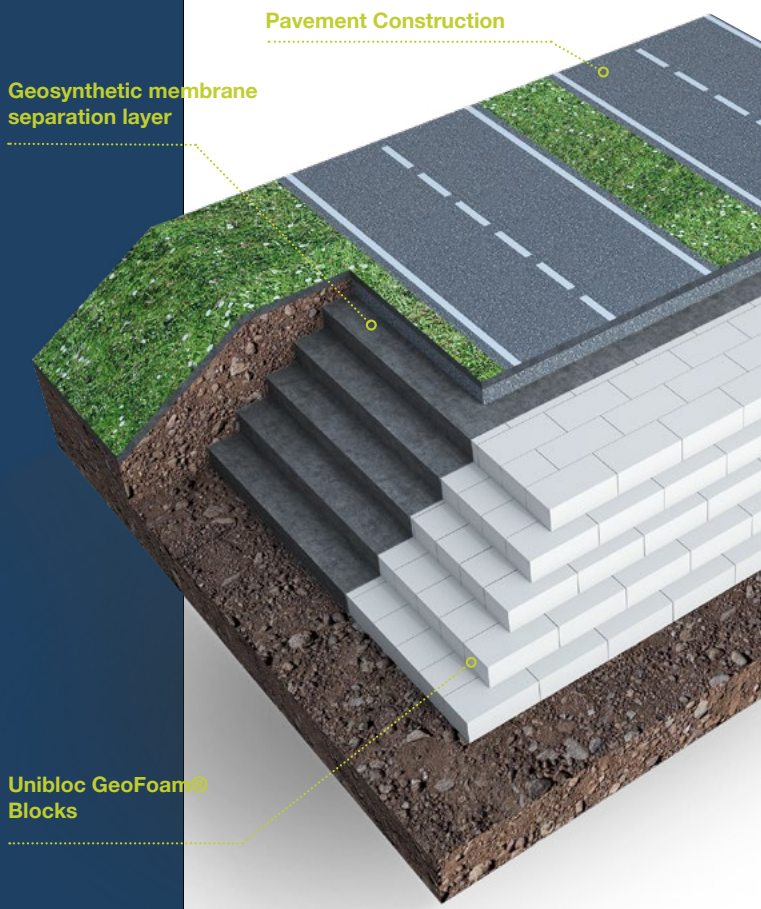
Unibloc GeoFoam® is an ideal material for application in these situations as it can be used to replace the existing poor-quality compressible soils or can be used in place of other alternate heavier fill materials. In doing so, the Unibloc GeoFoam® helps to prevent excessive loading being applied on the underlying ground and adjacent structures. The high compressive stress resistance of Unibloc GeoFoam® makes it an ideal material to safely support the high traffic loadings associated with new road constructions.

Furthermore, road construction undertaken using Unibloc GeoFoam® can assist in reducing overall construction times as Unibloc GeoFoam® is easy to handle, transport and install, without the need for specialised heavy equipment to be used. Most importantly, the project timing can be significantly reduced because the Unibloc GeoFoam® material once installed, can be built upon immediately, without the need to wait for compaction and settling to occur, as per what would normally be the case when most traditional fill materials are used. Traditional fill materials can take weeks or months to settle before they can be safely built upon.



A description of a typical road construction, using Unibloc GeoFoam® from bottom to top, is as follows:

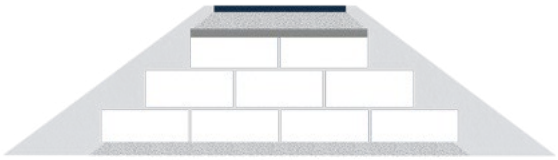
- A layer of sand is compacted at the base of the roadway excavation, such that a level and free draining construction surface can be provided for the Unibloc GeoFoam® to be laid upon.
- Once the construction surface has been laid, the Unibloc GeoFoam® blocks should be laid onto it in a layer upon layer configuration until the desired construction height is reached, whilst ensuring that the vertical joints in each course are staggered, so as not to create continuous vertical seams.
- The Unibloc GeoFoam® blocks should be laid following the same construction principle as the traditional layup patterns of bricks and mortar as applied in residential and commercial building construction. The application of the traditional brick layup pattern when laying the Unibloc GeoFoam® provides the greatest block intra layer stability and strength characteristics.
- If and where required, a separation layer may be installed between the top of the Unibloc GeoFoam® and the overlying pavement fill material.
- The application of the separation layer enables two important functions to be realised: Firstly, it enhances the overall performance and life of the installed pavement system by providing reinforcement, separation and / or filtration and also enhances the durability of the Unibloc GeoFoam® both during and after construction.
- There are a number of suitable materials that can be selected for application as the separation layer between the Unibloc GeoFoam® and the pavement system including but not limited to the following: geotextile, geogrid, hydrocarbon resistant geomembrane, and geocell with soil fill, soil, cement, or a reinforced concrete slab.



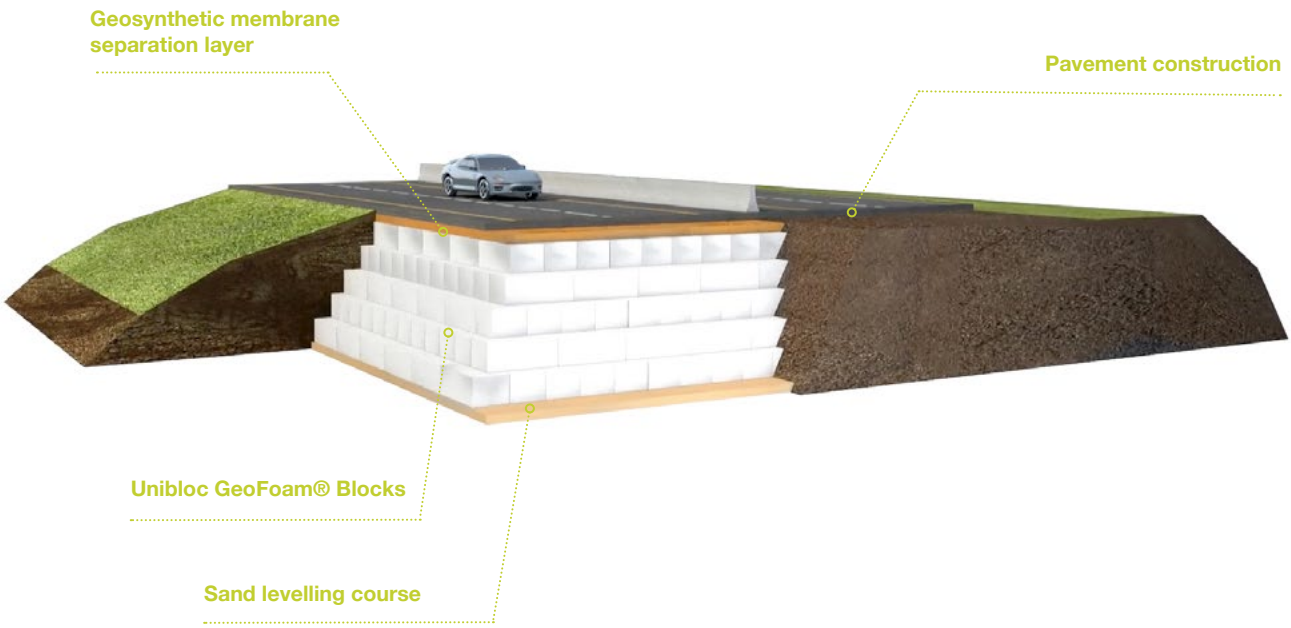
Road widening

Existing road constructions often require widening as population growth over time results in increased traffic density and congestion on the existing road infrastructure. Over time, this increased traffic congestion can become too great for the existing road infrastructure to handle. This phenomenon may eventually result in the requirement for the existing roadway to be widened, which often necessitates the need for soil or other fill types to build up the existing shoulders of the road. This process can be expensive and very time-consuming if the soil or ground cover adjacent to the existing roadway is deemed unsuitable to be able to support the newly projected traffic loads.

In traditional road construction, soil embankments are built up in thin sections or lifts, each of which must be compacted before the next lift is able to be installed. This process is very laborious and time intensive. Applying Unibloc GeoFoam® in place of the soil embankment lifts, eliminates the need for compaction and settling, saving considerable time. The use of Unibloc GeoFoam® also negates the need for off-site fill testing which in turn, greatly reduces the construction time and minimizes impact to the existing roadway and adjacent structures and / or buried utilities. The high compressive resistance of Unibloc GeoFoam® makes it able to withstand the induced traffic forces from the increased traffic flow without causing unacceptable loading of the underlying soils or adjacent fill.



Schematic drawing of a road widening construction using Unibloc GeoFoam®



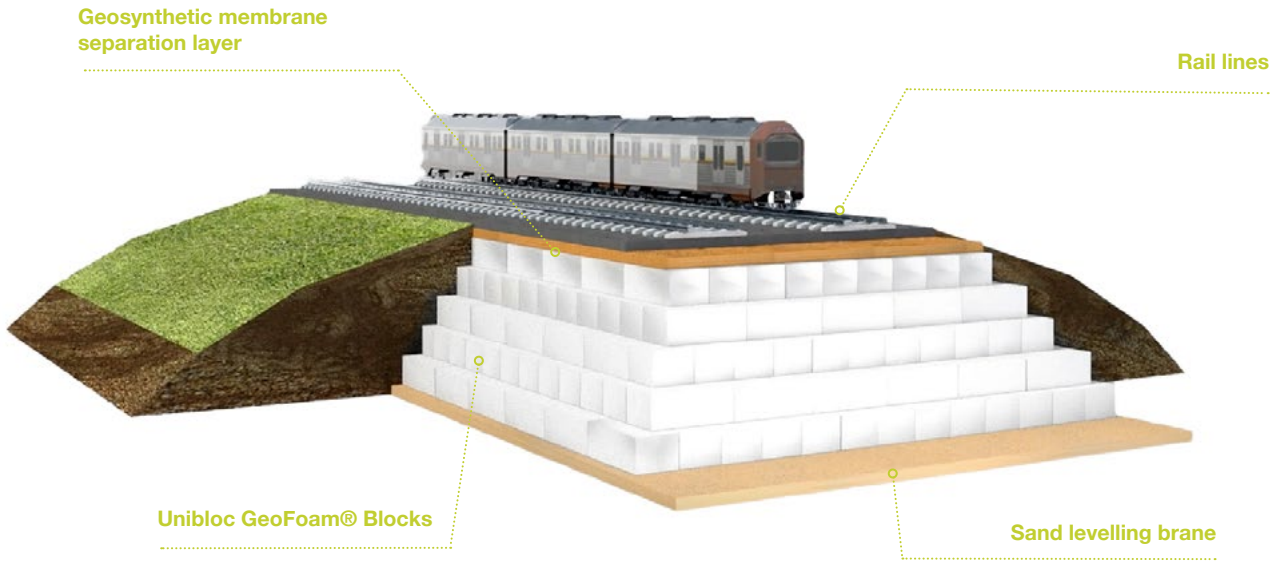
Airport runways & railway lines

Unibloc GeoFoam® is also a suitable product for use as the foundation material for the construction of airport runways. Unibloc GeoFoam® can be used to replace potentially unsuitable ground cover without overloading the underlying subgrade materials.

The high compressive strength of Unibloc GeoFoam® can be used in this application, to control settlement on potentially highly compressible and saturated soils and to prevent differential settlements at the intersection of new and existing pavements.

The same principle is also applied to foundation construction of railroad lines, greatly reducing the likelihood of settlement occurring and supporting the inherent loads of the rail lines and trains that travel on them.

Schematic drawing of Railway Embarkment construction using Unibloc GeoFoam®



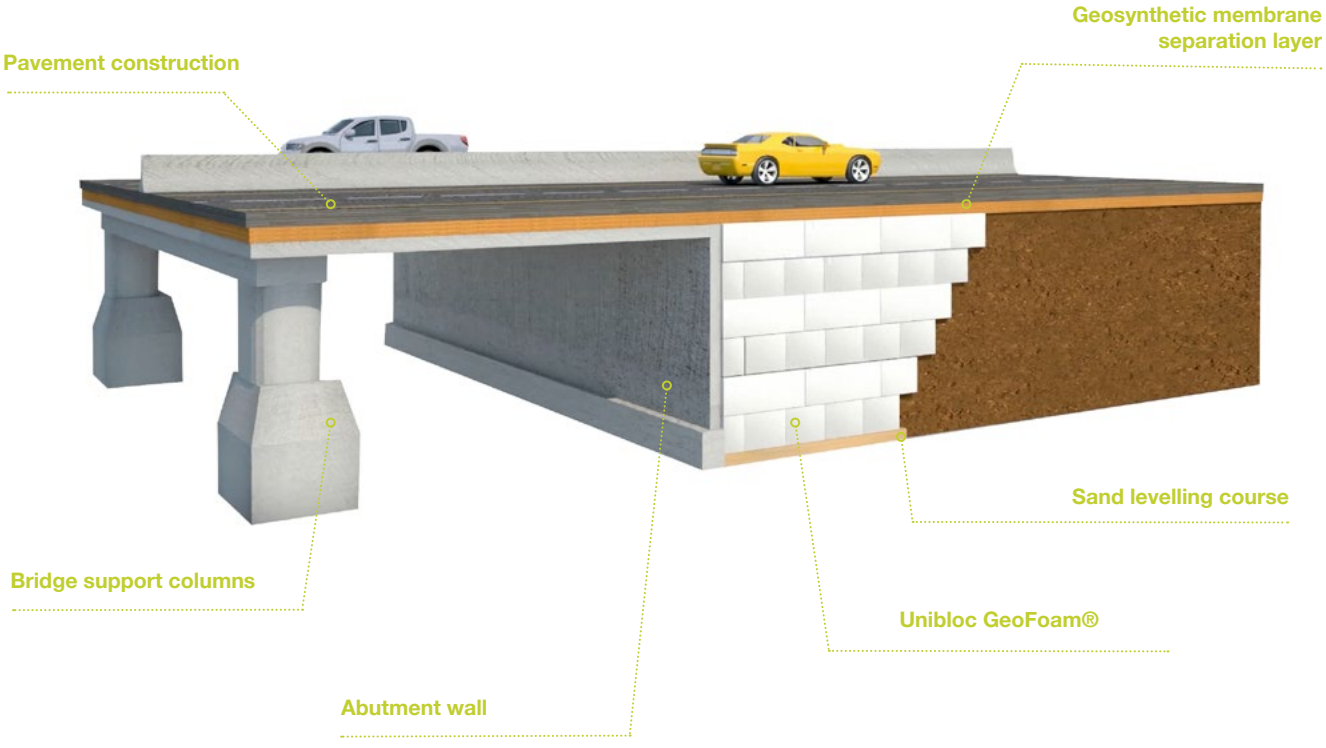
Bridge abutments

The use of Unibloc GeoFoam® can provide numerous advantages for the construction of approach fills for bridge abutments. The products high load bearing capacity allows the Unibloc® GeoFoam to safely support the combined live and dead loadings associated with these types of constructions without over-stressing the underlying ground cover.

The use of Unibloc GeoFoam® in bridge abutment construction usually results in less differential movement occurring at the bridge/approach fill interface.
In addition, when compared to traditional embankment fills, Unibloc GeoFoam® due to its light-weight nature, imparts significantly reduced lateral forces on abutment walls, foundations and other retaining structures, because the transmitted lateral force is proportional to the weight of the backfill applied.

If this weight is able to be substantially reduced, as would be the case where Unibloc GeoFoam® backfill is applied, this can lead to simpler, less expensive bridge abutment designs being able to be developed, as the bridge walls are no longer required to be able to resist large horizontal static and dynamic forces, that would normally be present and occur with the use of traditional soils, or other traditional heavy fill materials.

Schematic drawing of a Bridge Abutment construction using Unibloc GeoFoam®



Culverts, pipelines & buried structures

In situations where a new road, bridge or tunnel construction etc. is planned to be built, such that it will end up passing over areas where existing buried infrastructure such as concrete piping may be present, the engineering design plans will often call up for the placement of new fill to be installed over the existing underground structures to facilitate the new construction.

This common situation creates design challenges, as the existing piping and infrastructure that is intended to be buried, may not have been designed to accommodate the increased loads when it was originally specified and installed.

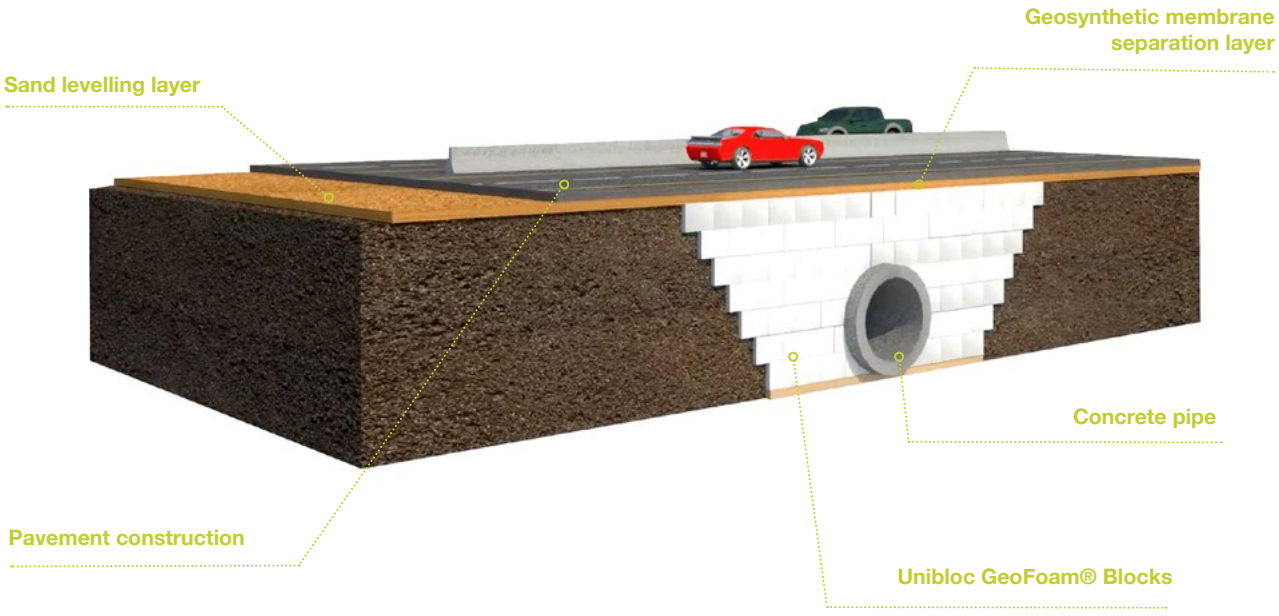
Rather than having to strengthen or completely remove or relocate the existing underground structures, the load bearing requirements can be reduced to an acceptable and safe level by the application of the Unibloc GeoFoam® as the fill material, instead of heavier traditional fills.

The use of Unibloc GeoFoam® in applications such as this, again, can result in significant project cost and time savings, as the existing buried infrastructure no longer needs to be either completely removed and replaced, or removed and modified to be able to cope with the increased loads from the addition of the new fill.

As with road construction, the use of Unibloc GeoFoam® provides the opportunity for significant project savings to be realised, as it is easy to handle, transport and install without the need for special equipment.

Most importantly the project lead time can be significantly reduced by virtue of the fact that the Unibloc GeoFoam® material once laid, can be built upon straight away, without the need to wait for compaction and settling that would normally occur when using most traditional fill materials.

Schematic drawing of a culvert fill over using Unibloc GeoFoam®

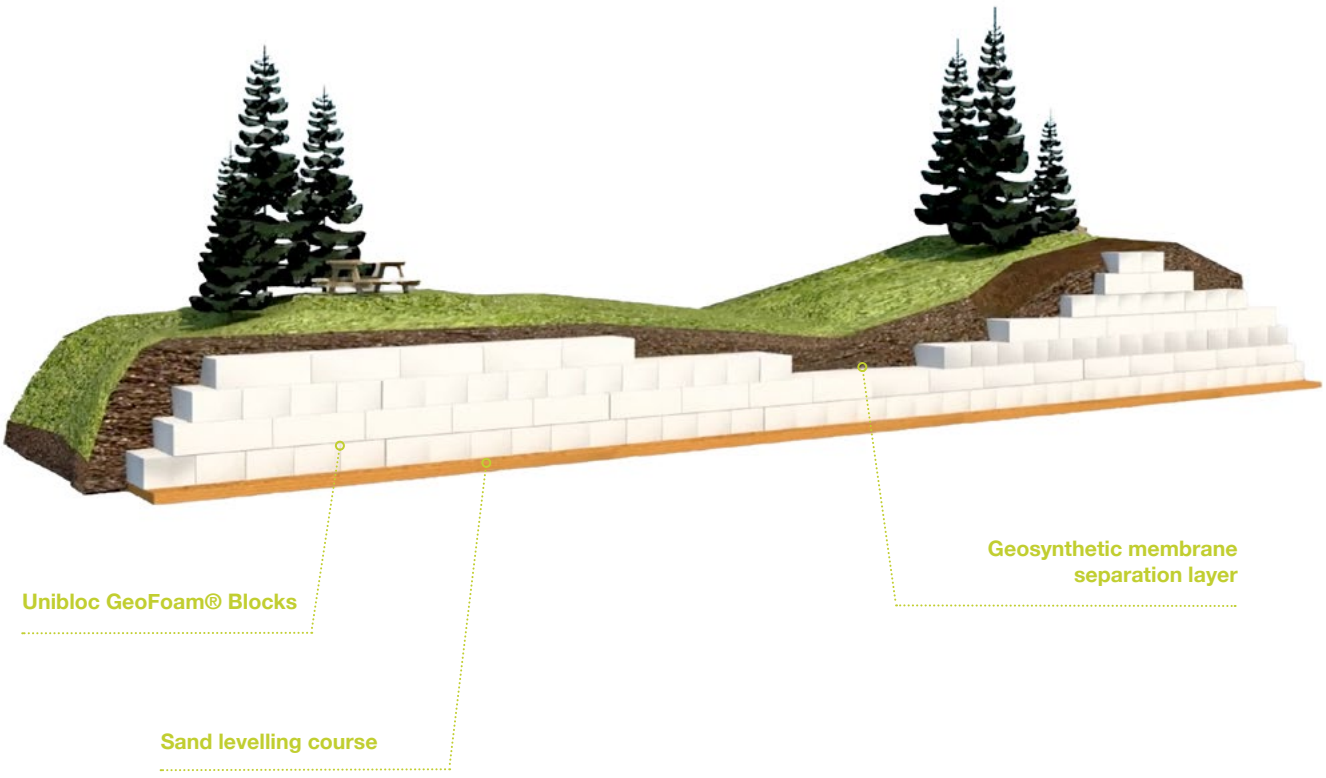


Landscape design

The Unibloc GeoFoam® product can be used in the creation of complex landscape designs. This can be done by the building up of block layers and the ability of each of the Unibloc GeoFoam® to be cut into intricate shapes and profiles. Where required, the cutting of the blocks to shape, can be done on site with the use of portable hot wire cutters or hand saws. Depending on the project complexity and size however, pre-determined block lay-up patterns can be developed, such that each of the Unibloc GeoFoam® blocks can be delivered to site, already pre-cut to the desired profile.

The application of Unibloc GeoFoam® allows complex landscape designs to be created without adding significant loads to any underlying structures and services that may be present. Some examples of the use of Unibloc GeoFoam® in landscape design includes the creation of specific design elements for golf courses and public parks and creating unique landscapes for performance stages to be built upon for live events such as concerts.

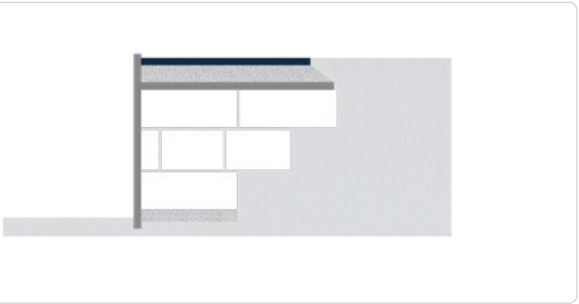
Schematic drawing of a landscape design using Unibloc GeoFoam®



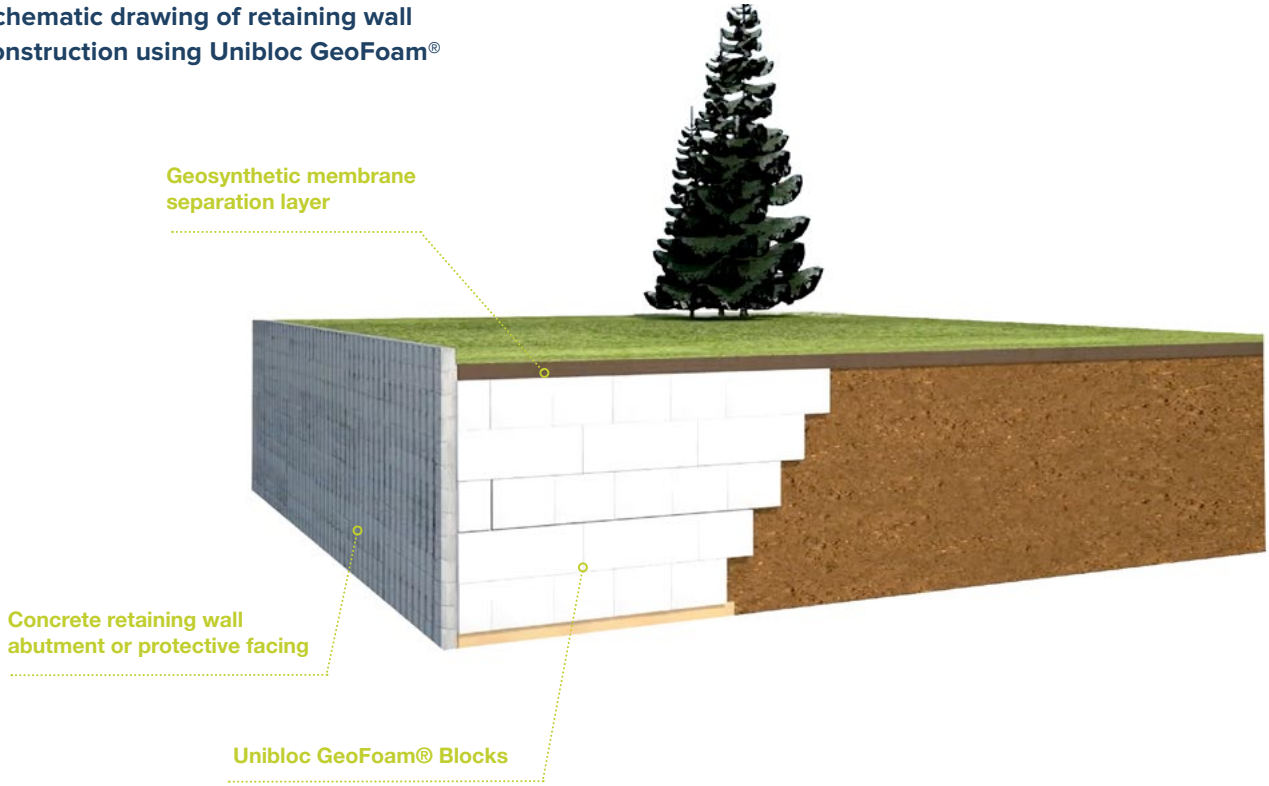
Retaining & buried wall backfill

Unibloc GeoFoam® can be used as light-weight backfill behind retaining and buried structures to greatly reduce the lateral pressures that would normally be acting on these structures when traditional fill materials are used. As the horizontal pressures acting on a retaining wall structure are directly proportional to the weight of the backfill material used, the use of Unibloc GeoFoam® as the chosen backfill material, results in greatly reduced horizontal loads being applied. This in turn enables the potential for implementation of a thinner or less complex retaining wall design to be able to be applied, resulting in significant project cost and time savings being able to be realised.

Likewise, the use of Unibloc GeoFoam® as backfill material, when installed behind retaining and buried structures, greatly assists in limiting the horizontal forces that can potentially develop during earthquake events, assisting in preservation of the structural integrity of the construction when subjected to these significant forces. Retaining wall applications using Unibloc GeoFoam® that are designed to be constructed in low lying areas, where shallow groundwater and loose soils may exist, require special consideration in the form of adequate drainage mechanisms to be considered as part of the overall design. Due to the light-weight nature of Unibloc GeoFoam®, the potential for the development of hydrostatic pressure, must be taken into consideration in the retaining wall design, as this can cause uplift displacement of the installed Unibloc GeoFoam® blocks.

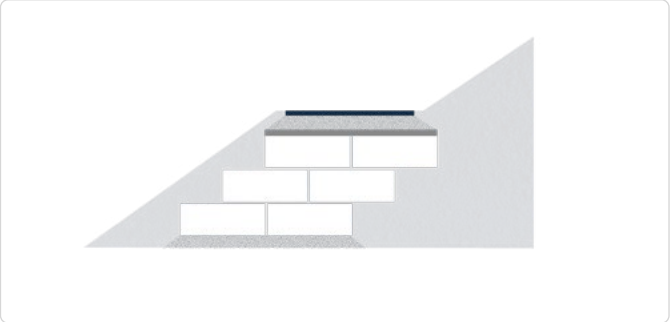


Schematic drawing of retaining wall construction using Unibloc GeoFoam®



Slope stabilisation

Unibloc GeoFoam® can be used to remediate unstable slopes whether they be man-made or if they are naturally occurring. Remediation of the slope can be achieved by removing a portion of the existing loose unstable soil and replacing it directly with Unibloc GeoFoam® fill. The inherent structural stability of the Unibloc GeoFoam® results in improved overall stability of the slope and significantly reduces the potential for landslides occurring in the area of the slope, due to excessive rain, earthquakes or other naturally occurring events taking place.



Schematic drawing of Slope stabalisation construction using Unibloc GeoFoam®

Levee construction design

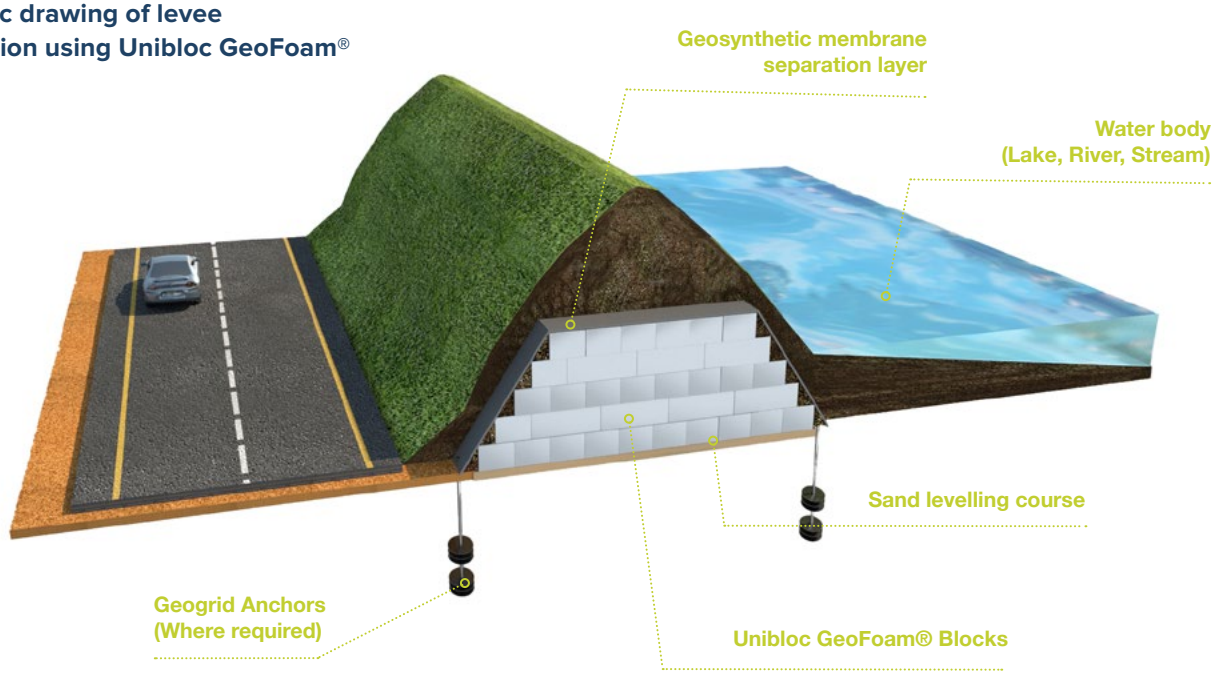
The construction of levees for the provision of flood mitigation protection around riverbanks is another application where the use of Unibloc GeoFoam® excels. Levees are frequently built on and around the highly compressible alluvial soils that are naturally occurring along riverbanks. These compressible and water saturated soils undergo settling over time due to ongoing compression. The settlement and / or erosion of these alluvial soils are natural processes that are continuously occurring on and around riverbanks necessitating the construction of levees.

Traditionally, river levees are most commonly constructed using the conventional soil types that are present in the surrounding land areas, near and around the river. The extra weight applied from the levee construction and any re-raising using these traditional soil types can cause additional settlement to occur over time, due to the added weight of the levee construction and the continuous cycle of soil settlement.

Replacing the traditional soil types with the Unibloc GeoFoam® fill in river levee construction, can greatly reduce or even eliminate this cycle of levee build up and settlement ocurring over time, resulting in the levee/s only needing to be newly constructed or reconstructed once, with minimal maintenance needed thereafter. Unibloc GeoFoam® having approximately 1-2% of the weight of traditional soil fills, greatly reduces and/or eliminates additional stress when used in lieu of traditional soil fill and in doing so, the cycle of ongoing soil settlement and potential levee collapse, is able to be eliminated.

The process of levee rebuilding using Unibloc GeoFoam® is done so by removal of a portion of the existing levee. The removed soil can be stockpiled for reuse as cover for the Unibloc GeoFoam® once all blocks have been laid in place. Once the existing levee is removed, Unibloc GeoFoam® blocks are placed on a sand levelling bed and a geomembrane cover is used to completely encapsulate the blocks. A geotextile is then placed over the geomembrane and the previously excavated soil is then able to be re-laid and compacted over the Unibloc GeoFoam® to bring the levee to its desired elevation. These same construction principles can also be applied to the construction of a new levee.

Schematic drawing of levee construction using Unibloc GeoFoam®



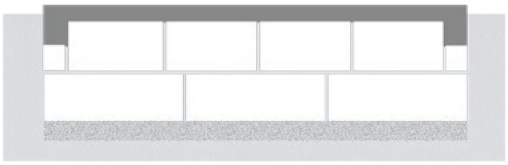
Compensating foundations & foundations for lightweight structures

Unibloc GeoFoam® can be used in areas where the underlying soil condition or soil type (such as clay) is deemed unsuitable for the support of civil and or residential building constructions that would transmit high load bearing stresses, which the existing ground cover may not be able to withstand.

Unibloc GeoFoam® can be installed in situations like these, to act as a compensating foundation, reducing the overall load on the underlying compressible soil types and minimizing the potential for building settlement occurring along with reducing the potential for structural load bearing capacity issues.

The existing soil is able to be excavated to reduce the net applied load to the soil by the new structure. If the amount of soil excavated, equals the full weight or stress applied by the new structure, the foundation is called a “floating” or “fully compensating” foundation.

An example of this would be land that is intended to be used for civil or residential construction that happens to be near a large water body such as a lake or river.



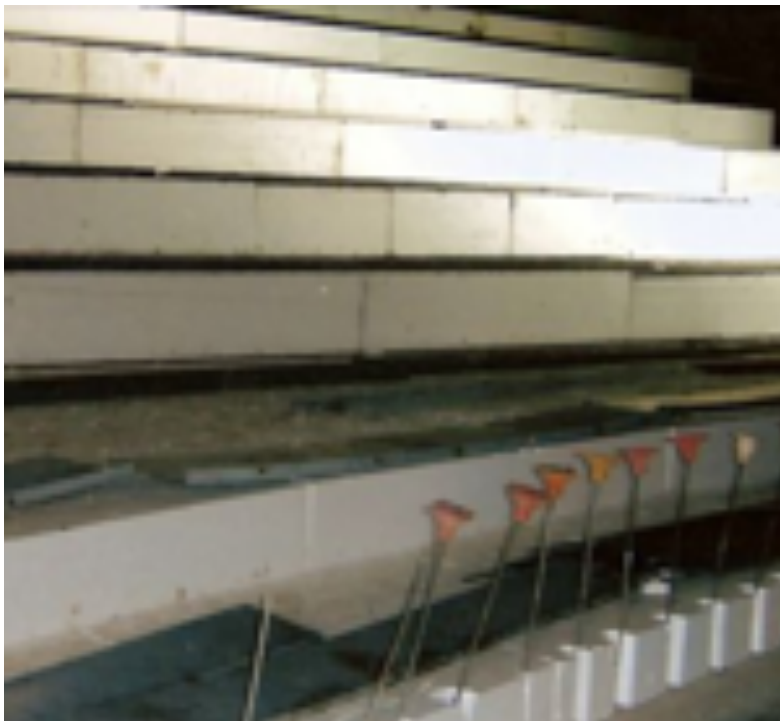
Schematic drawing of a compensating foundation using Unibloc GeoFoam®

Tiered seating applications for stadiums and theatres

Unibloc GeoFoam® can also be used in some specialist, non-traditional civil applications, such as the construction of tiered seating platforms as used in various public venues such as movie theatres, sports complexes, auditoriums, churches etc.

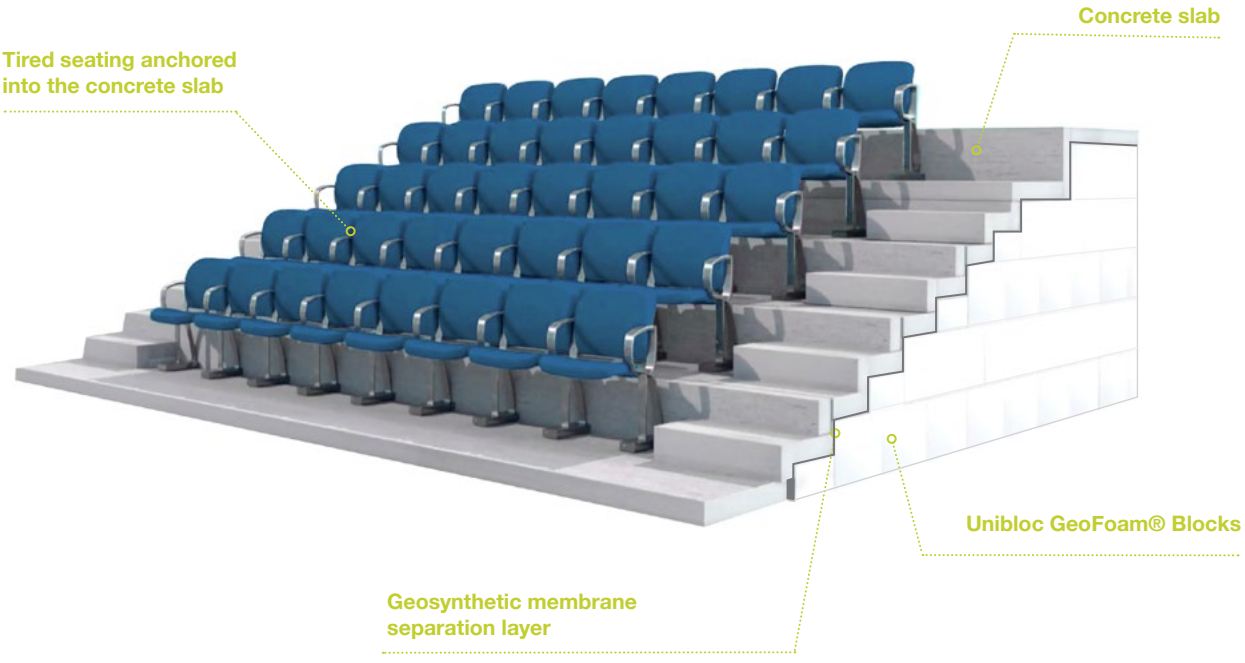
The high compressive resistance and light-weight characteristics of Unibloc GeoFoam® make it well suited to application in both new construction projects and for renovation of existing structures where applicable.

For these specialised projects, Unibloc GeoFoam® blocks can be fabricated and then stacked to specific heights to create the desired height and profile for each of the tiers. Fascia riser screeds can then be applied to the front of the Unibloc GeoFoam® blocks to provide support and formwork for the placement of finished concrete treads. Seats, bleachers, other attachments and finishes are then able to be directly attached to complete the tiered seat construction.



Tiered seating construction using GeoFoam

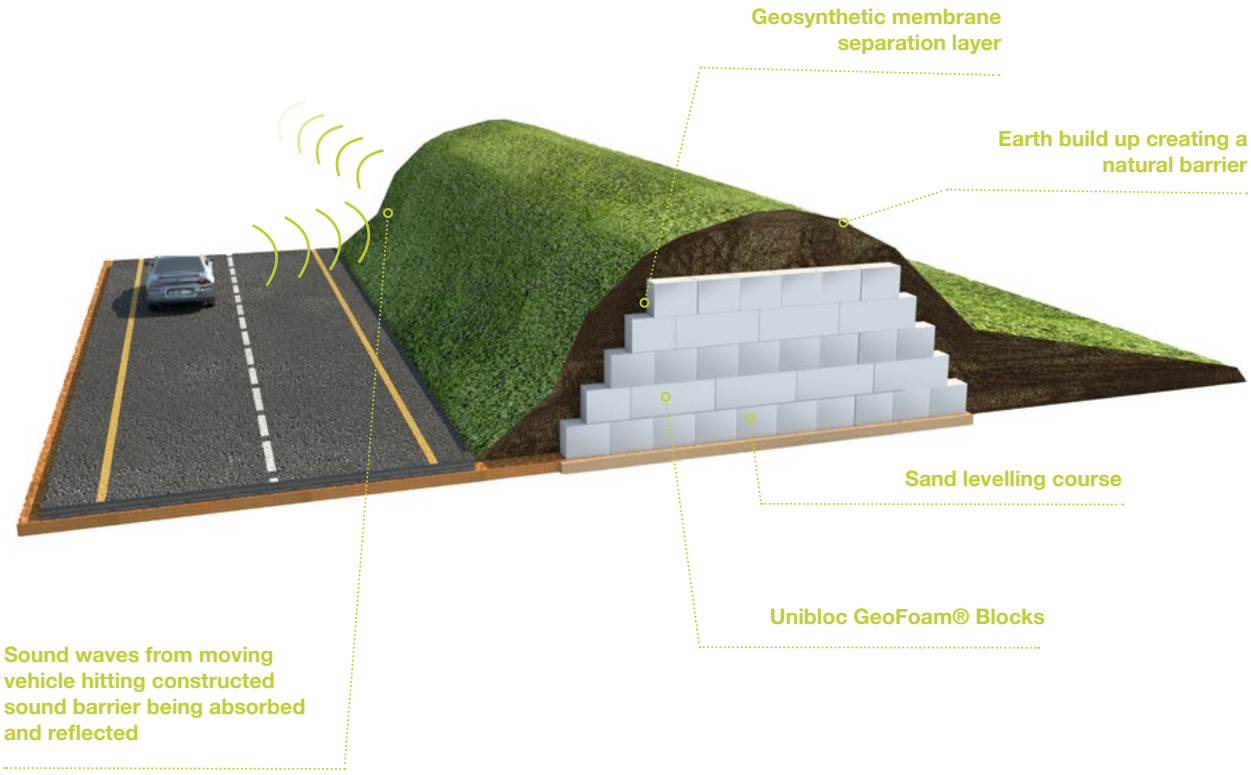
Schematic drawing of a tiered steating theatre construction using Unibloc GeoFoam®



Noise & vibration damping

Unibloc GeoFoam® can also be used to build free-standing, sound absorbing, high walls or embankments to reduce noise transmission in urban areas from road traffic on highways and freeways. Unibloc GeoFoam® can also be used to reduce the transmission of heavy transport and ground borne vibrations, for example, under railways or pavements, as part of the foundation of adjacent structures, or as a cut off wall between the railways or pavements and the adjacent structures.

Schematic drawing of noise barrier construction using Unibloc GeoFoam®



Construction Principles

In most applications, long term design loads should not exceed the linear elastic range of Unibloc GeoFoam®. The maximum combined live and dead load stresses that are likely to be experienced should not exceed the Unibloc GeoFoams® compressive resistance at 1% strain.

The bottom of the installation of the Unibloc GeoFoam® blocks should be above the mean height of the water table. If there is any possibility of the water table rising due to flooding, the buoyancy effects must be considered and appropriate countermeasures adopted at the project design stage. Common methods to counteract buoyancy or hydrostatic uplift forces acting on the Unibloc GeoFoam® involve the use of sufficient overburden or use of mechanical constraints. Suitable drainage measures must be taken especially on sloping sites.

1

Supporting layers: The bottom layer of the Unibloc GeoFoam®

Installation of each of the Unibloc GeoFoam® blocks must be supported over the entire lower face of each block, so a plane surface, inclined as appropriate, must be prepared.

Departures from planarity should not exceed a maximum of ±1 cm in 400 cm. The material used for the creation of the Unibloc GeoFoam® supporting layer, is generally sand with the thickness or depth of sand applied, being dependant on the site ground conditions present and the machines and equipment used to apply it.

2

Construction of Unibloc GeoFoam® installations.

The Unibloc GeoFoam® blocks must be installed such that they are laid flat, with staggered joints (following the residential/commercial brick pattern lay-up format); no voids, gaps or open joints should be left between individual Unibloc GeoFoam® blocks. The blocks should be butted up against one another, such that they are fit for fit as shown in the above photo.

The block joints must be offset by at least 50 cm. Where there is more than one layer of Unibloc GeoFoam® blocks to be installed in a given application, alternating layers of Unibloc GeoFoam® should always be staggered (following the residential/commercial brick pattern lay-up format). To prevent displacement of blocks during construction, they should be fixed together at intervals with Unipods® proprietary Geogripper plate mechanical fastening system or polyurethane-based adhesive. See Page 24 for further information on the use and application of the Unipod® GeoGripper plate.

Any standing water on or near the ground surface, must be pumped off until the Unibloc GeoFoam® installation is covered by enough overburden material, whose weight would be sufficient to counteract the possibility of any hydrostatic uplift forces causing upward displacement or floatation of the Unibloc Geofoam blocks.

3

Supporting layers: The bottom layer of the Unibloc GeoFoam®

As a rule, the sub-grade of the road normally distributes the load and protects the Unibloc GeoFoam® installation, while its surface constitutes the road formation. During construction, it is important to protect the Unibloc GeoFoam® blocks from damage from construction machinery traffic. This can be achieved by having an adequate thickness of suitable overburden materials, such as concrete over the Unibloc GeoFoam®.

Live Loads can be spread particularly well by the application of a reinforced concrete slab, nominally 12–15cm thick, formed in situ, otherwise strengthened layers of other suitable materials may be used instead. Direct contact of traffic

GeoFoam being laid in a brick pattern. Installed fit for fit.

over the installed Unibloc GeoFoam® foam blocks will cause damage to the blocks and should be avoided. The construction of the pavement above the road formation is to be undertaken in line with the usual civil construction practices, procedures and rules.

To ensure that adequate compaction is achieved, the thickness of the overburden material that is in direct contact with the upper surface of the Unibloc GeoFoam® block, or of the concrete slab over it, should be a minimum of 30cm deep.

4

Embankment Slopes

The stepped sides of the installation of Unibloc GeoFoam® blocks must be bounded by planes whose slopes are consistent with stability, the required profile, the covering material, and the kinds of vegetation intended to be planted once the construction is complete.

The depth of soil covering the sides cannot be less than minimum 25cm, measured normally to the planes bounding the installation of Unibloc GeoFoam® blocks.

If slopes greater than a ratio of 1:1.5 are proposed and soil-mechanical considerations allow them, the soil should be secured against slip by appropriate measures, such as reinforcement with geotextiles or gabions.

Where the sides of the embankment are to be greeted by other than shallow-rooted plants, the soil covering over the Unibloc GeoFoam® installation must be deep enough to allow the plants roots to provide adequate anchorage. Nominally this would be at least 50cm deep.

5

Subsidiary highway components

If the depth of material covering the top of the Unibloc GeoFoam® installation is 1.50m or more, no special arrangements need be made for anchoring subsidiary components such as safety fences, direction signs, etc. Depths of less than 1.50m necessitate provision of concrete anchor blocks, which can be factory-made components resting on the load-spreading course or cast in situ in EPS forms.

Cables can be laid within the Unibloc GeoFoam® blocks if necessary, provided the ducts or channels required are bridged in such a way that the load-bearing capacity of the whole system is not adversely affected. Welding or soldering of pipe ends where required will have to be undertaken off site or in an enclosed area. The pipes cannot be welded or soldered insitu under any circumstances.

Unibloc GeoFoam® GeoGripper plate

The Unipod® Unibloc® GeoGripper Plate is a proprietary galvanized steel multi-barbed Unibloc GeoFoam® block mechanical connector. Unipod® is the exclusive Australian distributor of the GeoGripper mechanical connector plate. It is used to restrain the rigid Unibloc Geofoam® blocks from moving laterally when the blocks are installed in a “layer upon layer” application.

Its unique single piece / two-sided barb design allows for excellent connection between the individual block layers in a one-step application. The use of the Unipod® Unibloc® GeoGripper mechanical connector plate keeps the Unibloc GeoFoam® blocks from being displaced in windy conditions.

Project Considerations

Anchoring

Due to Unibloc GeoFoams® closed-cell structure and its inherent light weight characteristics being composed of approximately 96-98% stabilised air, Unibloc GeoFoam® is a highly buoyant material.

As such, care must be taken during design, construction and post-construction, to ensure that any potential for the development of hydrostatic uplift forces to occur has been considered within the existing hydrological conditions of a given site. Adequate surcharge i.e. soil or pavement cover, or an alternate means of passive Unibloc GeoFoam® block restraint, such as physical ground anchoring of the Unibloc GeoFoam® blocks, must be provided to counter against the potential for hydrostatic uplift of the Unibloc GeoFoam® block layout occurring.

When installing Unibloc GeoFoam® blocks on site, regardless of application type, it is recommended that the vertical block joints of each block course are staggered so as not to create continuous vertical seams. The build-up of Unibloc GeoFoam® block layers is done in the same way as the construction of a brick wall with staggered vertical joints.

Handling & installation

Due to its lightweight characteristics, no specialised equipment is required for the installation of the Unibloc GeoFoam® Depending on application, the Unibloc GeoFoam® blocks can often be carried and safely set in place either by hand as shown in the photo below or with inexpensive mechanized equipment.

This is an important consideration when the construction site is congested with other services or does not have the space or clearances required for traditional use of compaction and other specialised equipment. Unibloc GeoFoam® can be easily cut to shape on site using a hot-wire cutter or hand saw where required to accommodate installation around existing underground utilities and services that may be present in a given application.

Transportation and handling of Unibloc GeoFoam® on-site

Construction time & cost savings

The use of Unibloc GeoFoam® assists in achieving ever tightening project construction schedules. The ease and speed with which Unibloc GeoFoam® blocks can be installed, results in shorter construction times, due to faster placement rates and reduced utility relocation.

Compared to traditional construction methods and depending on application type, for road and rail line construction, bridge abutment etc, the use of Unibloc GeoFoam® negates the need for compaction of the soils and having to wait for settlement to occur.

Traditional soil fills are constructed in small sections with repeated compaction. This requires considerable time with the use of heavy construction equipment resulting in increased costs, in both fuel and labour to operate the equipment and the requirement for field testing to ensure adequate compaction of the soils has been achieved.

For soft soil conditions, significant waiting time is required after fill placement while the underlying foundation soil consolidates and settles. In stark contrast, Unibloc GeoFoam® can be quickly laid in place, with no need for compaction or having to wait for consolidation or settling to occur. Unibloc GeoFoam® can effectively be laid and built upon straight away. This unique and highly attractive project cost saving attribute is continuing to disrupt the use of traditional civil infrastructure fill materials and construction methods.

Although Unibloc GeoFoam® may be more expensive than most traditional fill materials on a cost per cubic metre basis, the extra cost of the Unibloc GeoFoam® is usually completely offset by the considerable project savings that are able to realised, in reduced labour and the elimination of processes requiring the use of heavy machinery such as soil compaction. The use of Unibloc GeoFoam® also reduces the need for ongoing project maintenance and where maintenance is required, it helps to increase the minimum time frames between the maintenance intervals.

Design Considerations

Compressive resistance

Unibloc GeoFoam® is a low density (13kg/m³ to 39kg/m³) and high strength-to-weight ratio material that has the capacity to withstand and dissipate enormous forces. Its rigid cellular structure provides tremendous structural integrity and when installed correctly, can result in the significant reduction of loads (as a result of low density/weight ratio) on unstable sites by up to 95%.

GeoFoam behaves as a linear elastic material up to a strain of approximately 1%. Thus, the design recommendation for Unibloc GeoFoam® is to limit load bearing capacity to the maximum compressive resistance as measured at 1% strain. The resultant stress as measured at a compressive strain of 1% is called the elastic limit stress.

NOTE: Except for special compressible inclusion application requirements, higher compressive strain, typically tested at 5% or 10%, should not be used to estimate the Unibloc GeoFoam® compressive strength because these strain rates surpass the ultimate yield strength of the Unibloc GeoFoam® and this may lead to undesirable permanent strain and deformation.

Chemical exposure

As Unibloc GeoFoam® can be used in a wide variety of civil and other applications, there may be instances in certain applications where Unibloc GeoFoam® may be potentially subjected to chemical exposure. This can be either by direct exposure /contact with the chemicals themselves or through exposure /contact to the vapours that the chemicals may give off.

The potential for exposure to chemicals will most commonly occur during installation of the Unibloc GeoFoam® on site or as a result of contaminated site conditions that may occur after the Unibloc GeoFoam® has already been installed.

The tables on this page and the next page provide general guidance for the resistance of Unibloc GeoFoam® to a large number of industrial chemicals. The tables are intended to provide a preliminary guide only.

The information contained therein does not guarantee the long term performance of Unibloc GeoFoam® when in contact with the listed or any other chemicals. It is recommended that laboratory tests modelled to represent chemical exposure in end use conditions, be conducted to assure efficacy of the Unibloc GeoFoam® in the chosen application.

Chemical	Rating
Acetic acid (5%)	C
Acetic acid (10%)	I
Acetone	I
Alkalis	C
Ammonia	I
Animal Fats and Oils	I
Benzene	I
Butyl alcohol	C
Chlorinated Hydrocarbons	I
Citric Acid (10%)	C
Citric Acid (20%)	I
Detergents	I
Diesel Fuel	I
Dilute Inorganic Acids	C
Ethers	I
Ethyl Acetate (98%)	I
Ethyl Alcohol (95%)	I
Ethylene Glycol	I
Gypsum Plaster	C
Hexane	I
Hydrocarbons	I
Hydrochloric Acid (10%)	C
Hydrochloric Acid (38%)	I
Hydrochloric Acid (100%)	I
Hydrogen Peroxide (30%)	C
Isopropyl Alcohol	I

C = Compatible with Unibloc GeoFoam®
I = Incompatible with Unibloc GeoFoam®

Chemical	Rating
Ketones	I
Methyl Alcohol	I
Methyl Ethyl Ketone	I
Mineral Oil	C
Motor Oil	I
Nitric Acid (20%)	I
Organic Solvents	I
Paint Thinner	I
Paraffin	I
Petrol (Gasoline)	I
Petroleum Jelly	C
Potassium Hydroxide (30%)	C
Portland Cement	C
Propyl Alcohol	I
Propylene Glycol	C
Silicone Oil	C
Sodium Chloride (saturated)	I
Sodium Hypochlorite (15%)	C
Sodium Hydroxide (40%)	C
Solvent Free Bitumen	C
Sulphuric Acid (50%)	I
Sulphuric Acid (96%)	I
Toluene	I
Turpentine	I
Vegetable Oils	I
Salt Water (Brine or Sea Water)	C
Xylene	I

C = Compatible with Unibloc GeoFoam®
I = Incompatible with Unibloc GeoFoam®

If the exposure of Unibloc GeoFoam® to any harmful chemicals is a possibility or in doubt, the Unibloc GeoFoam® should always be protected by means of an appropriate barrier material being applied. An example of where this would be applicable, is in the case of a road construction where Unibloc GeoFoam® has been used as the material fill layer that the road has been constructed upon. If there were to be a vehicular accident which could cause petrol (benzene), motor oil, brake fluid, (glycol ether) radiator coolant (glycol) or other chemicals to potentially be released, these chemicals could seep through the various ground layers and eventually come into contact with the Unibloc GeoFoam® sub structure, potentially damaging it.

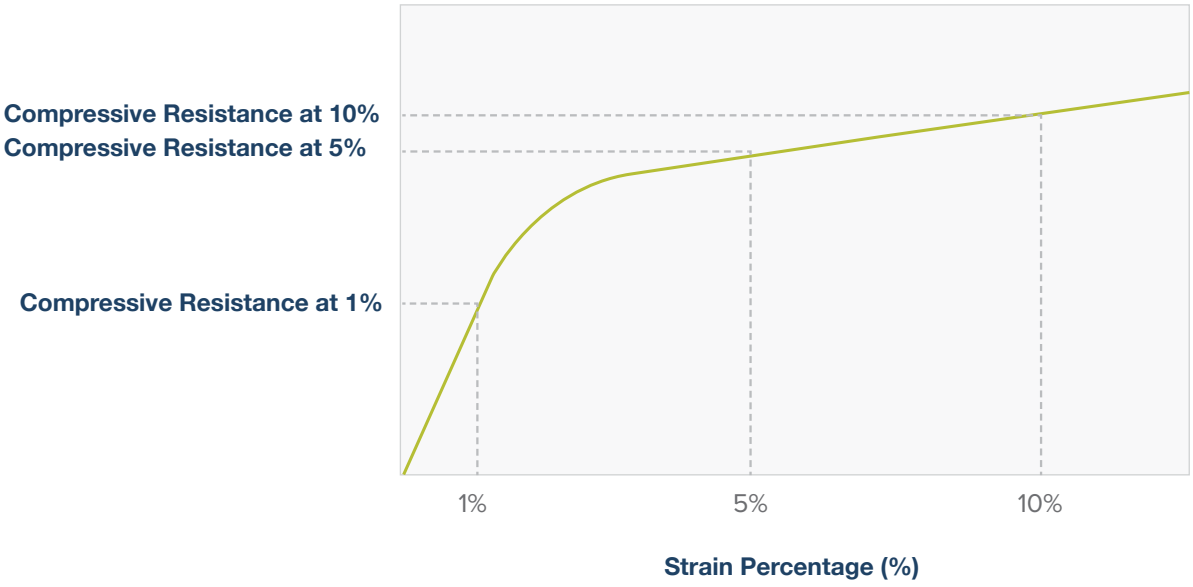
Unibloc GeoFoam® must be protected by an appropriate geo-synthetic textile membrane barrier material, if there is any potential for exposure to these chemicals either during installation or during the material's serviceable life. In selecting a suitable geotextile membrane barrier, its compatibility with the Unibloc GeoFoam® block material must be confirmed prior to application. There are a number of compatible hydrocarbon resistant geotextile membranes that could be used to protect the Unibloc GeoFoam® such as polypropylene (PP), polyethylene (PE), chlorosulphonated polyethylene (CSPE) and Ethylene Interpolymer Alloys (EIAs).

The above information should be used as a guide only. Consultation with a qualified geotechnical engineer or specialist geotextile membrane supplier should always be undertaken, as to the selection of the most suitable membrane for a given application which ensures compatibility with the Unibloc GeoFoam® product.

Creep behavior

The as tested creep behavior of GeoFoam is minimal at strain levels below 1%. The effects of creep significantly increase at higher strain rates of 5% and 10% as typically tested however. This is one of the primary reasons for using a compressive resistance at maximum 1% strain for load bearing design applications of Unibloc GeoFoam®.

Stress-strain relationship for GeoFoam



Lateral resistance (Coefficient of Friction)

The lateral resistance of Unibloc GeoFoam® is based on the inherent friction that naturally exists between layers of Unibloc GeoFoam® blocks that are in direct contact with one another, unless some special design (such as adhesives or shear keys) are used to join the blocks.

The coefficient of friction, μ, between Unibloc GeoFoam® blocks along moulded faces is 0.5. The coefficient of friction is higher along cut faces of the blocks where there is increased surface roughness. The coefficient of friction for a wire cut face of a block can be assumed to be the same as a moulded face of a block (i.e. 0.5)

Load distribution: (Poisson's Ratio):

The Poisson's ratio for Unibloc GeoFoam® is approximately 0.12 within the elastic range.

Load bearing strength characteristics

Unibloc GeoFoam® is available and can be supplied in a range of compressive resistances. A project designer can choose the specific type of Unibloc GeoFoam® required to support the project design loading (maximum combined live and dead loads) while minimising cost.

It is recommended that the Unibloc GeoFoam® design loads do not exceed the maximum compressive resistance as tested at 1% capacity. This limit controls the amount of long-term deflection, or creep, resulting from permanent sustained loads that the Unibloc GeoFoam® would be subjected to in service.

Note: Adequate soil cover, or a load distribution slab, may be required to distribute large concentrated point loads in a given application.

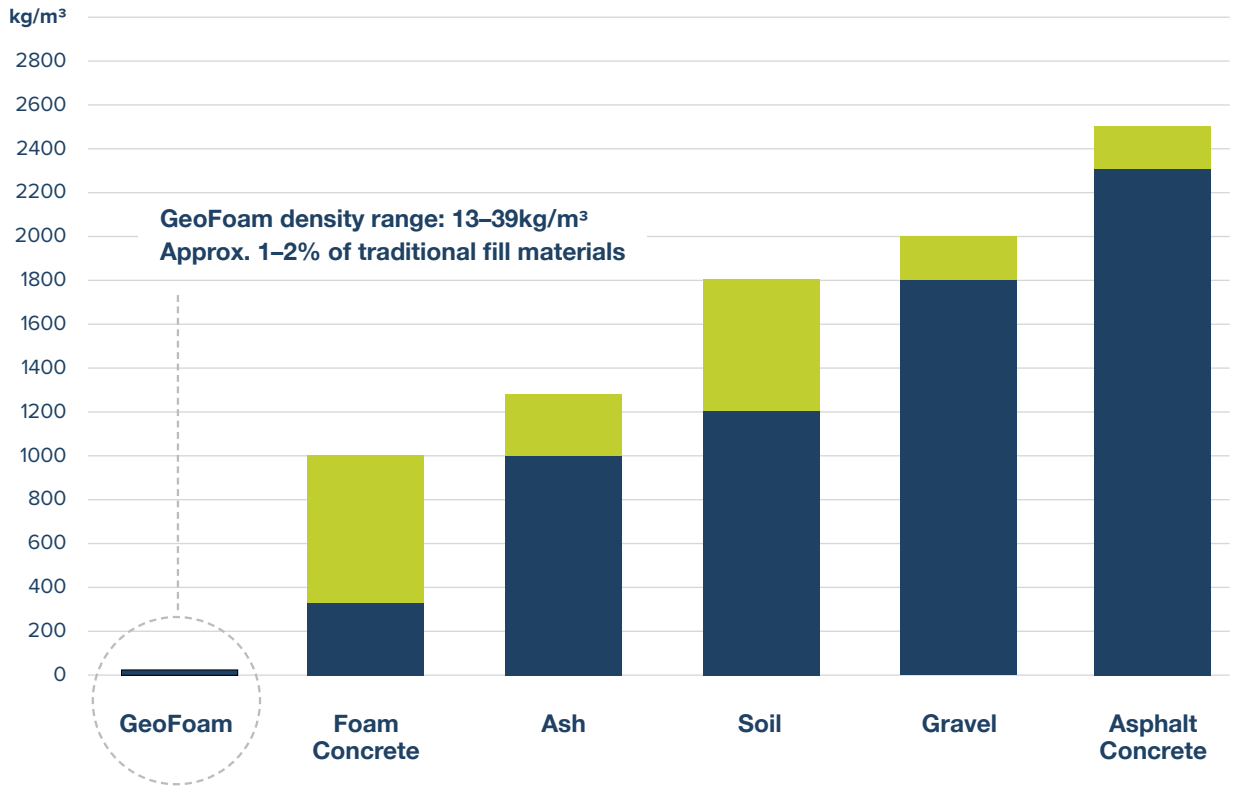
Lightweight characteristics

Unibloc GeoFoam® can be manufactured in various densities ranging from 13g/l through to 39g/l and in volumes that typically range from approximately 13kg/m³ to 39kg/m³. As a result, of this very light weight per unit area characteristic, the Unibloc GeoFoam® blocks end up imparting negligible dead loads or stresses to underlying soils, structures and utilities.

This is highly advantageous where the existing soils or fill material may be poorly suited to support additional loading requirements (e.g., compressible clay, peats, etc.). Existing loads can be significantly reduced by excavating and replacing the existing native soils which commonly weigh upwards of 1.5 tonnes per cubic metre, with Unibloc GeoFoam® which, even in its heaviest form weighs a small fraction of this.

Furthermore, the replacement of heavy density soils with Unibloc® GeoFoam® assists in eliminating the need for specialised foundations or site preloading to reduce settlement and improve bearing capacity. Additionally, the use of Unibloc GeoFoam® over existing utilities can eliminate the need for utility removal, relocation or redesign.

Density comparison between GeoFoam & other civil construction material



California Bearing Ratio (CBR)

The California Bearing Ratio (CBR) value is an important information requirement for civil and road design engineers in determining what materials may be applicable for use specifically as a subgrade in new road construction. The CBR value determines the resistance of the subgrade material to deformation under load from stationary and moving vehicles, in other words it measures the inherent strength of the ground or material that a road is intended to be built upon (i.e. the layer of naturally occurring or introduced material such as Unibloc GeoFoam®, upon which the road is to be built.)

As the use of GeoFoam® continues to increase as a preferred material of choice for road subgrade preparation, Unipod® has taken the liberty of determining the CBR value for the most popular density grades of its Unibloc GeoFoam® product that it manufactures and distributes.

The table below lists the CBR value as tested and calculated against a number of popular Unibloc GeoFoam® densities. The Unibloc GeoFoam® samples were tested against Australian Standard AS1289 2014, Section 6.1.1 (California Bearing Ratio) by an Australian independent accredited testing authority, both in the as supplied “dry” state and after being fully immersed in water for 4 days. (“wet state”).

Unibloc GeoFoam® CBR values at tested

Unibloc GeoFoam® Grade	CBR value as tested	Unibloc GeoFoam® test sample wet (W) or dry (D)
SL	1.5	D
SL	1.5	W
M	2.5	D
M	2.5	W
H	3.5	D
H	3.5	W
VH	4.5	D
VH	5.0	W
X39	4.5	D
X39	5.0	W

The data in the table to the left illustrates that the water-soaked samples as tested, resulted in the same or greater CBR value as the samples tested in the dry state. When comparing the VH and X39 densities these higher densities actually perform better in terms of their resultant CBR value compared to the dry samples.

This is advantageous as the subgrade material will be exposed to moisture from rain soak and the potential presence of ground water, throughout its serviceable life, so having a resultant CBR value that does not change in the wet state is very advantageous.

Where requested, Unipod can provide a copy of the CBR test reports for the given Unibloc GeoFoam® densities specified.

California Bearing Ratio (CBR) continued

The table below lists the typical CBR design values for a range of soil and rock types as commonly found in Victoria and around Australia.

Description of Subgrade	Presumptive CBR Value
Extremely poor subgrade conditions - Saturated basaltic areas - clay of extremely high plasticity (PI>50) - Saturated alluvial areas - Silty soils subject to saturation	2
Very poor subgrade conditions - Clay of extremely high plasticity (PI 35-50) - Disturbed and re-compacted Dilurian clays - Disturbed and re-compacted Tertiary clays and sandy clays of high moisture content - Basaltic clay areas not saturated	3
Silty subgrade soils - Well drained silty soils	4
Silty clay subgrade soils - Silty clay of very high plasticity (PI 35-50) - Soils capable of carrying construction traffic (CBR > 5)	3-5
Plastic sandy clay subgrade soils - Sandy clay of immediate to high plasticity (P1 15-35) - well drained situations - Undisturbed Silurian clays	3-6
Low plasticity subgrade soils - Sandy clay of low to intermediate plasticity (PI 10-20) - Well compacted silty sandy clay, sandy clay (well drained situations)	*6-10
Ordovician, Silurian and Devonian Sedimentary Rocks - Broken and compacted weathered rock	*6-10

As can be seen from the table above, the Unibloc GeoFoam® material densities as tested, closely match the CBR values of the most commonly found subgrade soils and rocks; thus, based on the soil or rock type that is present in a given terrain, a suitable Unibloc GeoFoam® density grade can be selected for substitution.

Physical Properties

Unibloc GeoFoam® meets or exceeds the requirements of Australian Standard AS 1366.3 and American Standard Test Method ASTM D6817" Standard Specification for Rigid, Cellular Expanded Polystyrene (EPS) Geofoam". Unipod conducts routine, rigorous testing of Unibloc GeoFoam® to ensure quality is maintained to these standards.

Physical Properties of GeoFoam

As per Australian Standard AS 1366.3, 1992

Physical Property	Unit of measure	Class of EPS							Test Method
Unibloc GeoFoam® Grade		**SL**	**S**	**M**	**H**	**VH**	**X32**	**X39**	
Nominal density	Kg/m³	13.5	16	19	24	28	32	39	ISO 845
Compressive Stress at 1% deformation (min.)	kPa	23	30	35	48	55	75	82	AS 2498.3
Cross-break Strength (min.)	kPa	135	165	200	260	320	360	460	AS 2498.4
Rate of water vapour transmission (max.) parallel to rise at 23°C	µg/m²s	630	580	520	460	400	400	350	AS2498.5
Dimensional stability of length, width, thickness (max.) at 70°C, dry condition seven days	Percent	1	1	1	1	1	1	1	AS 2498.6
(R-value) Thermal resistance (50 mm sample) at a mean temperature of 23°C	m²K/W	1.23	1.27	1.32	1.37	1.43	1.45	1.52	AS 2464.6
Thermal conductivity (k) measured at 23°C	W/mK	0.0407	0.0394	0.038	0.0366	0.035	0.034	0.033	AS 2464.5
Flame propagation characteristics:									AS 2122.1
– Median flame duration (max.)	Seconds	2	2	2	2	2	2	2	
– Eight value (max.)	Seconds	3	3	3	3	3	3	3	
– Median volume retained (min.)	Percent	18	22	30	40	50	50	50	
– Eight value (min.)	Percent	15	19	27	37	47	47	47	
Buoyancy Force	Kg/m³	986	984	981	976	972	970	963	

As per the American Standard Test Method ASTM D6817

Physical Property	Unit of measure	Class of EPS							Test Method
Unibloc GeoFoam® Grade		**SL**	**S**	**M**	**H**	**VH**	**X32**	**X39**	
Compressive Stress at 1% deformation (min.)	kPa	22	31	42	58	72	75	103	ASTM D6817
Elastic Modulus (min.)	kPa	2200	3150	4200	5800	7250	7550	10200	ASTM D6817

Product stability

Unibloc GeoFoam® being made from expanded polystyrene is an inert, inorganic material that will not rot and is resistant to mould, mildew and fungi. Unibloc GeoFoam® is non-toxic, odourless and non-irritating to the skin or eyes. It contains no HCFCs and is safe for the environment. Furthermore, Unibloc GeoFoam® offers no nutritional value to insects and does not attract ants, termites or rodents. It is unaffected by the normal range of climatic conditions and temperatures and when specified and installed correctly, it can be considered a permanent long-life fill solution.

The Unibloc GeoFoam® material exhibits a long service life and is able to withstand the effects of long-term temperature cycling and will retain its physical properties under engineered conditions of use.

There are civil road projects constructed in the 1970's in Norway that used GeoFoam, that are still in full service today. GeoFoam has also been in use in similar applications in Australia since its introduction in the early 1990's.

For applications in areas where termites are known to persist, Unibloc GeoFoam® can also be manufactured with a termite repellent additive.

Insulation characteristics

As Unibloc GeoFoam® block is 96-98% air by volume, it is one of the most efficient man made thermally insulating materials available. EPS insulation has been used in residential and commercial building construction in ceilings, walls and floor systems etc, for many years.

The high insulative capacity of Unibloc GeoFoam® in most civil applications, is not normally one of the principal reasons for its selection, however in specific road construction applications where permafrost may be an issue, (highly prevalent in parts of the USA and Europe) its insulative capacity becomes a very important consideration for material selection.

Protection from exposure to fire

Unibloc GeoFoam® is manufactured with an environmentally acceptable non HBCD derived flame retardant additive (Poly FR). This flame retardant inhibits the early stages of fire development and propagation. Like many commonly available construction materials however, GeoFoam is deemed combustible. Thus, where Unibloc GeoFoam® is intended to be used, appropriate precautions should be implemented on site.

The Unibloc GeoFoam® should be suitably protected from exposure to open flame sources from processes such as welding or other hot work that may be undertaken on a given project site. Once installed however, the Unibloc GeoFoam® will be fully protected from fire or open flame exposure by the overburden material covering it, be that soil, concrete or other forms of cover material.

UV light exposure

Unibloc GeoFoam® is susceptible to ultra-violet (UV) degradation if exposed to direct sunlight for long periods of time. Where UV degradation has occurred, this can be identified by the development of a pale yellow coloured friable layer which occurs directly on the surface of the Unibloc GeoFoam® blocks over time. This friable layer is normally only a few mm deep and can be safely and effectively removed by a scourer or the use of a high-pressure water cleaner. The development of this friable layer will have a negligible detrimental effect on the overall physical properties of the Unibloc GeoFoam®.

It is recommended however, that in areas of high UV concentration, or where the blocks may be exposed to direct sunlight for extended periods of time (weeks or months), that where ever possible, the blocks be kept under shaded cover or physically covered using a hessian canvas or other UV resistant type material.

Under no circumstances however should a clear plastic cover be used to cover the Unibloc GeoFoam® blocks, if they are intended to be on site for prolonged periods of time prior to installation.

Wind exposure

Due to the lightweight nature of Unibloc GeoFoam®. exposure to high winds should be avoided where possible. Where applicable, wind speeds should be monitored on site, especially during project construction and installation of the Unibloc GeoFoam®.

Where possible, installation and/or movement of Unibloc GeoFoam® blocks on site should be avoided on windy days. Furthermore, where strong winds may prevail and are an ongoing concern on a given job site, overburden weight restraints such as sandbags should be placed on top of each of the Unibloc Geofoam® blocks once the blocks have been installed in place (as per the photo below). All installed blocks should be tethered together by the use of Unipod® Unibloc GeoFoam® GeoGrippers to prevent the potential for the individual blocks shifting under the influence of strong wind loads.

Buoyancy

As a function of Unibloc® GeoFoams® rigid closed-cell structure and light weight characteristics, it is very buoyant. Subsequently, care must be taken during civil project design, construction and post-construction to ensure that any potential for exposure of the Unibloc GeoFoam® blocks to hydrostatic uplift forces has been accounted for within the hydrological conditions of the project site in question.

Adequate surcharge, i.e., soil or pavement cover, or an alternate means of passive restraint (anchoring of the blocks) must be provided to guard against the potential for hydrostatic uplift of the blocks once installed. Alternately, the material can be installed above the water table or the water table can be lowered using suitable drainage techniques and/or other dewatering systems. Drainage (generally a sand or gravel layer) can be provided between the Unibloc GeoFoam® fill and the natural soils to reduce the potential for hydrostatic uplift occurring. Appropriate design consideration for adequate drainage of groundwater and/or surficial waters below the Unibloc GeoFoam® prevents water from infiltrating upwards through to the Geofoam layer and reduces the potential for development of hydrostatic uplift forces, which could cause displacement of the Unibloc GeoFoam® blocks.

Blue plastic bags filled with sand, acting as a weight restraint for Unibloc GeoFoam®.

Water absorption characteristics

Unibloc GeoFoam® is a material that has a rigid, closed-cell structure that limits water absorption and inhibits the mass migration of liquids through its structure. Even under prolonged saturation the individual EPS bead cells maintain their physical shape, size, cohesion, appearance and structural integrity.

When used in well-drained conditions, negligible change in Unibloc GeoFoam® block weight is expected to occur as a function of intermittent exposure to water or moisture over time. A minor increase of less than 5% in the overall weight of Unibloc GeoFoam® blocks can be expected over time however, if the blocks are installed in a partially or completely submerged application.

Although the generic water absorbency of Unibloc GeoFoam® is low as per the information above and in the physical properties table on page 33, where Unibloc GeoFoam® is to be considered for installation in a partially or fully submerged application, the selection of a higher density Unibloc GeoFoam® is recommended.

Product sustainability

Where Unibloc GeoFoam® block off cuts are generated on site, these can be reused in other areas of the site. Where the Unibloc GeoFoam® block off cuts are not able to be reused, Unipod® offers a clean GeoFoam recyclable waste pick up service. The recycled Unibloc GeoFoam® block off cuts can then be recycled into a variety of differing products and applications such as picture frames, and lightweight concrete.

EPS offcuts being recycled at Unipod®.

Our Service Commitment

Sales & Service

You can have full confidence in the long-term sales and service of Unibloc GeoFoam® because it is proudly designed and manufactured in Australia by Unipod® – One of Australia's largest producers of Expanded Polystyrene products.

Unipod® is a company driven by continuous improvement and innovation. With state-of-the-art EPS manufacturing facilities, Unipod® has the ability to deliver innovative product solutions for our customers. Unipod® is the only EPS manufacturer in Australia that is fully ISO 9001 Certified. Together with our industry first, complete product traceability system and our customer portal- Foamhub®, Unipod® proudly continues to lead the Australian EPS industry in providing innovation, quality, consistency, visibility and continuous improvement in all EPS products that we manufacture, including the Unibloc Geofoam® product.

Unipod® is committed to working with our customers to deliver high quality, creative solutions to civil construction problems. Contact us and see how our innovative approach using Unibloc Geofoam® in civil building construction can help you.

Unipod® can also provide quick, reliable and easy delivery of the Unibloc GeoFoam® blocks directly to site and with our wealth of experience, we can advise and answer all your questions and queries. Simply contact our sales team to speak to a Unibloc GeoFoam® consultant today.

Foamhub®

Foamhub® is a unique, online tool that gives the user direct access to all segments of their Unipod account, anytime.

This tool allows the user to download all documents related to their account in real-time, enabling full visibility of valuable customer information such as invoices, pricing, test results, delivery dockets & schedules, etc. The user has access to track their Unibloc Geofoam® order from entry, through manufacturing, to proof of delivery with photos taken on-site via our exclusive traceability program.

Unipods® Unibloc Geofoam® "Quality Conformance certificate" is available on Foamhub® for every order and verifies that the Unibloc Geofoam® product supplied by Unipod®, conforms to all relevant Australian and International standards.

Foamhub® is 100% free and provided as part of Unipods® customer service experience, with Unipod® being the only EPS products manufacturer in Australia, that can provide this fully integrated service.

FOAMHUB®

Safety & the Environment

At Unipod®, the health and safety of our employees and all our stakeholders is of paramount importance. Unipod is committed to maintaining the highest standards of operation. Our ISO 9001 accredited management system ensures that well developed work practices, controls and risk mitigation strategies are inherent considerations in all our daily operations.

Unipod® continues to evolve and develop to meet our customers' ever-changing needs through the adoption of measurable quality assurance protocols and a cycle of continuous improvement that ensures minimum quality and service standards are not only able to be consistently met but are routinely exceeded. Primary issues that are considered at all times:

- **Risk mitigation through the development and adherence to safe work practices.**
- **Effective incident management and prevention strategies.**

Unipod® is focused on being a responsible corporate citizen, ensuring that we meet all our environmental responsibilities. Its environmental sustainability and environmental protection strategies are centred around the recycling of EPS and other EPS manufacturing derived waste, waste management and waste reduction outcomes.

The manufacture of Unipod® EPS products is a low pollution process. Steam is the key ingredient in all the EPS products Unipod® manufactures. The water consumed to produce the steam is recovered and reused many times. Furthermore, there is no waste in the production of Unipods® EPS products as all off cuts and rejects can be re-used or recycled. Unipod® has established EPS recycling facilities within its state-of-the-art Truganina manufacturing plant in Melbourne and offers all its customers the convenience of drop off or pick up, of clean EPS waste from its project sites.

Quality Assurance

Unipod® maintains ISO 9001 accreditation. In doing so Unipod® acknowledges that effective leadership, communication and personal engagement are fundamental pillars to not only our business model but are also key aspects towards the ongoing retention of our ISO accreditation. Therefore, customers can be assured of our continuous commitment to driving ongoing quality assurance in all aspects of the business, especially our product manufacture and our customer service delivery.

ISO 9001 CERTIFIED
SCI QUAL INTERNATIONAL

JAS-ANZ
WWW.JAS-ANZ.ORG/REGISTER

Unibloc GeoFoam® 20 Year Limited Product Warranty

Unipod® Pty. Ltd. is the manufacturer of the Unibloc GeoFoam® Product. This warranty shall apply to the Unibloc GeoFoam® product and shall be read and construed in conjunction with Unipods® standard terms and conditions of sale. In the event of any inconsistency, the provisions in this warranty shall prevail.

Unibloc GeoFoam® Warranty

Unipod® warrants that for a period of 20 years, commencing with the date of delivery (the "Warranty Period"), that the Unibloc GeoFoam® product will maintain 90% of its ASTM D6817 Compressive Resistance as tested at 1% strain using the D1621 test method. If during the Warranty Period, the Unibloc GeoFoam® is determined by sampling and testing in the manner described below not to meet warranty value, Unipod® will, subject to the clauses set out below, either deliver to the owner of the project on which the Unibloc GeoFoam® was initially installed ("Owner"), a quantity of equivalent Unibloc GeoFoam® product to replace the non-performing Unibloc GeoFoam® or, at Unipods® sole discretion, refund to the Owner, the original purchase price of the non-performing Unibloc GeoFoam®.

Sampling & Testing

All sampling shall be conducted in accordance with sampling procedures prescribed by Unipod®. Samples of the Unibloc GeoFoam® shall only be taken in the presence of an authorised Unipod® representative. Testing of Unibloc GeoFoam® samples shall be undertaken in accordance with the requirements of the ASTM D6817 test standard. Unibloc GeoFoam® samples shall be conditioned to equilibrium prior to testing. All sampling and testing costs (including but not limited to costs of Unibloc GeoFoam® covering removal and replacement) shall be at the Owner's sole expense. Owner agrees to be bound by and shall not dispute the findings and conclusions of the sampling and testing.

Warranty Conditions

Unipods® obligations under this warranty will only take effect if the Unibloc GeoFoam® was correctly installed by a skilled and experienced installer in accordance with the product installation recommendations and guidelines issued by Unipod®. This warranty shall be void if, in Unipods® sole judgment, the Unibloc Geofoam® performance has been impaired by either damage, abuse or alterations to the Unibloc GeoFoam® where such alterations were made without the prior written approval of Unipod®.

Warranty Exclusions

Unipod® does not warrant the compatibility of any other product/s (including but not limited to any geotextiles or geomembranes or coatings) with the Unipod GeoFoam®. It is the Owner's sole responsibility to consult with a fully qualified geomembrane or geotextile engineer as to product compatibility with the Unibloc GeoFoam® product and the correct installation thereof.

To the full extent permitted by law, Unipod® shall have no liability whatsoever in contract, tort, law or otherwise for any loss or damage arising directly or indirectly out of or in relation to the use of any incompatible product (including but not limited to any geotextiles or geomembranes or coatings) with Unibloc GeoFoam®.

1. To make a warranty claim, the owner must provide the following information:

(a) The details of the Unibloc GeoFoam® product purchased. (Application dates, product batch numbers and quantities must be recorded and supplied as a minimum to commence a warranty investigation.)

(b) The date and location of the Unibloc GeoFoam® product purchase.

(c) A description of the fault observed with the product, providing photographs and samples where possible.

(d) The contact details of the Owner.

2. The required information can be submitted to Unipod® directly by the following means:

(i) By mail: Unipod® Sales, 2–10 Distribution Dr, Truganina VIC 3029.

(ii) By email: sales@unipod.com.au

3. Unless otherwise agreed to in writing by Unipod®, the Owner shall bear the full expense of claiming the warranty.

4. Where the Owner is a consumer under the Competition and Consumer Act 2010, the benefits given under this warranty are in addition to the statutory rights and remedies available to the consumer under Australian Consumer Law. Our goods come with guarantees that cannot be excluded under Australian Consumer Law.

You are entitled to a replacement or refund for a major failure and for compensation for any other reasonably foreseeable loss or damage. You are also entitled to have the goods repaired or replaced if the goods fail to be of acceptable quality and the failure does not amount to a major failure.

5. There are no warranties and/or guarantees which extend beyond the terms and provisions as set forth in this warranty document. The warranty shall not be extended or altered except by written instrument as signed by an authorised Unipod® representative.

6. To the full extent permitted by law, the liability of Unipod® for any defect or a breach of the Owner's statutory rights are limited solely to any one or more of the following as determined by Unipod® in its sole discretion, namely:

(i) The supply of replacement product.

(ii) A refund of the purchase price of the product.

7. Except as expressly provided in this warranty, to the full extent permitted by law, Unipod® shall not be liable to the Owner in contract, tort, law or otherwise howsoever and whatever the cause thereof, for the following:

(i) Any loss of profit, hire, business contracts, revenues or anticipated savings, financial or economic loss, loss of opportunity or

(ii) Damage to the Owner's reputation or goodwill, or

(iii) Any loss resulting from any claim made by any third party, or

(iv) Any special, indirect or consequential loss or damage of any nature whatsoever, and none of these shall be included in any direct damages claim

NOTE: Unipod® pursues a policy of continuous improvement in the design and performance of its EPS products. The right is therefore reserved to vary specifications without notice.

References

1. AS 1366.3-1992 Rigid cellular plastics sheets for thermal insulation - Rigid cellular polystyrene - Moulded (RC/PS - M)
2. ASTM International 100 Barr Harbor Drive, West Conshohocken, PA. USA
3. ASTM D5321 Standard Test Method for Determining the Coefficient of Soil and Geosynthetic friction by the direct Shear method.
4. ASTM D6817 Standard Specification for Rigid Cellular Polystyrene Geofoam.
5. ASTM D7180-05 Standard Guide for Use of Expanded Polystyrene (EPS) Geofoam in Geotechnical Projects.
6. Expanded Polystyrene Geofoam Applications and Technical data. The EPS Industry Alliance, 1298 Cronson Boulevard, Crofton MD. USA.
7. Foam Control Geofoam Tech Bulletin Nos 5008 and 5009. AFM Corporation Lakeville, Minnesota, USA
8. Geopave Technical Note 25 Embankment/Landslip Repair using Expanded Polystyrene. VicRoads, 2006
9. Geotechnical Engineering, 174 Turner Street, Port Melbourne, VIC 3207. California Bearing Ratio test report for various Unipod EPS densities tested against Australian Standard AS1289 2014, Section 6.1.1 (California Bearing Ratio). Test reports dated 01/06/2020.
10. National Cooperative Highway Research Program (NCHRP) Report 529 Guideline and Recommended Standard for Geofoam Applications in Highway Embankments 2004.

Website References

1. www.fhwa.dot.gov/crt/lifecycle/geofoam.cfm Website of the USA Federal Highway Administration's Research and Technology Program.
2. www.geofoam.syr.edu Website of The Geofoam Research Centre at Syracuse University USA

Appendices

Appendix 1

SCI QUAL INTERNATIONAL

Quality Management Systems

Certificate of Registration

Unipod Pty Ltd
8 Foundation Road
Truganina VIC 3029

In recognition of the implementation of a management system conforming to

ISO 9001:2015

The Scope of Certification covers the following activities:

Manufacturer of expanded polystyrene products including waffle pods, blocks, sheets and contour cut products for the building, civil engineering, insulation and packaging markets.

Certificate No.	Date of Issue	Certification Date	Expiry Date
5655	02 March 2020	02 March 2020	01 March 2023

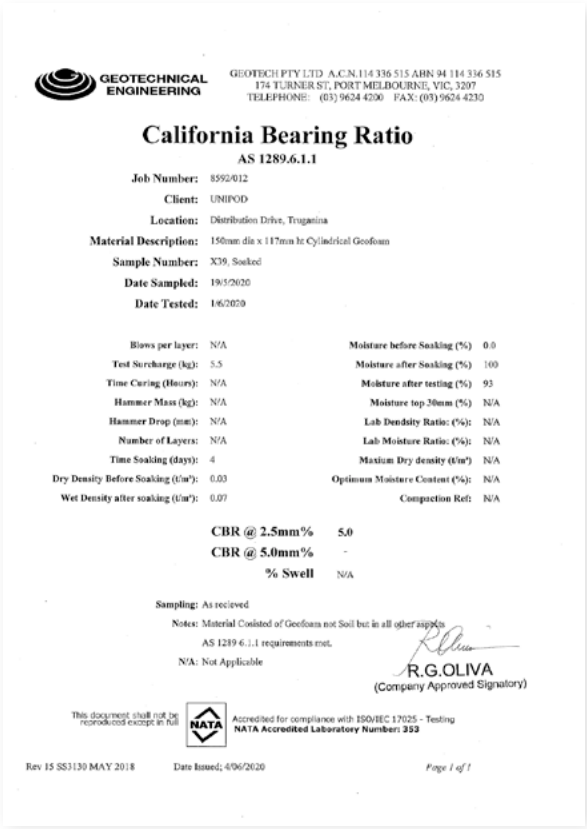
Alain Etchegaray
GENERAL MANAGER

Signed for and on behalf of
Sci Qual International Pty Ltd

Suite 19, Building D, "The Lakes Centre", 8-22 King Street, Caboolture QLD 4510

The certificate of Registration, which remains the property of Sci Qual International Pty Ltd, is granted subject to the Regulations governing the certification scheme operated by Sci Qual International Pty Ltd and in respect of goods or services described in the schedule hereto, bearing the same number as this certificate.

Appendix 2



GEOTECHNICAL ENGINEERING

GEOTECH PTY LTD A.C.N.114 336 515 ABN 94 114 336 515
174 TURNER ST, PORT MELBOURNE, VIC, 3207
TELEPHONE: (03) 9624 4200 FAX: (03) 9624 4230

California Bearing Ratio
AS 1289.6.1.1

Job Number:	8592/012
Client:	UNIPOD
Location:	Distribution Drive, Truganina
Material Description:	150mm dia x 117mm ht Cylindrical Geofoam
Sample Number:	X39, Soaked
Date Sampled:	19/5/2020
Date Tested:	1/6/2020

Blows per layer:	N/A	**Moisture before Soaking (%)**	0.0
Test Surcharge (kg):	5.5	**Moisture after Soaking (%)**	100
Time Curing (Hours):	N/A	**Moisture after testing (%)**	93
Hammer Mass (kg):	N/A	**Moisture top 30mm (%)**	N/A
Hammer Drop (mm):	N/A	**Lab Dendsity Ratio: (%):**	N/A
Number of Layers:	N/A	**Lab Moisture Ratio: (%):**	N/A
Time Soaking (days):	4	**Maxium Dry density (t/m³)**	N/A
Dry Density Before Soaking (t/m³):	0.03	**Optimum Moisture Content (%):**	N/A
Wet Density after soaking (t/m³):	0.07	**Compaction Ref:**	N/A

CBR @ 2.5mm% 5.0
CBR @ 5.0mm% -
% Swell N/A

Sampling: As recieved
Notes: Material Coisted of Geofoam not Soil but in all other aspects AS 1289.6.1.1 requirements met.
N/A: Not Applicable

R.G.OLIVA
(Company Approved Signatory)

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NATA Accredited for compliance with ISO/IEC 17025 - Testing
NATA Accredited Laboratory Number: 333

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Notes

Unipod®

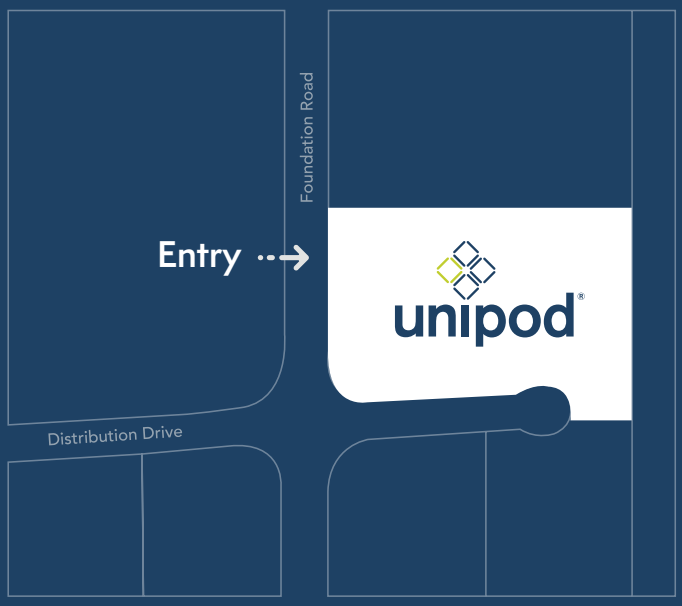
Unibloc GeoFoam® is manufactured in Australia by Unipod® using one of the world's largest and most techinically advanced block moulding machinery. Due to an absence of Australian standards for GeoFoam, Unipod® works closely with AFM Corporation in the United States, to deliver tested and proven GeoFoam products to the Australian market that assure high-performing solutions for the construction industry.

In addition to Unibloc GeoFoam®, Unipod® also manufactures and supplies:

- Unitherm® Underslab Insulation
- Unipod® Waffle Pods
- Unipoly® EPS Block / Panel
- Marine Pontoons
- Profile cutting

Proud Licensee of: AFM CORPORATION

Unipod® is a progressive moulded polystyrene manufacturing and recycling company, founded in 2007, Victoria Australia. The plant's machinery and equipment are custom designed and built, making the plant a state-of the-art operation, and Unipod® the market leader in product quality, design flexibility and overall service.



2-10 Distribution Drive,
Truganina, Vic 3029 Australia
(Enter via foundation road)

1800 486 4763
info@unipod.com.au

unipod® Engineered performance

unipod.com.au